NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF EDUCATION

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COURSE TITLE: COMPUTER SCIENCE EDUCATION METHODS

EDU 758 COMPUTER SCIENCE EDUCATION METHODS

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COURSE GUIDE

Introduction

Welcome to EDU 758 Computer Science Education Methods which is a two credit unit course offered in the second year to students of the undergraduate degree programme in Science Education. There are fifteen Study Units in this course. There are no prerequisites for studying this course. It has been developed with appropriate local examples suitable for the Nigerian audience.

This course guide is for distance learners enrolled in the B. Sc Ed Science Education programmes of the National Open University of Nigeria. This guide is one of the several resource tools available to you to help you successfully complete this course and ultimately your programme.

In this guide you will find very useful information about this course; aims, objectives, what the course is about, what course materials you will be using; available services to support your learning; information on assignments and examination. It also offers you guidelines on how to plan you time for study; the amount of time you are likely, to spend on each study unit; your tutor-marked assignments.

I strongly recommend that you go through this course guide and complete the feedback form at the end before you begin your study of the course. The feedback form must be submitted to your tutorial facilitator along with your first assignment. This guide also provides answers to several of your questions. However, do not hesitate to contact your study centre if you have further questions.

I wish you all the best in your learning experience and successful completion of this course.

Course Objectives

There are objectives to be achieved in each study unit of the course. You should read them before studying each unit. On completion of this course you should be able to:

- List the sequences of early non-mechanical counting aids and articulate the stages of envelopment of electronic numerical machine.
- List the generation of computers.
- List various components of computer and their functions and identify different types of software
- Articulate the uses of computer in teaching and learning processes
- Identify the three modes of computer lesson presentation
- Prepare and deliver a computer based instruction
- Identify problems militating against the global use of computer in the teaching and learning processes with particular attention to Nigerian schools.

Course Summary

      Module 1 introduces you to historical development of computer. Module 2 presents computer and computer components. Module 3 deals with computer and instructional processes. Module 4 presents computer based instruction and Module 5 deals with problems militating against the use of computers in the classroom. There are fifteen Study Units in this course. Each study unit consists of one week's work and should take you about three hours to complete. It includes specific objectives, guidance for study, reading material, and Self-Assessment Exercises. Together with tutor-marked assignments, these-exercises will assist you in achieving the stated learning objectives of the individual Study Units and of the course.

Study Plan

      This table is a presentation of the course and how long it should take you to complete each study unit and the accompanying assignments.

Unit	Title of Study Unit	Weeks/Activity	Assignment
	Course Guide	1	Course guide form
Module 1	Historical Development of Computers		
1	Early Aids to Counting and Computing	2	Assignment
2	Evolution of Electronic Machine	3	Assignment
3	Computer Generation	4	Assignment
Module 2	Computer and Computer Components		
1	Computer Components	5	TM I to be submitted
2	Computer Hardware	6	Assignment
3	Computer Software	7	Assignment
4	Software Classification	8	TM 2 to be submitted
Module 3	Computer and Instructional Processes		
1.	Computer Usage in Education Process	9	Assignment
2	Mode of Computer Lesson Presentation	10	Assignment
3	The Use of Network and Internet for Instruction	11	TMA 3 to be submitted
4	Issues in Computer Usage in Education	12	Assignment
Module 4	Computer based Instruction		
1	Developing Computer Science Scheme of Work for Secondary Education	13	TMA 4 to be submitted
2	Lesson Notes for Science/Information Technology	14	
Module 5	Problems Militating Against the Use of Computers in Classroom		

1	Global Problems	15	
2	Problems in Nigerian Schools	16	
	Revision	17	
	Examination	18	
	Total	18	

*You can equally use this overview to plan your personal timetable.

How to get the most from this Course

In distance learning, the Study Units replace the university lecturer. The advantage is that you can read and work through the course materials at your pace, and at a time and place that suits you best. Think of it as reading the lecture instead of listening to a lecturer. Just as a lecturer might give you in-class exercise, your Study Units provide exercises for you to do at appropriate times.

Each of the Study Units has common features which are designed to aid your learning. The first feature is an introduction to the subject matter of the unit and how a particular unit is a set of learning objectives. These objectives let you know what you should be able to do by the time you have completed the unit. You should use these objectives to guide your study.

When you have finished the unit, you should go back and check whether you have achieved the objectives. Self-Assessment Exercises are interspersed throughout each study unit and answers are given at the end of the course.

These exercises are designed to help you recall what you have studied and to evaluate your learning by yourself. You should do each Self-Assessment Exercise as you come to it in the study unit. The summary at the end of each unit also helps you to recall all the main topics discussed in the main content of each unit. There are also tutor-marked questions at the end of each unit. Working on these questions will help you to achieved the objectives of the unit and prepare you for the assignments which you will submit and the final examination.

It should take you about three hours to complete a study unit, the exercises and assignments. When you have completed the first study unit take note of how long it took you and use this information to draw up a timetable to guide your study for the rest of your course. The wide margins on the left and right side of the pages of yours course book are meant for you to make notes of main ideas or key points at which you can use when revising the course. If you make use of all these features, you will significantly increase your chances of passing the course.

Course Deliver

As an open and distance learner, you learn through several ways. You learn when you interact with the content in your course material in the same way as a student interacts with the teacher in a conventional institution. You also learn when you are guided through the course; however you are not taught the course. Instead, your course material is your teacher, and as such you will not be able to get answers to any questions which may arise from your study of the material. It is for this reason that, in additions to the course material which you have received, the delivery of this course is supported by tutorial, facilitation, and counselling support services. Although these services are not compulsory, you are encouraged to take maximum advantage of them.

Tutorial Sessions

The total number of tutorial hours for this course is 8 hours. Tutorial sessions form a part of your learning process as you have an opportunity to receive face-to-face contact with your tutorial facilitator and to receive answers to questions or clarifications which you may have. Also you may contact your tutorial facilitator by phone or mail.

On your part, you will be expected to prepare ahead of time by studying the relevant Study Units…. write your questions so as to gain maximum benefit from tutorial sessions. Information about the location and time schedule for facilitation and will be available at yours study centre.

Tutorial sessions are a flexible arrangement between you and your tutorial facilitator. You will need to contact your study centre to arrange the time schedule for the sessions. You will also need to obtain   your tutorial facilitator's phone number and   email address. Tutorial sessions are optional. However, the benefits of participating in them provide you a forum for interaction and peer group discussions which will minimize the isolation you may experience as a distance learner.

Facilitation

Facilitation is learning that takes place both within and outside of tutorial sessions. Your tutorial facilitation guides your learning by doing the following:

- provide answers to your questions during tutorial sessions on phone or by email;
- coordinate group discussions;

- provide feedback on your assignments;

- pose questions to confirm learning outcomes;

- coordinate, mark and record your assignment examination score; and

- monitor your progress.

The language of instruction for this course is English. The course material is available in print or CD formats, and also on the university website.

On your part, you will be expected to prepare ahead of time by studying the relevant Study Units, write your questions so as to gain maximum benefit from facilitation.

Information about the location and time schedule for facilitation will be available at your study centre. Time of facilitation is a flexible arrangement between you and your tutorial facilitator. You should contact your tutorial facilitator if:

- you do not understand any part of the Study Units

- you have difficulty with the Self-Assessment Exercises

- you have a question or a problem with an assignment, with your tutorial facilitator's comments on an assignment or with   the grading of an   assignment or with the grading of an assignment.

Counselling

Counselling forms a part of your learning because it is provided to make your learning experience easier. Counselling is available to you at two levels, academic and personal counselling. Student counsellors are available at the study centre to provide guidance for personal issues that may affect your studies. Your study centre manager and tutorial facilitators can assist you with questions on academic matters such as course materials, facilitation, grades and so on. Make sure that you have the phone numbers and email addresses of your study centre and the various individuals.

Assessment

There are three components of assessment for this course: Self-Assessment Exercises and assignments at the end of each study unit; the Tutor-Marked Assignments; and a written examination. In doing these assignments, you are expected to use the information gathered during your study of the course. Below are detailed explanations on how to do each assignment.

Self-Assessment Exercises (SAEs)

There are Self-Assessment Exercises spread out through your course material. You should attempt each exercise immediately after reading the section that precedes it. Possible answers to the exercises are provided at the end of the course book, however, you should check the answers only after you must have attempted the exercises. The exercises are for you to evaluate your learning; they are not to be submitted. There are also questions spread through each study unit. You are required to attempt these questions after you have read a study unit. Again, the questions are to help you assess your knowledge of the contents of the unit. You are not required to submit the answers for SAEs.

Tutor-Marked Assignments (TMAs)

There are four Tutor-Marked Assignments for this course. The assignments are designed to cover all areas treated in the course. You will be given your assignments and the dates for submission at your study centre. You are required to attempt all four Tutor-Marked Assignments. You will be assessed on all four, but the best three performances will be used for your continuous assessment.

Each assignment carries 10% and together will count for 30% of your total score for the course. The assignments must be submitted to your tutorial facilitator for formal assessment on or before the stipulated dates for submission. The work that you submit to your tutorial facilitator for assessment will count for 30% of your total course score.

Guidelines for writing Tutor-Marked Assignments

1. On the cover page of your assignment, write the course code and title assignment number (TMA 1, TMA 2), and date of submission, your name and matriculation number. It should look like this:

   Course Code:

   Course Title

   Tutor-Marked Assignment

   Date of Submission

   School and Programme

   Matriculation Number

2. You should endeavour to be concise and to the point in your answers and adhere to word limit where given. Your answer should be based on your course material, further readings and experience. However, do not copy from any of these

materials. If   you do,   you will be penalized. Remember to give relevant examples and illustrations.

3.   Use ruled foolscap sized paper for writing answers. Make and keep a copy of your assignments.

4.   Your answers should be hand-written by you. Leave a margin of about 1.5 inches of the left side and about 5 lines before the answer to the next question for   your tutorial facilitator's comments.

5.   When you have completed each assignment, make sure that it reaches your tutorial facilitator on or before the deadline. If for any reason you cannot complete your work on time, contact your study centre manager and tutorial facilitator before the assignment is due to discuss the possibility of an extension. Extensions will not be granted after the due date unless under exceptional circumstances.

Final Examination and Grading

The final examination for EDU 758 will be of two hours duration, and will carry 70% of the total course grade. The examination will consist of questions which reflect the kinds of Self-Assessment Exercises and questions in the Tutor-Marked Assignments which   you have previously encountered. All areas of the course will be assessed. You should use the time between finishing the last unit and taking the examination to revise the entire course. You will find it useful to review your answers to Self-Assessment Exercises and Tutor-Marked Assignments before the examination. For you to be eligible to sit for the final examinations, you must have done the following:

1.   You should have submitted all the four Tutor-Marked Assignments for the course

2.   You should have registered to sit for the examination. The deadline for examination registration will be available at your study centre. Failure to submit your assignments or to register for the examination (even if you sit for the examination) means that you will not have a score for the course.

Course Marking Scheme

The following table lays out the marks that constitute the total course core.

Assessment	Marks
Assignments 1-4 (four submitted, but the best three of all the assignments selected)	Three assignments, marked out of 10% totaling 30%
Final examination	70% of overall course score

Total	100% of course score

Conclusion

In conclusion, all the features of this course guide have been designed to facilitate your learning in order that you achieve the aims and objectives of the course. They include the aims and objectives, course summary, course overview, Self-Assessment Exercises and study questions. You should ensure that you make maximum use of them in your study to achieve maximum results.

Summary

EDU 758Computer Science Education Methods provides you a basic knowledge on the use of computer for instruction upon which you develop skills in the use of computer in the classroom. It is aimed at equipping you with skills necessary for computer usage in the modern classroom. Upon completing the course you should be able to articulate the historical development of computer, identify various components of computer, select necessary software for classroom instruction, prepare and deliver a computer based instruction and articulate problems militating against the use of computers in the classroom.

I wish you success with the course and hope that you will find it both interesting and useful.

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MODULE 1   HISTORICAL DEVELOPMENT OF COMPUTER

Unit 1   Early Aids to Counting and Computing
Unit 2   Evolution of Electronic Machine
Unit 3   Computer Generation

UNIT 1   EARLY AIDS TO COUNTING AND COMPUTING

CONTENTS

1.0   Introduction
2.0   Objectives
3.0   Main content
            3.1   Early Non-mechanical Counting Aids
            3.2   Early Mechanical Counting Aids and Computing Device
            3.3   Information Processing Devices
4.0   Conclusion
5.0   Summary
6.0   Tutor-Marked Assignment
7.0   References/Further readings

1.0   INTRODUCTION

History serves as the linkage of the present to the past as well as to the future.
Therefore, your understanding of historical development of computer will not only be
an impetus for you to appreciate efforts made to arrive at where computer technology
is today but also sensitize you to also make your own contribution to its future uses
and how to improve computer technology as a whole for the betterment of humanity.
An historical approach will help you to understand that the invention of computer was
as a result of human problems related to mathematics and the beginning of
mathematics is counting. Various aids were used for counting at one time or the other;
starting with fingers, pebbles, and ABACUS. This unit will take you through the
stages of early aids to counting; starting with early non-mechanical counting aids,
followed by early mechanical counting and computation devices and finally the
evolution of information processing aids.

2.0   OBJECTIVES

By the time you complete this unit, you should be able to

    (1)   List the sequences of early non-mechanical counting aids.
    (2)   Identify the first counting device.
    (3)   Name early inventors of counting and computing devices.

3.0   MAIN CONTENTS

3.1   Early Non-mechanical Counting Aids

Throughout history, man experienced an ever-increasing need for numerical calculations and has continued to seek ways to meet this need with a minimum of mental and manual efforts. The early man, like his predecessors, was blessed with fingers and toes as an inherent means of counting.   For instance, look at   your hands; have you ever used your fingers to help you count? Perhaps you used them to help you to add two numbers. When you did this, you were using your fingers as a counting device. It was a very simple device which helped you to carry out simple additions. However, there were limitations on how far one could go with these facilities.

As time progressed, these limitations were overcome by the discovery that pebbles, grains of corn, and other small objects could be used for counting. Again, look at your fingers . How many have you? You have ten if you include your thumbs. Because you have ten fingers, they are not very good for counting when the numbers are larger than 10. Because of this, primitive man started to use pebbles and related materials, instead of fingers, to help him to count. Suppose he wanted to count the number of animals he owned, He built a pile of stones with one stone for every animal. After he had finished building the pile he would then look at it and see how many stones there were in it. This was not easy if all the stones were in a single pile. So he put them into smaller piles of the same size. What size did he choose for each of these smaller piles? He decided that the size of each pile should be ten. He picked this number because he had ten fingers.

Suppose that after counting his animals the primitive man had three piles of ten stones and one smaller pile of four. After looking at the piles he said, "I have three tens and one four". He called the number thirty-four. Even quite small numbers like 34 used a lot of stones. Using stones is no good for large numbers. The   next   step was to use a different stone to mean ten animals. Perhaps our primitive man used black stones to count up to 10. He used white stones to count the number of tens. The number 34 only needed 7 stones, 3 white and 4 black. This method was also used to count larger numbers. Red stones could be used for hundreds. Then the number 154 used only ten stones. The piles of stones looked like this: *1 red stone, 5 white stones and 4 black stones.* This simple way of counting was difficulty to use because stones were very awkward.

The next idea was to use coloured beads threaded on a string. At first the beads were made of stone. Around about the year 1200 the Chinese used this method of counting to address the problem of how to handle pebbles conveniently. The beads were threaded on lines of wire frame. The beads on the first line counted the units. The beads on the second wire counted the tens. The bead on the third wire counted the hundreds and so on. By moving the beads back and forth along wires, numbers could be added and subtracted. This device was called an *ABACUS. The Abacus is a Wooden frame with strings on which colourful beads are strung*

However, the problem of how to handle pebbles conveniently had earlier been solved in the Tigres-Euphrates Valley about five thousand years ago by designing a clay board with grooves into which the pebbles could be placed. This device enabled the grooves to be moved from one side of the instrument to the other to facilitate counting. This technique, which was the forerunner of the ABACUS, came to be adopted and modified by the Chinese and Japanese. The ABACUS in its present form is believed to have originated in China about 2600 B. C. The Japanese had a similar device called the soroban. The ABACUS probably did not reach Europe prior to the beginning of the Christian era because the abax (as it was called by the Romans) was first described by Greek authors about A. D. 300, and was of exactly the same design as the Chinese and Japanese devices.

The ABACUS comprises several rows of beads which slides on sticks or wires mounted in a rectangular frame. The frame of the ABACUS is divided by a cross member so that each row of beads has a sector with one bead (two on some ABACUSES), and another sector with four or five beads. Although simple in appearance, the ABACUS is an amazingly versatile and efficient computing device and is still widely used in certain parts of the world.

After this first milestone, about four thousand years passed before the next significant development in computational aids, A major obstacle to the invention of mechanical computing devices was the Roman numeral system which was in use throughout Europe as the at the time. Roman numerals, although they added dignity top monuments, presented a lot of difficulty in arithmetic operations, for example, the multiplication of MCMXIX by XVIII. This problem was alleviated by the introduction of the Arabic numeral system about A. D. 1200. However, with the improved numeral system, no mechanical aid to calculation of any merit appeared until the seventeenth century (the great century of Mathematical progress).

SELF ASSESSMENT EXERICES 1

1. Which aids did people use for counting in the early time?
2. State the major limitation of Roman numeral.

3.2 Early Mechanical Counting Aids and Computing Device

ABACUS can be said to be the first device for counting and computation. However, the inversion of numerals gave way to other computation devices. For example, In 1617 John Napier, a Scot, developed logarithms, a tabular system of numbers by which arithmetic operations are simplified. With tables of logarithms multiplication and division are more easily performed as addition and subtraction, respectively. This development stimulated the invention of many devices that used addition of logarithms in place of multiplication. Notable among these was an instrument

invented by Napier himself in 1617 and came to be known as "Napier's bones". The device was a mechanical arrangements of strips of bone on which numbers were printed. When brought into combination, the strips were capable of performing direct multiplication. However, just over three hundred years ago, the first machines for helping with calculations were invented. These machines were mechanical. They had parts which moved. The power that caused the movement was provided by the person who was using the machine. Calculating machines like these were in used in the 1970s but became out of date with the invention of electronic calculators.

A Frenchman called Blaise Pascal was the first person to achieve success in the development of a digital counter. In 1642, at 19, he invented a device to assist in adding long columns of figures in his father's tax office in France. Pascal's gear-driven machine, named *PASCALINE,* the size of a shoe box, comprised a row of wheels with teeth numbered from 0 to 9. The first wheel denoted units, the second, tens; etc. When the first wheel was turned five spaces, 5 showed in a window at the top of the machine. If the wheel was turned two more spaces the result was 7. The addition of another seven caused the indicator to proceed through 0 to 4. In this instance, a lever on the units dial must have moved the tens dial one-tenth of a revolution so that the machine had "carried one," indicating a total of 14. This was a simple device, more like a mileage gauge or a revolution counter than a modern computer, but it contained three principles that were used in later inventions: (i) carry over should be automatic (ii) subtraction could be accomplished by turning dials in reverse (iii) multiplication could be performed by repeated addition. The period of Pascal invention can be described as the transition between mechanical computation aids and calculating machine.

In 1671, the German Philosopher and Mathematician, Gottfried Leibniz, conceived a calculating machine, called *The Stepped reckoner,* which utilized the principle of multiplication by repeated addition. The most important component of his instrument, completed in 1674, was the stepped where, a cylindrical drum with nine teeth of increasing length along its surface. On rotating the drum, a gear sliding on an axis parallel to that of the drum engaged some of the teeth, thus being rotated an equal number of steps. This feature of the Leibniz machine is still present in some of today's calculators. The next century was marked by a futile search for a satisfactory machine.

SELF ASSESSMENT EXERCIES 2

1. Who built the first computing device?
2. What did John Napier develop in 1617?

3.3   Information Processing Devices

The machines mentioned so far are only calculators. They are used to add, subtract, multiply and divide two or more numbers. However, In the nineteenth century there was a new idea. This idea was to give a machine some information which was then used by it. We say that the machine is *processing* the information which it has been given.

An early example of a machine which processed information was used by a French cloth manufacturer, called Joseph Jacquard. In 1802 he built a machine to help weave complicated patterns. When a pattern is woven, each of a number of threads must be raised or lowered. When this has been done the weaving loom pulls another thread between the raised and lowered thread, then each of the threads is raised or lowered in a different way and the loom passes between them again. This is done very many times when a length of cloth is woven. Jacquard's loom used lines of holes on a card to represent the weaving pattern. If there were ten threads there was space in each line for ten holes.

The card was attached to a device on the loom which was able to look for holes in the card. The device looked at each line. If there was a hole in positions 3, 5 and 9 then the third, fifth and ninth threads were raised and the rest lowered. After this was done the loom would start to weave. Then the device would look at the next line of holes on the card. It would raise and lower the threads and start weaving again. The information on the card was processed by the loom. A loom operator used to do these before the invention and it was a tedious and time consuming job.

Jacquard's invention emphasized three concepts:
- information could be coded on punched cards
- cards could be linked in a series of instructions and
- many programs could automate jobs.

Similarly, In 1822, an Englishman called Sir Charles Babbage built a machine called *Difference Engine.* In this, information on cards was supplied to the machine. The machine then used wheels with teeth on them to do some mathematical calculations. Babbage later designed another machine called an 'Analytical Engine'. He wanted to use this for more complicated calculations. Babbage died before he could complete this difficult task. He was the first to exploit the concepts from Jacquard's loom in a computing machine. Charles Babbage is known as the father of computers because of the ideas he introduced. A friend of Babbage called Ada, Countess, of Lovelace, showed how the 'Analytical Engine' could be used to do some particular calculators. Sir Charles Babbage is often thought of as the inventor of the computer and Lady Lovelace is regarded as the first computer programmer. She is also one of the few women to have been involved in the early history of computing.

The Analytical Engine has four parts:

- a mill for calculating
- a store for holding instructions, intermediate and final results
- an OPERATOR (or system) for carrying out instructions
- a device for "reading" and "writing" data on punched cards.

During the rest of the nineteenth century more complicated mechanical devices were built. The most important was made by an American called Hermann Hollerith. He used it to process the information obtained in the census of the population carried out in the United Stated in 1890. With this machine, he was able to do in three years what would have taken very many people seven years to do by hand. Hollerith formed a company to sell his machines. After a series of mergers with other companies, his company became part of American Computer Company, International Business Machines (IBM). IBM is now one of the largest computer manufacturers in the world.

Another machine, used for computing, recording, and controlling, was the cash register, invented in 1879 by James Ritty of Dayton, Ohio. The cash register was made commercially successful by John Patterson, who founded the National Cash Register Company in 1894. These machines have given a valuable service to stores throughout the world.

In 1909, Charles Kettering developed for the National Cash Register Company the first accounting machine, a teller machine for certifying passbooks. Using a tabulating carriage, the machine could sort data into a number of columns in addition to performing the functions of recoding, calculating, and summarizing. By 1920 electromechanical machines had come into several uses. Electric activation accorded greater speed and facility in adding, calculating and book keeping machines. Nevertheless, these machines although efficient, had two major limitations:

(i)   they were manual rather than automatic instruments, since they required an operator depressing a key, a bar or lever, in order to perform each processing step.

(ii)   the machines operated independently of other units of equipment, although each machine could carry out one or more of four processing functions: recording, summarizing, calculating, and to some extent, sorting.

Both of the above limitations were eliminated by the punched card system which first brought about compatibility of machines. Furthermore, these machines provided a means of performing more operations automatically. For the first time ever, a series of machines was able to carry out a variety of functions through the punched card.

The first attempt at using the punched card principle in a mathematical application was made by the English Mathematician, Charles Babbage, who, in 1912 began work on what was called his "folly" by critics. This was a "different engine" designed to calculate and print mathematical tables. After about a decade of work on the difference engine, Charles Babbage turned his attention on a more challenging project,

the "analytical engine", a device with many highly sophisticated innovations. These included a memory or storage unit that would store data in the form of holes punched in cards. Secondly, the device had an arithmetic unit where mathematical calculations would be performed. In addition, it had a control unit which would direct operations. Unfortunately however, Babbage's machine was ahead of its time by a century and could not work in his time.

Earlier in 1887 Dr. Herman Hollerith a statistician with the US census bureau developed a mechanical system of recording, computing, and tabulating census data. Dr. Hollerith had been engaged by the census Bureau in 1880 and was motivated by the need for a more practical approach to handling census data. The 1880 US census data was written on large cards which had to be sorted by hand into necessary classifications, such as age, sex, occupation, and location, and counted manually. These cards were resorted and recounted several times to provide the required information. From the magnitude of the work, it became apparent that the 1890 census, with millions of additional people would not be completed at the end of the decade, so that the reallocation of congressional seats as required every ten years by the constitution would not be possible.

By the completion of the 1880 censure report in 1897, Dr. Hollerith already had his plans for a new system using punched holes in a long strip of paper tape as a means of recoding data. However, this proved impractical, so that the 1890 census data had to be placed on cards by means of holes cut with a hand- operated punch. The cards were positioned one by one over mercury-filled cups. Rows of telescoping pins descending on the surface of each card dropped through the holes, thereby completing electrical circuits and causing pointers on appropriate counting dials to move one position.

Using this device, which tabulated cards at the rate of 50 to 75 a minute, the 1880 census of 62 million people was completed in one-third the time taken to complete the 1880 census of only 50 million people. To commercialize his machines, Dr. Hollerith organized the Tabulating Machine Company in 1896. His punched card machines were patronized by railroads, insurance companies, department stores, etc. In 1911, the company which had been formed by Dr. Hollerith to develop his equipment merged with two other companies to become the Computing Tabulating-Recording Company, which in 1924, changed its name to International Business Machines Corporation.

Significant advancements in the use of punched card machines occurred between 1900 and the early 1930s when punched cards with a greatly increased capacity of 80 and 90 columns of information came into use. Machines were developed that could not just add and subtract figures but also multiply. This made it possible for them to perform full-scale record-keeping and accounting functions. The advent of machines that could handle alphabetic data resulted in the use of the punched card method for name-and-number jobs such as payroll and inventory.

These innovations among others enhanced the speed, versatility, and usefulness of punched card machines, resulting in the constantly increasing use of such devices for business data processing as well as for scientific calculations and statistical studies. However, the electromechanical nature of punched card equipment posed several constraints:

(i)   their speed is limited by their basic design and by the physical or mechanical manipulation of cards.

(ii)   since each machine is designed to perform a specific function the transfer of cards from one unit to another for various operations not only takes time but also leaves room for error.

The first successful attempt to overcome these constraints by combining the various operations in a single device was made by Professor Howard Aiken of Harvard University. Prof. Aiken with a team of engineers from International Business Machines Corporation worked from 1939 to 1944. Their combined efforts resulted in the completion in 1944 of the Automatic sequence Controlled Calculator, popularly called Mark 1. It was an electro-mechanical machine, most of whose parts were from standard IBM equipment or modifications of them. Mark 1 made use of relays and was controlled by punched paper tape. By this Babbage's dream of a hundred years earlier had come to reality. Following this success, other large-scale digital machines using electromechanical techniques were developed.

Although these were a great improvement over devices of the past, they could not meet the vast data requirements of science and engineering that developed swiftly from the Second World War. As these machines were electromechanical devices using electrical relays or counter wheels, their effectiveness was limited by slowness and mechanical operating difficulties. These restrictions were overcome by the next major development in data processing history, the invention of the electronic computer.

SELF ASSESSMENT EXERCIES 3

1. Who is the father of computer?
2. What did Hermann Hollerrith use his machine to process?

4.0   CONCLUSION

The Early man is believed to have started the counting with his fingers and due to the limitation of this counting aid, he used pebbles, grains of corn, and other small objects to assist him in his process of counting. The problem of how to handle pebbles conveniently motivated Tigres-Euphrates Valley about five thousand years ago to design a clay board with grooves into which the pebbles could be placed. This device enabled the grooves to be moved from one side of the instrument to the other to facilitate counting. The first computation device is ABACUS and it took a period of four thousand years after the invention of ABACUS before the invention of Roman and Arabic numerals. The invention of numerals paves way for invention of various computational and information processing devices, including punched card machines.

5.0   SUMMARY

In this Unit, you have been exposed to various developmental stages of counting, computing, and information processing devices. The limitations of one counting device pave way for the preceding counting device, until the arrival of counting, computation and information processing devices. The invention of counting, computation and information processing devices lead to the evolution of electronic machines. Therefore, the next Units will expose you to evolution of electronic machines.

6.0   TUTOR-MARKED ASSIGNMENT

(1)   List the sequences of early non-mechanical counting aids.
(2)   List the limitations of each of the non-mechanical counting aids
(3)   List the advantages of mechanical computation and information processing aids over mechanical computation aids and non-mechanical counting aids.
(4)   Charles Babbage was unable to realize his computer dream and computer is still regarded as his brain child; discuss.

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UNIT 2   EVOLUTION OF ELECTRONIC MACHINE

CONTENTS

1.0 Introduction
2.0 Objectives
3.0 Main content
       3.1   Electronic Numerical Machine
       3.2   Electronic Computers
4.0 Conclusion
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6.0 Tutor-Marked Assignment
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1.0   INTRODUCTION

The need to understand the stages of development that led to the emergent of computer necessitate the study of evolution of electronic machine. Hence, the evolution of electronic machine will expose you to efforts made to arrive at present day computer.

The evolution of electronic numerical machine started with musical box. The music box builder deals with only two options when it comes to placing pins on the drum: put a pin in or don't put a pin in. This is the principle based on the binary system. During the seventeenth, eighteenth, and nineteenth centuries, several scientists including John Napier, *Blaise Pascal,* Gottfried Leibnitz, and Charles Babbage, invented mechanical aids for solving simple mathematical problems. The devices of Pascal, Laibnitz, and Babbage all used intermeshed gears to represent the basic mathematical operations of adding and subtracting.

The most ambitious of these devices, the *difference engine* of Charles Babbage, was so complex that it required gears more precise than could be produced in the nineteenth century. As the nineteenth century ended, the precision required to produce reliable mechanical calculators became available. ENIAC was the beginning of the age of computers. The first of these developments was the transistor, which was developed in 1947. The mid 50s marked a period of transition in the history of computers. Many of the computers developed were built specially for business use. It made modern computers practical because of it dependability, small size and low power requirements. Another computer revolution occurred in 1971 when Intel Corporation produced the **microprocessor** IC. The details of these stages of the development are fully discussed under this unit.

2.0   OBJECTIVES

At end of this Unit, you will be able to:

1. Articulate the stages of envelopment of electronic numerical machine.
2. List the processes that lead to the invention of modern computer.
3. identify examples of first generation computers

3.0   MAIN CONTENTS

3.1   Electronic Numerical Machine

One of the earliest ancestors of electronic computers is the music box. The sound from a music box is created by a slowly rotating drum with small metal pins protruding from it. As the drum revolves, the pins catch music boxes that play very complex, very beautiful compositions. The important point you have to remember is that the music box builder deals with only two options when it comes to placing pins on the drum: put a pin in or don't put a pin in.   When you have only two choices you have a ***Binary system.***   The binary number system has only two digits, I and 0, and it uses these two digits to build larger numbers. The music box builder converts binary 1's and 0's   into pins on a drum (that is, 1 = pin, 0 = no pin). Today, computer designers convert binary numbers into electrical signals (1=on, 0= off). The basic principle is the same. The music box builder and the modern computer designer both build complicated patterns from simple ones. Inside the computers you will use in your classroom everything is expressed in patterns of 1's and 0's.

While the music box is one ancestor of the computer, it is not the only one. During the seventeenth, eighteenth, and nineteenth centuries, several scientists including John Napier, ***Blaise Pascal,*** Gottfried Leibnitz, and Charles Babbage, invented mechanical aids for solving simple mathematical problems. The devices of Pascal, Laibnitz, and Babbage all used intermeshed gears to represent the basic mathematical operations of adding and subtracting. On these machines, adding numbers involved turning gears that in turn caused other gears to rotate. The answer to the problem was then read from indicators attached to the gears. The most ambitious of these devices, the ***difference engine*** of Charles Babbage, was so complex that it required gears more precise than could be produced in the nineteenth century.

In spite of his difficulties in actually building the difference engine, the English mathematician   Charles Babbage is generally considered the father of computing (Evans, 1981), because he also   designed the ***analytical engine,*** a device that could be programmed or instructed to perform a variety of computational tasks. Babbage was assisted by ***Ada Lovelace,*** the daughter of the poet Lord Byron and a theoretical mathematician in her own right. Her contribution to the development of computing was acknowledged in the 1970s when a new computer language, Ada, was named after her.

The reason that computers are relatively young, therefore, is not the complexity of the concepts used to create them. It was the problem of manufacturing them that held back earlier efforts. Babbage's analytical engine was to be a huge assemblage of metal rods, wheels, and gears run by a steam engine. The precision possible at that time was simply not good enough to allow the design to work properly. Charles Babbage died in 1871 and in 1876 and American engineer named George Grant demonstrated a difference engine that worked. Grant, in fact, actually sold a number of machines, which he called rack and pinion calculators.

As the nineteenth century ended, the precision required to produce reliable mechanical calculators became available. It was also at this time that American technology began to equal and even exceed European technology. In the first half of the twentieth century, researchers continued to work on mechanical computers in the tradition of Babbage. For example, Vannevar Bush, a professor at MIT, built and demonstrated a differential analyzer in 1930. Bush's machine was the first to use electricity not only to turn the gears, but also to store data. His machine could store numbers or quantities as electricity in one part of the system. Because memory, the ability to store data the computer will use later, is an important aspect of any electronic computer.

Konrad Zuse, a German engineer, and Howard Aiken, a Harvard math professor, both built hybrid, part mechanical and part electronic machines in the period between 1930 and 1945. These hybrid computers were never widely used in Germany or the United States. The future belonged to fully electronic computers. Although there is some controversy over the title, many consider the still secret British computer called Colossus the first special-purpose, electronic digital computer. Digital computers are no/off devices. In computers On and Off are generally referred to as 1 and 0, and all data inside digital computer consist of patterns of 1's and 0's. Colossus was developed by a secret team of scientists that included *Alan Turing*, a mathematician who made several contributions to the theoretical concepts of computing.

Another major contributor to the intellectual and conceptual stew that led to the development of modern computers was John von Neumann (goldstone, 1972). Born in Budapest and educated at several major European universities, he published a scholarly treatise at age 18. Both von Neumann and Turing believed that binary numbers should be the basis of computers. At first glance it is difficult to see how a machine that can deal with only two states, on and off (or 1 and 0), could accomplish anything important. Fortunately, more than 100 years earlier another British mathematician, *George Boole*, had developed a complete algebraic system of logic that used only two digits, 1 and 0. Early computer theorists, who needed a system of logic for a machine that could deal with two states, *on and off,* found Boole's logic essential to their work. The leap from obtuse theory to electric circuits was by George Shannon. He used the **yes - no, true – false** of Boolean logic to wire electrical switching circuits. Shannon expressed Boolean logic with electrically operated mechanical relay. Less than a decade later others created a computer by expressing Boolean logic with vacuum tubes.

The general-purpose electronic digital computer which is said to have had its beginning with Electronic Numerical Integrator and Calculator (ENIAC) was developed between 1942 and 1946 at the University of Pennsylvania by Dr. John Mauchly and J. Presper Eckert. The ENIAC occupied the entire basement of the University's School of Electrical Engineering, weighed almost 30 tons, had more than 18,000 vacuum tubes, and needed more than 1,500 square feet of floor space. History shows that many early creative minds mode their mark on the development of today's electrical computer. In 1948, there was invention of transistor to replace vacuum tubes by a single small device.

The ENIAC was designed primarily for solving problems in ballistics at the Aberdeen Proving Ground but contained advisements that were adopted for use in other computers built for business applications. Switching and control functions performed by relays in previous machines were handled by vacuum tubes in the ENIAC. Hence the relatively slow movements of switches in electromechanical devices were replaced by the fast movement of electrons. By this innovation computations could be performed one thousand times as fast as before. Although the ENIAC was a great advancement and was adaptable to a wide range of applications, its limited storage and the difficulty in presenting instructions were serious handicaps.

During the early days of computers, machine instructions were programmed on interchangeable control panels, cards or paper tapes. As work progressed, detailed instructions were wired or read into the machine. As the computer processed data according to predetermined instructions, the operations of the ENIAC were very inflexible. In order to increase the computer's ability to process data without the assistance of an operator, it was important to have its program (i.e. instructions) stored in a high-speed internal storage unit. This was such an internal storage system the computer would be able to process a program in the same way that it processed data and would also be able to modify its own instructions as necessary during processing.

SELF ASSESSMENT EXERCIES 1

1. List two electronic numerical machines.
2. On what principle are the electronic numerical machines based?

3.2   Electronic Computers

ENIAC was the beginning of the age of computers. Over the next two decades, a number of developments helped bring us from boxcar-sized computers like ENIAC to computers the size of a book. The first of these developments was the transistor, which was developed in 1947. It made modern computers practical because of it dependability, small size and low power requirements. Transistors replaced vacuum tubes as the building blocks of computers, and the computer age was underway.

Since 1947 several major advances in semiconductor technology have produced smaller and smaller components that do more and more. The most important of these advances is the development of the *integrated circuit* or IC. By 1958, transistors had revolutionized the electronics industry. However, during manufacture each component in a transistorized electronic circuit had to be connected to other components. In large computer, this meant millions of connections.
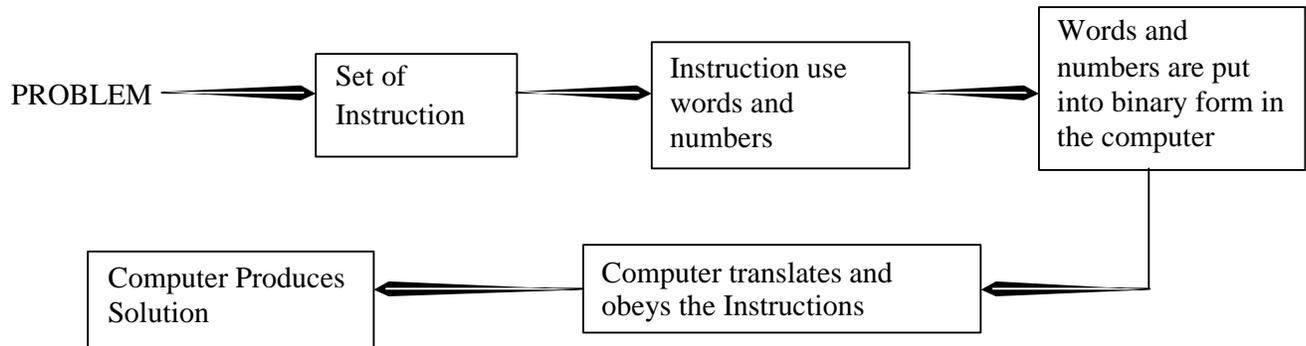
Large scale integrated (LSI) circuits followed soon after ICs with hundreds and then thousands of components packed into a single *chip.* Chip contains many transistors, resistor, and capacitors in a circuit enclosed in a single small case. The large scale integrated, followed by very large scale integrated (VLSI) and ultra large scale integration, enabled designers to put the equivalent of large room and then buildings full of 1950s-era vacuum tube circuits on a tiny sliver of silicon smaller than the smallest coin.

Another computer revolution occurred in 1971 when Intel Corporation produced the **microprocessor** IC. These computers on a chip are what made personal computers possible. In 1974, the first microcomputer kit was advertised. In 1977 and 1978, several companies, including Tandy/Radio Shack and Apple Computer Company, began selling assembled computers. These personal computers (PC) were designed so that the buyer could unpack the system, plug it in, and begin using it. Tandy/Radio Shack and Apple Computer still manufacture popular computers that are widely used in business and education.

Electronic computers are possible because of these two important points:

i.   Information such as words and numbers can be put in a binary form. Each number and letter is represented by a series of Is and Os.
ii.   Electronic devices have been invented to enable words and numbers to be represented in binary form. Each number and letter is represented by series of ONs and OFFs of a current.

Computers are used to solve problems. Problems are solved by giving the computer a set of simple instructions. Here is a picture of what happens.

PROBLEM → Set of Instruction → Instruction use words and numbers → Words and numbers are put into binary form in the computer

Computer Produces Solution ← Computer translates and obeys the Instructions ←

The VALVE provides a method of switching a current on and off. A set of ONs and OFFs can be used to represent the binary form of a number. The invention of value allowed the first electronic computers to be built. However values are quite large. Because these early computers had many values, they were very large. Values were also unreliable and so they had to be replaced very often.

These features were built into the stored program digital computers that marked the next great milestone in the evolution of electronic computers. The first to be completed was the EDSAC, Electronic Delayed Storage Automatic Computer, built by Cambridge University in England and came into operation in 1949. The EDSAC employed mercury acoustic delay lines for storage. These devices comprise thin tubes of mercury with crystals at both ends. An electrical impulse entered on the input crystal, causes the crystal to vibrate mechanically, thereby sending as acoustic signal through the fluid to the output crystal. When this sound wave hits, it produces a mechanical vibration in the second crystal. This vibration becomes an electrical signal (the image of the one originally transmitted). The reformed and amplified electrical impulse is fed back to the input crystal with the process repeated. By the process of this loop, data represented by a set of impulses may be kept circulating through the mercury until it is needed.

The EDVAC, Electronic Discrete Variable Automatic Computer, designed for the US army by the University of Pennsylvania, was completed in the early 50s and was comparable to the EDSAC since it also utilized the sonic delay properties of mercury for storage. Another well-designed machine was the ACE (Automatic Calculating Engine) completed at the National Physical Laboratory, London in 1950. Compact and reliable in operation, the ACE used standard punched card equipment for input and output. Unlike the EDVAC and EDSAC which operated in such a way that instructions are placed in consecutive positions in storage, the ACE adopted the two-address system in which each instruction contains not only the location of the number to be operated upon (operand) but also the location of the next instruction. This

procedure minimized the waiting time inherent in delay line storage device by allowing the use of better programming techniques.

Among other machines developed on the principle of acoustic delay line storage was the UNIVAC (Universal Automatic Computer), designed by Eckert and Mauchly, builders of the ENIAC. The first UNIVAC computer was delivered to the census Bureau in 1951, and was used almost continuously 24 hours a day, 7 days a week for over 12 years. UNIVAC was among the first computers to use magnetic tape as an input-output medium. It was well-known for its speed, reliability, memory capacity, and the ability to handle numeric and descriptive information equally well. Since these features make computers economically attractive, the first UNIVAC was delivered to a business enterprise in 1954.

The mid 50s marked a period of transition in the history of computers. Many of the computers developed were built specially for business use. Although they processed data in much the same way as previous computers, the new business systems were designed to handle the vast quantities of date typical of business operations. Instead of the punched cards or punched tape used for input of data in earlier computers, magnetic tape was used for external data storage. The new method increased input speed from 50 to 75 times that of punched cards and also improved output and storage. For internal storage, magnetic cores came to be used and were destined to become the predominant form of internal storage. Magnetic cores are small rings of ferromagnetic material, which when strung on a complex of wires constitute a high-speed internal storage system in which items of information can be located and made available for processing few millionths of a second.

SELF ASSESSMENT EXERCIES 2

1. What is the role of Integrated circuit in the invention of electronic computer?
2. What is ENIAC?

4.0   CONCLUSION

The evolution of electronic machine, started as one of the earliest ancestors of electronic computers. The music box which forms the basis for the development of modern computers is created by slowly rotating drum with small metal pins protruding from it. The Binary System are also used to build larger numbers from the two digits of 1 and 0. There are other devices apart from the earliest ancestors computers (music box)developed in the seventeenth, eighteenth and nineteenth centuries. ENIAC was the beginning of the age of computers. Over the next two decades, a number of developments helped bring us from boxcar-sized computers like ENIAC to computers the size of a book. The first of these developments was the transistor, which was developed in 1947. Large scale integrated (LSI) circuits followed soon after ICs with hundreds and then thousands of components packed into a single *chip.*   The EDVAC, Electronic Discrete Variable Automatic Computer, designed for the US army by the

University of Pennsylvania, was completed in the early 50s and was comparable to the EDSAC since it also utilized the sonic delay properties of mercury for storage. The mid 50s marked a period of transition in the history of computers. For internal storage, magnetic cores came to be used and were destined to become the predominant form of internal storage.

5.0   SUMMARY

This unit has revealed the evolution of electronic machine called the music box. This machine has led to the development of modern computers over the years. The Binary System are also used to build larger numbers from the two digits of 1 and 0. The first of these developments was the transistor, which was developed in 1947. A number of developments helped bring us from boxcar-sized computers like ENIAC to computers the size of a book. The EDVAC, Electronic Discrete Variable Automatic Computer, designed for the US army by the University of Pennsylvania, was completed in the early 50s and was comparable to the EDSAC since it also utilized the sonic delay properties of mercury for storage. However, the computers are classified according to either time of invention or size of memory, the detail of these classifications will be discussed in the next Unit.

6.0   TUTOR-MARKED ASSIGNMENT

(1) Explain the operation of the music box?
(2) Mention and explain the trends that led to the evolution of modern computers?

7.0   REFERENCES/FURTHER READINGS

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UNIT 3   COMPUTER GENERATIONS

CONTENTS

1.0   INTRODUCTION

From the previous Units, the developmental stages of computers were discussed. During the discussion, it was discovered that the invention of computers spanned across a long period of time. Besides, the earlier computers were so big and latest are of reasonable sizes. Each generation of computer is characterized by a major technological development that fundamentally changed the way computers operate, resulting in increasingly smaller, cheaper, more powerful, more efficient and reliable devices. Therefore, the classifications of computers are along the sizes and periods of invention and well efficiency. The Unit however will expose you the various generations of computers; ranging from first generation to fifth and future computer generations.

2.0   OBJECTIVES

At the end of this Unit, you will be able to
    1. List the generation of computers
    2. Identify the peculiarity of the each generation of computers

3.0   MAIN CONTENT

3.1   First and Second Computer Generations

First Generation (1940-1956) Vacuum Tubes: The first computers used vacuum tubes for circuitry and magnetic drums for memory, and were often enormous, taking up entire rooms. They were very expensive to operate and in addition to using a great deal of electricity, generated a lot of heat, which was often the cause of malfunctions. First generation computers relied on machine language, the lowest-level programming language understood by computers, to perform operations, and they could only solve

one problem at a time. Input was based on punched cards and paper tape, and output was displayed on printouts.

The UNIVAC and ENIAC computers are examples of first-generation computing devices. The UNIVAC was the first commercial computer delivered to a business client, the U.S. Census Bureau in 1951.

When we were discussing the history of computing, we talk about different GENERATIONS of computers, because, a new invention led to each new generation.
In the Second World War, from 1939 to 1945, some of the first electronic computes were built. In Germany a computer helped to design the German flying bomb and missiles. The British used a computer called COLOSSUS to crack the secret code used by Germany to send messages. The COLOSSUS computer was very large indeed. It contained 1500 values. It was used for the first time in 1943. After the war more large computers were built. Some of the first ones were used for carrying out complicated calculations. One of the first was called ENIAC and was built in the United States. It contained 1800 values. ENIAC is an acronym for Electronic Numerical Integrator and Calculator. Most of the first electronic computers were built and used in universities for solving scientific problems. It was soon realized that they could be used in other places such as industry and business. One of the first to be built outside a university was built for the well-known Tea Company, J.M. Lynos. Their computer was called LEO.

Features of the first generation computes include:
i. huge size
ii. instructions were coded in machine language
iii. expensive to buy and power
iv. slow and often unreliable
v. limited internal storage
vi. used to enter data into the machines.

First generation computers employed vacuum tubes for their circuits. They were bulky, slow, demanded considerable power, and produced much heat, thus creating air conditioning problems.

Characteristics of first generation computers: (not all first generation computers had all these characteristics)

-vacuum tube based
-punched tape input or output
-about 1,000 circuits per cubic foot

Examples of first generation computers

-Harvard Mark I (electromechanical)
-Whirlwind
-ENIAC
-EDSAC
-UNIVAC I, UNIVAC II, UNIVAC 1101
-RCA BIZMAC
-NCR CRC 102A, NCR CRC 102D
-Honeywell Datamatic 1000
-Burroughs E101, Burroughs 220
-IBM models 604, 650 (drum memory), 701, 702, 704, 705, 709

Second Generation (1956-1963) Transistors: Transistors replaced vacuum tubes and ushered in the second generation of computers. The transistor was invented in 1947 but did not see widespread use in computers until the late 1950s. The transistor was far superior to the vacuum tube, allowing computers to become smaller, faster, cheaper, more energy-efficient and more reliable than their first-generation predecessors. Though the transistor still generated a great deal of heat that subjected the computer to damage, it was a vast improvement over the vacuum tube. Second-generation computers still relied on punched cards for input and printouts for output.

Second-generation computers moved from cryptic binary machine language to symbolic, or assembly, languages, which allowed programmers to specify instructions in words. High-level programming languages were also being developed at this time, such as early versions of COBOL and FORTRAN. These were also the first computers that stored their instructions in their memory, which moved from a magnetic drum to magnetic core technology. The first computers of this generation were developed for the atomic energy industry.

Second generation computer utilized solid-state devices, such as transistors. They were physically less bulky, more reliable, and generated less heat. During this period, modularity or the "building block" concept was introduced into computer design, particularly the design of internal circuitry. This made computer systems easily expandable instead of being replaced as users required increased speeds or more storage capacity. Improvements in peripheral devices, such as increasing the speed of output units made it possible for these units to be directly connected to the computer and used on-line, without unduly reducing the overall speed of the system. Other innovations included built-in error detection and correction devices as well as better programming techniques, which reduced the need for operator intervention. In addition, teleprocessing equipment was introduced to expedite the flow of information to and from computers over long distance.

It must be noticed that first generation computers relied on values. These were quite large and often had to be replaced. This was a big drawback with first generation computers. It was overcome with the invention of the TRANSISTOR. The transistor

was invented by William Shockley in 1948. Transistor did the same job as values but they were small and reliable. In the second generation of computers transistors replaced values. Second generation computers were not just more than the earlier computers, they could also carry more difficult calculations. They used more sophisticated English-like computer languages for coding, e.g. COBOL, FORTRAN. External storage like magnetic tape or magnetic disks supplemented the internal storage for which magnetic cores were used instead of magnetic drums.

These improvements were further enhanced by the development of magnetic disc storage which provided random (or direct) access to stored information. Before disc storage, in both electromechanically and electronic systems, information was batched or sorted into sequence before processing began and professing was done sequentially. With disk storage it became possible to locate and update any one record in a stack of rotating discs in a fraction of a second.

Characteristics of second generation computer:
-used transistors
-about 100,000 circuits per foot

Examples of second generation computer:
-UNIVAC 1107, UNIVAC III
-RCA 501
-Philco Transact S-2000
-NCR 300 series
-IBM 7030 Stretch
-IBM 7070, 7080, 7090, 1400 series, 1600 series
-Honeywell 800, 400 series
-General Electric GE 635, 645, GE 200
-Control Data Corp. CDC 1604, 3600, 160A
-LARC
-Burroughs B5000, 200 series

SELF ASSESSMENT 1

(1) What do you understand by computer generation?
(2) What are the features of the first generation?

3.2   Third and Fourth Computer Generations

*Third Generation (1964-1971) Integrated Circuits***:** The development of the integrated circuit was the hallmark of the third generation of computers. Transistors were miniaturized and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers. Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system, which allowed the device to run

many different applications at one time with a central program that monitored the memory. Computers for the first time became accessible to a mass audience because they were smaller and cheaper than their predecessors.

The major breakthrough came in 1964 with third generation computers. The new computes were marked by microminiaturized remarkable innovations resulting from continued advancements in electronic technology. Among the techniques were etching or printing rather than wiring circuits and utilization of tiny crystal strictures in place of comparatively large transistors. These advances have ushered in computer systems with smaller size, greater capability, and faster, with speeds of billionths of a second. Another important feature of the third generation equipment is greater compatibility of components, which offers flexibility in modifying or expanding systems without altering the basic systems. Notably, third generation computers are truly general purpose and so can handle both business and scientific applications with equal ease.

These generations of computer were again more reliable than the earlier ones. Individual transistors were not used any more. They were replaced by very small electric circuits contained many tiny transistors. These circuits are called INTEGRATED CIRCUITS. The third generation computers used less power, cost less, they were smaller in size and are much more reliable. Their internal memory increased and COMPATIBILITY was introduced. This period also marked the emergence of software industry and the development of mini computers. As years passed more and more circuits could be packed onto smaller and smaller pieces of silicon. Today a piece of silicon and its circuits is often called a SILICON CHIP.

In addition to improvements in hardware there have been significant achievements in other areas. Many data recording devices have been designed to capture data at source in a form the computer can process. Optical scanners and magnetic ink character recognition (MICR) devices provide more effective techniques for data collection. Magnetic discs along with other random access devices have facilitated the storage and rapid retrieval of large amounts of data. Data communication facilities have continued to transmit data directly to computer storage, to interconnect computers, and to make possible interrogation of a computer system from remote terminals. Added to the chain of advancements is the tremendous increase in the sophistication of programming techniques.

Rather than speculate about future possibilities, suffice it to say that continuing developments are inevitable as designers continue to strive to design more versatile and useful systems that will perform at even greater speeds, store more information, require fewer instructions, need less power, occupy less space, and reduce the ratio of cost to performance. From the progress so far made in the relatively short history of computers it can be asserted that even the most fantastic predictions of today may in time prove to have been conservative.

Characteristics of third computer generation:
-large scale integrated circuits
-10 million circuits per square foot
Examples of third computer generation:
-Burroughs 6700
-Control Data 3300, 6600, 7600
-Honeywell 200
-IBM System/360, System 3, System 7
-NCR Century Series
-RCA Spectra 70 series
-UNIVAC 9000 series
-General Electric GE 600 series, GE 235

Fourth Generation (1971-Present) Microprocessors: The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip. What in the first generation filled an entire room could now fit in the palm of the hand. The Intel 4004 chip, developed in 1971, located all the components of the computer—from the central processing unit and memory to input/output controls—on a single chip. In 1981 IBM introduced its first computer for the home user, and in 1984 Apple introduced the Macintosh. Microprocessors also moved out of the realm of desktop computers and into many areas of life as more and more everyday products began to use microprocessors.

As these small computers became more powerful, they could be linked together to form networks, which eventually led to the development of the Internet. Fourth generation computers also saw the development of GUIs, the mouse and handheld devices. The fourth generation computers used Large Scale Integrated Circuits (LSI) and more recently Very Large Scale Integrated circuits (VLSI) and Ultra Large Scale Integrated circuit (ULSI). Although a silicon chip is very small, it is very powerful Computers using chips may be small in size but they can solve very complicated problems. Computers are no longer so big that they have to fill large rooms. They are small enough to sit on a small table. These computers are called MICROCOMPUTERS. Chips used in microcomputers are called **microprocessors.** Metal-Oxide Semi-conductor (MOS) was used for the internal memory.

Characteristics of fourth generation of computer:
-very large scale integration
-continued miniaturization
-billions of circuits per cubic foot

Examples of fourth generation of computer:
-IBM System 3090, IBM RISC 6000, IBM RT
-ILLIAC IV
-Cray 2 XMP
-HP 9000

SELF ASSESSMENT
    (1) Explain the major breakthrough in computer development in 1964
    (2) Distinguish between the first and second generation and the third and forth generation

SELF ASSESSMENT 2

1.   Name one item used in the building of each generation of computers which distinguishes the computer of one generation from the other.
2.   What are valves?
3.   What are the features of first generation computers?

3.3   Fifth and future Computer Generations

Fifth Generation (Present and Beyond) Artificial Intelligence: Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today. The use of parallel processing and superconductors is helping to make artificial intelligence a reality. Quantum computation and molecular and nanotechnology will radically change the face of computers in years to come. The goal of fifth-generation computing is to develop devices that respond to natural language input and are capable of learning and self-organization.

The race towards the end of one millennium to the beginning of another has caused the development rate of the computers to be very rapid. Reducing the size of the computers and enhancing its power are areas of concentration. Movement was made in such a way that greater memory capacity was possible. New words such as "SIMMS", "SDRAM" were introduced to re-christen "CHIPS". Large-sized software in terms of memory utilization and complexity are common features. Additional storage devices and drives as in CD-ROM (Compact Disk Read Only Memory) are common features of this generation of computers. Communication between hardware, no matter the distance in-between them, was conquered as in the INTERNET. The speed of operation could range from 233 to 500 MHz, the RAM from 32 MB to 128 MB, and the hard disk from 6.4 to 20GB as in Pentium III.

Since the urge now is to endow computers with the ability to take decisions in various circumstances, it is expected that this will now be the area of interest. To achieve this, software, will have to develop more, so that its artificial intelligence and robotics can grow.   The computer system too will have to be developed to cope with the software that will be developed and the task at hand to be accomplished. Every components of the computer and aspect of computing will go through changes so that both able and

disabled people, in whatever manner, can use the computer and enjoy the world of
computing alike.

Characteristics of fifth generation of computers:
Combinations of some or all of the following technologies:
-extremely large scale integration
-parallel processing
-high speed logic and memory chips
-high performance, micro-miniaturization
-voice/data integration; knowledge-based platforms
-artificial intelligence, expert systems
-virtual reality generation
-satellite links

SELF-ASSESSMENT 3

Write a short note on the following;
1. CD- ROM
2. SIMMS
3. SDRAM

4.0   CONCLUSION

The history of computing generally deals with the generations of computers.
Therefore, this Unit exposed you to the fact that the generation of computers started
after the Second World War from 1939 to 1945 where some of the first electronic
computers were built. You also leant that an integrated circuit (IC) is a small
electronic device made out of a semiconductor material. The first integrated circuit
was developed in the 1950s by Jack Kilby of Texas Instruments and Robert Noyce of
Fairchild Semiconductor. The first computers used vacuum tubes for circuitry and
magnetic drums for memory, and were often enormous, taking up entire rooms. They
were very expensive to operate and in addition to using a great deal of electricity,
generated a lot of heat, which was often the cause of malfunctions. Transistors
replaced vacuum tubes and ushered in the second generation of computers. Second-
generation computers moved from cryptic binary machine language to symbolic, or
assembly, languages, which allowed programmers to specify instructions in words.
High-level programming languages were also being developed at this time, such as
early versions of COBOL and FORTRAN.

You discovered that the development of the integrated circuit was the hallmark of the
third generation of computers. Transistors were miniaturized and placed on silicon
chips, called semiconductors, which drastically increased the speed   and efficiency of
computers. *:* The microprocessor brought the fourth generation of computers, as

thousands of integrated circuits were built onto a single silicon chip. What in the first generation filled an entire room could now fit in the palm of the hand. The Intel 4004 chip, developed in 1971, located all the components of the computer—from the central processing unit and memory to input/output controls—on a single chip. Fifth generation computing devices, based on artificial intelligence, are still in development, though there are some applications, such as voice recognition, that are being used today. The use of parallel processing and superconductors is helping to make artificial intelligence a reality.

5.0   SUMMARY

The generations of computers are divided into first and second, third and fourth, fifth and future computers generations. First generation computers were the first computers that stored their instructions in their memory, which moved from a magnetic drum to magnetic core technology. The first computers of this generation were developed for the atomic energy industry. However, second generation computers were not just more than the earlier computers, they could also carry more difficult calculations. The development of the integrated circuit was the hallmark of the third generation of computers. Transistors were miniaturized and placed on silicon chips, called semiconductors, which drastically increased the speed and efficiency of computers. More so, the microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip.   The goal of fifth-generation computing is to develop devices that respond to natural language input and are capable of learning and self-organization. Besides, the use of parallel processing and superconductors is helping to make artificial intelligence a reality.

6.0   TUTOR-MARKED ASSIGNMENT

1. What are the features of first, second, third, fourth and fifth generation computers?
2. What are valves?
3. Name one item used in the building of each generation of computers which distinguishes the computer of one generation from the other.

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MODULE 2   COMPUTER AND COMPUTER SYSTEM

Unit 1   Computer Components
Unit 2   Computer Hardware
Unit 3   Computer Software
Unit 4   Software Classification

UNIT 1   COMPUTER COMPONENTS

CONTENTS

8.0   Introduction
9.0   Objectives
10.0   Main content
      10.1   Futures and Functions of Computer
      10.2   Types and Classification of Computers

1.0   INTRODUCTION

In this Unit, you will be exposed to the components of a computers and how they function. A computer is any machine or device which, under the control of a stored program, can accept data in a prescribed form, process the data, and supply the results as information in a specified form. The components include- Input, Central processing Unit (CPU) and Output. Input devices transmit information to the CPU and Output devices display information that has been held or generated within a computer. Similarly, computers are classified into digital, analogue computers, and hybrid computers. Digital computers operate by being given a series of steps of instructions. The analogue computers operate by accepting data as a quantity varying over a length of time. However, hybrid computers combine some of the properties of both digital and analogue; they operate in a programmed form and combine the properties of analogue and digital. Therefore, this Unit presents you with details and examples of each of the components and devices.

2.0   OBJECTIVES

At the end of this Unit, you should be able to:
1. List various components of computer and their functions
2.   Identify types of computers and their futures.

3.0   MAIN CONTENTS

3.1   Futures and Functions of Computer

A computer is any machine or device which, under the control of a stored program, can accept data in a prescribed form, process the data, and supply the results as information in a specified form. Computer as a machine consist of electronic and electromechanical parts working together, to process data. These machine parts are referred to as computer hardware. Essentially, a computer performs three major functions- accept data (this is often referred to as input), process data and supplies information (this is often referred to as output).

A computer is controlled by a stored program- a program is a set of instructions which tell the computer what to do. The general term used to describe computer programs is software, in contrast to hardware. A program is normally stored in the computer's memory while the instructions are being carried out. Professionals trained in the art of instructing the computer to solve problems normally write these programs. The manufacturers permanently fix some programs, called firmware, into the computers. In contrast, software can be placed in the computer's memory, used, taken out, and re-used again whenever required. When a computer is used, data must be presented to it in a prescribed form. This is called data input format. The form, in which data is supplied to the computer, is that in which the program to be used by the computer is expecting it. A computer program is also used to determine the

format in which the results are to be supplied. A Computer System is more than just the
computer alone; it includes all the other things that make the computer function.
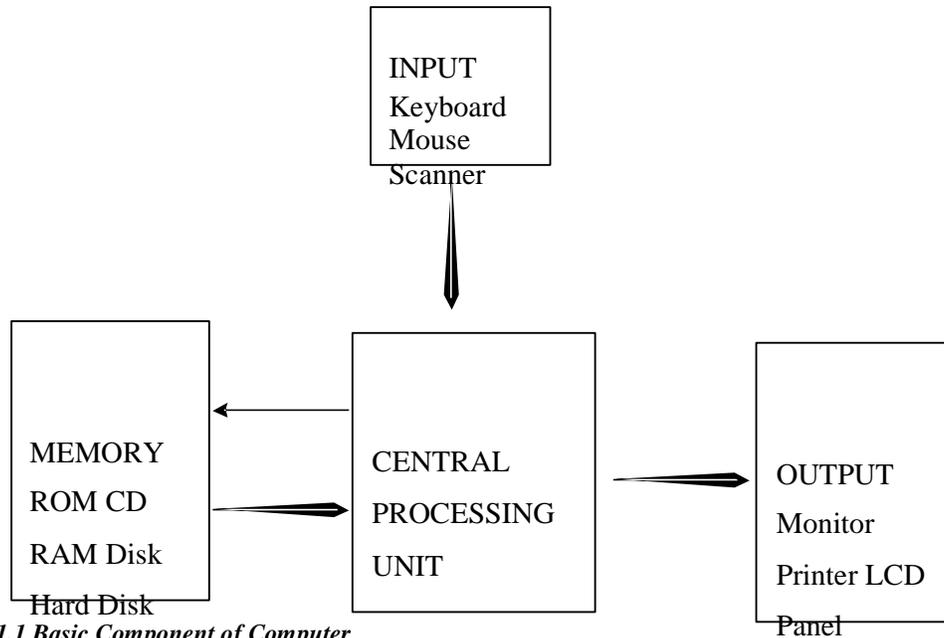
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                              ┌─────────────┐
                              │ INPUT       │
                              │ Keyboard    │
                              │ Mouse       │
                              │ Scanner     │
                              └─────────────┘
                                     │
                                     ▼
┌─────────────┐          ┌─────────────┐          ┌─────────────┐
│ MEMORY      │◄─────────│ CENTRAL     │─────────►│ OUTPUT      │
│ ROM CD      │─────────►│ PROCESSING  │          │ Monitor     │
│ RAM Disk    │          │ UNIT        │          │ Printer LCD │
│ Hard Disk   │          └─────────────┘          │ Panel       │
└─────────────┘                                   └─────────────┘
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Fig. 2.1.1 Basic Component of Computer

Figure 2.1.1 diagrams the basic components of a personal computer. The physical components constitute the hardware. The central processing unit (CPU) is the computer's "brain. "It performs the commands you specify, carries out calculations, makes logical decisions, and so forth. The programs that tell the CPU what to do are the software. Read-
only memory (ROM) consists of the control instructions that he been "wired" permanently into the computer's memory (RAM) is the flexible part of the memory. The programs and data being manipulated by the user are temporarily stored in RAM, then erased to make way for the next program or stored on floppy disks, compact disks, or in the computer's hard drive for future access.

Input devices transmit information to the CPU. The most common input device is a keyboard.
Other input devices include the mouse, joysticks, track balls, scanners, and graphic tablets. Output devices allow the computer to send information to you. Common output devices induce a video monitor, and LCD panel, and a printer.

A computer's memory size is usually described in terms of how many bytes it can store at one time. Essentially, a byte is a single character (such as "A" or "?"). You will often hear statements much as "My computer has 8 megabytes of RAM", or "My hard drive will hold 800 megabytes". A megabyte ("meg" or MB) is approximately 1 million bytes. Software has gradually improved in quality and variety and is now available for all subject areas and grade levels. Indeed, current software presents whole units and courses of instruction. The newer software permits a variety of student responses, with branching to appropriate levels of instruction based on the correctness of students' responses. If students fail to master intended skills or concepts, the software breaks down the concept using analogies, examples, and suggestions rather than simply repeating presentation of the subject mater. Moreover, overall instruction is made more appealing and enhanced through the use of graphics and sound.

The selection, evaluation, and purchase of classroom software should be based on how well the program sustains students' interest and, more important, how well it addresses intended goals and objectives. More specifically, you should focus on (1) how well the software appeals to students and acts as a motivator, (2) how well the software helps students master intended skills and concepts, and (3) how well the software encourages and develops higher-level thinking. Computers can greatly expand the types of instruction received by students; improve on current teaching modes, and free teachers to increase their personal attention to students. Indeed, positive experiences can come from meaningful interactions with computers as students learn concepts concurrently with the training exercises are integrated into computer programs that actually call for students to use spreadsheets while using the training programs in business education classes.

The information processing in computer can be related to some natural processing systems. For instance, the digestive system in man- how does digestion take palce in man? Food is first taken in through the mouth as **input,** the **process** of digestion starts from the mouth, through many organs of the body such as the stomach, intestines, liver, pancreas, etc., and the **output** is whatever the body cannot absorb, which comes out as faces, through the anus.

Similarly, how does respiration take place in man? Oxygen is breathed in through the nostrils as   **input;** the **process** involves the utilization of the oxygen within the body and the **output** comes out as carbon dioxide through the nostrils. Another example is that of water tank system- Let us look at the water storage taken we normally have in houses. Water is either pumped or fetched into the tank: this serves as the   **input.**   The tank serves as a store, and at times the water undergoes purification with chemicals added to it in the tank; this is the **process.** The water is then distributed into the house or fetched from the tap: this is the **output.**

Looking at our definition of computers, are the following equipment computers:

- adding machine?
- slide rule?
- cash register?
- calculators?

No, they are not computers. Though they take data as input, process it, and provide results as output, nevertheless, they   fall short in some   respects. So how do   we distinguish a computer from these other processing tools? The computer has some distinguishing characteristics that make it different from the tools mentioned above. Such characteristics include:

- speed
- capacity
- versatility
- programmability

Speed: Ability to process at very fast rate and accurately. The computer is faster than all the machines listed above.

Capacity: Ability to store and process large amounts of data than all the other machines listed above.

Versatility: It can be used for many things. The same computer can be used for all the things the other information processing tools can be used for, such as addition, subtraction, multiplication, division, etc. It an also be used for many other things they cannot do, such as we have seen earlier in the processing of examination results and the keeping of students records.

Programmability: Ability to be instructed. We shall see how to do this when we get to the section on LOGO and BASIC languages.

SELF ASSESSMENT EXERCIES 1

1.   Why computers are called input-output devices.
2.   What are the characteristics of computers?

3.2   Types and Classification of Computers

There are three main types of computers-they are:

- digital computes
- analogue computers and
- hybrid computers

This classification is based on the way they operate.

Digital Computers: The word, "digital", as used here, means whole numbers (discrete); for example the channel selector on the television set is a digital device because it restricts your to a discrete set of channels; you cannot, for example, select channel 3.141. Another example is the digital wristwatch, which shows you the exact time in digits. Digital computers are the most common computers. They operate by being given a series of steps of instructions. Some examples of digital computers are IBM 360/370; PDP 11/34, the various IBM PC compatible and Apple microcomputers often seen in offices and schools.

Analogue Computers: In contrast to digital devices, analogue devices have continuous values. For example, the volume control on your television set is an analogue device, because it allows you to adjust the volume continuously in one smooth continuous action. Other examples of analogue devices are thermometers, speedometers, and petrol dispensers at the petrol station. You will see that they operate in a very similar way, i.e. in one smooth continuous form. Analogue computers operate by accepting data as a quantity varying over a length of time. They are mostly used in industrial operations.

Hybrid Computers: These combine some of the properties of both digital and analogue. For example, setting (programming) on a modern day television set invokes both digital and analogue. You first select the channel (digital), you then tune the channel until it receives the station you want clearly (analogue); you then store the station on that channel (digital). This is an example of a hybrid device; it involves different processes that combine both the properties of analogue and digital. Hybrid computers are not too common; they operate in a

programmed form and combine the properties of analogue and digital. An example is a robot used in an industrial environment. First, it allows the process to get to a particular temperature (analogue); it then does some other processes, which could be digital and/or analogue.

Similarly there are factors that determine the classification of computers. The following factors are used in classifying computers: size of its internal memory, processing capability, price range and speed of operation. It must however be noted that it is becoming increasingly difficult to distinguish among the classes of computers.
These factors can be used in a general form to classify computers into:

- Supercomputers
- Mainframes
- Minicomputers, and
- Microcomputers

Supercomputers: These are the largest, fastest and most expensive computers. The cost is several millions of dollars, and the speed is between 600 million to 900 million instructions per second (MIPS). Scientists in weather forecasting, oil exploration, etc. use these for complex calculations. Examples of supercomputers are CRAYX-MP   and   CRAY2, which cost about N800, 000, 000.00 million each.

Mainframes: A mainframe computer is a large computer in terms of price, size of internal memory and speed. Mainframe manufacturers tend to make a "family" or a range of computers, rather than a single computer-in much the same way as a care manufacturer produces a range of different cars. A mainframe costs from N300, 000, 000. 00 to several millions of Naira. It also has a variety of peripheral devices such as printers, plotters, terminals, etc more than are found with small computers, and a large amount of external storage. Mainframe computers usually need a specialized environment in which to operate: with dust, temperature and humidity carefully controlled. The size of the internal memory is usually more than 2.56 megabytes of storage. They are used mostly in large establishments (e.g. universities, banks, commercial houses, etc). They are usually sophisticated and large; thus they call for great detail of support from their manufacturers or representatives. Examples of mainframes are IBM 360/370 systems, NGR V-8800 system. Figure 3.3 shows a mainframe computer.

Minicomputers: Minicomputers were developed in the 1970s for specialized tasks (i.e. they are special purpose computers). They are smaller and less powerful and less expensive than mainframes. Minis, as they are often called, are easier to install and operate and they require less floor space. Minicomputers do not require specialized environment to operate in, but care must always be taken to ward off dust from the equipment. They cost between N225, 000, 000. 000 and N600, 000, 000. 00.   Internal storage capacity of a minicomputer is usually between 128 megabytes and 256 megabytes. Examples include PDP 11, VAX 750/6000, NCR 9300, DEC, HEWLETT PACKARD 3000, IBM system 38 and MV400 (Data General).

Microcomputers: A microcomputer is a computer whose central processing unit (CPU) is based on a microprocessor. Miscomputes are at present the most popular of computers. They are very small (desktop to briefcase size). The capability is generally not as many and not as complex as minis or mainframes. They are easy to use. They can be linked with mainframes and minis, and their capabilities are gradually approaching those of minicomputers. Most

microcomputers today generally have between 16 and 128 megabytes. The price ranges from about 600, 000, 000. 000 to over N750, 000, 000. 00. Examples include IBMPC and its compatible, Apple Macintosh, etc. They are often called PCs.

SELF ASSESSMENT EXERCIES 2

1.   Give three examples of analogue devices
2.   Give three examples of digital devices

4.0   CONCLUSION

In this Unit you ought to have learnt that a computer is any machine or device which, under the control of a stored program, can accept data in a prescribed form, process the data, and supply the results as information in a specified form. The machine parts are referred to as computer hardware. These parts include input device, CPU and output devices. Computers are classified into digital, analogue computers, and hybrid computers. Digital computers operate by being   given a series of steps of instructions. The analogue   computers operate by accepting data as a quantity varying over a length of time. However, hybrid computers combine some of the properties of both digital and analogue; they operate in a programmed form and combine the properties of analogue and digital. Similarly there are factors that determine the classification of computers. The following factors are used in classifying computers: size of its internal memory, processing capability, price range and speed of operation. Some examples of digital computers are IBM 360/370; PDP 11/34, the various IBM PC compatible and Apple microcomputers. Examples of analogue devices are thermometers, speedometers, and petrol dispensers at the petrol station. An example is a robot used in an industrial environment. First, it allows the process to get to a particular temperature (analogue); it then does some other processes, which could be digital and/or analogue.

5.0   SUMMARY

The computer components which are also referred to as computer hardware is made up of
three major parts- input, CPU and output. While the input devices enable the users to send information into computer for processing in the CPU, the output made available the processed information. The computers are classified into three such as digital, analogue, and hybrid. Similarly, Computers are rated according to size of its internal memory, processing capability, price range and speed of operation. These factors can be used in a general form to classify computers into- Supercomputers, Mainframes, Minicomputers, and Microcomputers. For better understanding of these parts of computer, their feature and functions, the next Unit shed more light on the hardware of the computers.

TUTOR-MARKED ASSIGNMENT

1.   List the three types of computers and explain the differences among them.
2.   What are the factors used in the classification of computers?
3.   Define/explain the following terms:
       (a)   Hardware
       (b)   Input Device
       (c)   Digital

(d)   Hybrid

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UNIT 2   COMPUTER HARDWARE

1.0   INTRODUCTION

Hardware is the word used to describe the electro-mechanical components of a computer system. This is the computer equipment itself. It consists of all the bits and pieces of the computer. In this Unit, we will look at various parts and devices that comprise the computer hardware. The basic parts of a computer's hardware consist of the following- Input devices, system unit (Arithmetic and Logic Unit, Control Unit and Memory), Output devices and Peripherals. The features and functions each of these devices will be discussed fully in this Unit.

2.0   OBJECTIVES

At end of this Unit you are expected to:

1. Identify input and output devices.
2. Articulate the functions of storage devices.

3.0   MAIN CONTENTS

3.1   Input Devices

Input devices are equipment used to get instructions into the computer. Some common input devices are:

- Keyboard
- Mouse
- Light pen
- Voice input

Keyboard: The keyboard resembles QWERTY typewriter keyboard, but usually has several additional keys, which are used to control and edit the display. The keyboard contains alphabetical keys in the original layout known as the QWERTY layout along with:

- Numeric Keys: both above the alphabets and in a separate optional group

- Special character keys
- Control key: for example, shift key, return key, cursor control on a Visual Display Unit (VDU), etc
- Function keys: processing function used by a program.

The Mouse: This is a simple device that moves a pointer around the computer screen and
enables simple commands to be sent to the computer screen. It normally works in conjunction
with a keyboard and is dependent on the software being used.

A Light pen: A light pen is attached to a computer; it is an input device. This attachment
resembles a pen at the end of a length of electric cable. More bulky hand held alternatives are
sometime called 'wards" or "barcode readers". They read specially coded data called
barcodes. In virtual libraries, this is used to keep a record of which books have been
borrowed and who was the borrower. Similarly, In Supermarkets, the person at the
checkouts can use a light pen to help make up the bill for a customer.

Voice Input: Voice input means speaking to the computer. It provides the directness and
"user friendliness". The principal problem still remains that the way one person pronounces a
word is different from how another person pronounces the same word. Also voice input
machines are mostly only capable of recognizing a few words, but vocabularies are very vast
and so will demand a lot of storage. This has been a hindrance in voce input but is considered
an essential ingredient for a final breakthrough of computers. These are particularly suitable
for people wishing to use a few words again and again in situations where their hands are not
free to use a keyboard; for example, people in the laboratories and the handicapped.

Multimedia Input devices: Multimedia is the combination of sound and images with text
and graphics. To capture sound and image data, special input devices are required. Voice
input, for instance, can be recorded via a Microphone. Digital Cameras record photographs in
the form of digital data that can be stored on a computer. These are often used to record
photographs on identity cards.

SELF ASSESSMENT EXERCIES 1

List and describe four common input devices

3.2   Output Devices

These are equipment whereby the output of a computer can be viewed, heard or printed. Some common output devices are:

- Cathode Ray Tube (CRT) Monitor
- Printers
- Microfilm
- Voice output

Cathode Ray Tube (CRT) Monitor: The most common form of display monitor is the CRT.
This is the type of monitor used with microcomputers. Virtually all computers used in information handling initially output their information to display unit. They can output either text or pictures or both in monochrome (mainly two colour, e.g. black and white) or colour.

Printers: This is the most common output device which produces a permanent record in print.
There are various types of printers available and are dependent on the quality of production; examples are dot matrix printers, laser printers and ink jet printers.

Microfilm: Computer Output on Microfilm (COM). Pages of print may be photographically reduced and produced on reels of film. Special output devices are able to produce microfilm output from data on magnetic tape without the need to first produce a printed copy. Special viewers must be used to read the COM output. These viewers are often seen in the libraries.

Voice Output: There are a few specialist applications using computer speech output. At present the sounds produced sound rather unnatural. One application is a book reading machine for the blind.

Multimedia Output Device: The most common multimedia output is sound including music.
The audio output device on a computer is a speaker. Also headphones can be used to receive audio output in place of speakers.

SELF ASSESSMENT EXERCIES 2

1.   List and describe four output devices
2.   Which of these input devices is hand held?

3.3   System Unit

The System Unit of computer which is main functional parts of the computer and is made up
of Central Processing Unit (CPU), Control Unit, the Main Memory and Arithmetic and Logic
Unit (ALU). When you boot a   typical personal computer by placing a disk in the drive and
turning on the power, the CPU causes a program to be transferred from the disk into the high
speed internal memory, where the program teaks control of the CPU. The CPU shifts data
back and forth between internal memory and the disk (external memory) in order to process
data. Data cannot be processed directly while stored on the disk, data must be brought into
internal memory to be totaled, compared, displayed, printed, and so forth. Eventually, the
program gives up control of the computer and ceases to operate. When this happens, you
must tell the computer what to do next.

No matter what directions you give the computer, the same pattern is followed. a program is
transferred into high-sped memory, where it takes over control, process the data and finally
terminates. This three-part process is called program execution or a program run. Programs
are run on the CPU under control of a control unit, main memory, and an arithmetic/logic
unit.

The arithmetic logic unit (ALU) does all the computing. It can add two numbers, subtract,
multiply, and divide. It can compare two numbers to determine which is larger, move data
from one place to another and keep track of time. The ALU works exclusively on encoded
binary numbers. It takes its orders from binary encoded instructions stored like any other
information in the main memory.   The control unit is the supervisor of the CPU; fetches
numbers from the memory and interprets them as instructions. The control unit treats each
instruction and then directs the flow of information through t1-ALU, input/output deices and
the main memory.

Microprocessor: In every personal computer, the control unit and ALU are combined into a
single component called chip. Because this component is so small, it is called a
microprocessor. The microprocessor is also in other devices that behave like computers./
Devices like automatic cars, calculators, digital watches, and electronic diaries have
microprocessors.

Basic Building Blocks: The functions of a central processing unit are performed
electronically-that is,   its operations are in form of electrical signals (called pulse trains)
flowing from one component to another, rather than moving parts. The component parts of a
central processing unit are designed as electronic circuits: this implies that a central
processing unit is a collection of electronic circuits (remember integrated circuits!). Data and
instructions are transmitted between the various parts of the processor or between the
processor, memory and peripherals by means of pulse trains.   Various   tasks   are
performed by passing pulse trains through 'electronic switches' called gates. A gate is an
electronic circuit which may have provision for receiving or sending several pulses in a
particular way. There are three basic types: the AND, OR, and NOT gates. These are the
basic electronic circuits from which those that perform complex calculations are made.
Before we describe these gates further, let us talk about logic, which is often used to explain
how gates work.

Boolean Logic: In the mid-1800s, George Boole developed a new type of arithmetic logic
that today bears his name: Boolean algebra. Boolean algebra allows us to solve complex

mathematical and logical problems by manipulati0n of only two conditions: true or false (0 or 1). The computer is a two-state device (using binary 0 or 1), making Boolean logic (based on two states, true or false) ideals for use on computer. Most of the modern digital computers are based on Boolean logic. Boolean logic basically requires only tree basic logic blocks or gates: AND, OR and NOT. Each gate normally performs some simple function (or operation), and for this reason gates are often called logic elements. All of the functions performed by a computer are implemented through a combination of these three basic building blocks.

This is not to imply that making a computer is simple. In actual fact, a simple function or operation of the computer might involve thousands of these three logic blocks. What is important, however, is the fact that a computer is basically constructed from these three building blocks.   In order to construct a larger function of operation such as square root, for example, instructions called microcode would be written for the actual AND, OR, and NOT logic to implement the function. The microcode is then converted into an electrical circuit. The product is what is normally referred to as firmware.

Logic Diagrams: In logic diagrams,   gates are represented by symbols; and arrowhead lines, labeled by letters, represent inputs and outputs. Of course, it is much easier to express logic in tabular form (Tables 2.2.1, 2.2.2 and 2.2.3). This form of table is known as a table. It represents the output (result) function of all the input combinations. We will be looking at the 'and', 'or' and 'not' gates.

Table 2.2.1: The AND Gate and its truth			
	Inputs		Output
The four Possible Cases	X	Y	XY
X O --------	-- 0	0	0
--- ------ O X Y / Y O -------- / X O --------	0	1	0
--- ------ O X Y / Y 1 --------	-- / 1	0	0
X 1 -------- / --- ------ O X Y	-- / 1	1	1

Y 0 --------
X 1 --------

--

--- ------ 1 X Y
Y 1 --------

"1" means a "high" signal. "0" mean a "low" signal. AND gate will only output a "high"			
signal if receives both X and Y "high" signals at the same time. (When X is 1 and Y is !, X, Y will be 1)			
Table 2.2.2: The Or Gate and its truth			

The four Possible Cases

X O --------

Inputs		Output
X	Y	XY
0	0	0

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	-- 0	1	1
--- ------ O X + Y			
Y 1 -------- X 1 --------	1	0	1
--- O X + Y Y 0 -------- X 1 --------	1	1	1
	--		

--- ------ 1 X   +   Y

Y 1 --------

The OR gate will only output a 'low' signal if it receives box X and Y low signals at the same time (When X is 0 and Y is 0, X+Y will be 0).

		Inputs	Outputs
Table 2.2.3: The NOT gate and its truth			
		X	Y
The Two Possible Cases			
X 0 ---- NOT ---- 1 X		0	1
X 1 ---- NOT ---- 0 X		1	0

The NOT gate output will always output its opposite (i.e. when X is 0, X is 1, and vice versa)

SELF ASSESSMENT EXERCIES 3

1.   What are the major components of the CPU, and what is their relationship?
2.   What is the difference (if any) between a CPU and a microprocessor?

5   3

3.4   Storage devices

Main memory is always connected to the processor. In a computer it is usually in the same
box as the processor.   When you type a set of instructions on the keyboard of your computer,
they are put into the main memory. When you tell your computer to obey some instructions,
they are taken one by one from the main memory and put into the processor. After each
instruction has been put into the processor it is obeyed. The main memory is used to hold the
instructions and information which are being used by the computer. The main memory has
two parts:

- Read Only Memory or ROM for short;
- Random Access Memory or RAM for short.

When you type the computer instructions, usually called programs, into your computer, they
are put into the main memory. The part of the main memory into which they are put is the
random access memory or RAM. RAM is the part of the main memory that stores your
programs.   When you switch off your computer, all the information and programs held in
the RAM disappear. If you want to use the program again you have to type it in whenever
you switch on your computer. To avoid this we must carry out these two steps:

Step 1:   Copy your program into your computer which puts it into the RAM.
Step 2:   Copy your program from RAM into backing store or external storage, such as
               diskettes or magnetic tapes.

Once you have put a copy of your program onto a diskette or a cassette tape it is safe to
switch off your computer. Next time you switch on your computer, you can copy the program
from the diskette or from the cassette tape into the RAM part of the main memory. It is
available for you to use without having to type it on the keyboard again.

When you turn your computer on, your computer must have some pre-set instructions to tell
it what to do. These permanent, non-volatile instructions are programmed onto ROM chips.
Other names for ROM chips are firmware, or pre-wired. ROM chips have many functions;
for example, they tell the computer what to do when the power is turned on, they check to see
that the cable to the printer is connected, and they tell the control unit what each key on the
keyboard means. Unlike RAM, users cannot normally store their own instructions on the
ROM. ROM is the preset instructions that tell your computer what to do

Any program could be put into a computer in ROM form, which could save you time because
you do not need to move disk in and out. However, ROM has in the past been very
expensive. In addition, software vendors would have to create new ROM chips every time
they update program, and users have to open the computer case and replace chips when they
want to update their applications. There are however, three new types of ROM chips which
do allow the users to change them:

PROM: Programmable Read Only Memory. This is a version of ROM that can be
changed for the user. Once changed, it is permanent and can no longer be altered.
PROM
gives the user the advantages of ROM and the flexibility to meet special needs. However,
mistakes in a PROM unit can be corrected.

EPROM: Erasable Programmable Read Only Memory; The chops can be erased and then re-used. The chips, however, must be removed from the computer and erased through
certain processes before they can be re-used.

EEPROM: Electronically Erasable Programmable Read Only Memory. These allow information to be changed by software without removing the ROM chip from the computer.

As mentioned earlier, because we humans have ten fingers, we began counting in tens (decimal). Electronic devices are either 'on' or 'off', so they use the binary number system.
These devices use only two binary digits (0 and 1) known as bits. Not only are numbers stored in memory as combinations of the bits 0 and 1, but so are letters and special characters.

Because a single bit is not sufficient to represent numbers, letters and special characters, a
group of eight bits are used; this is known as a byte. When you type a character on the
keyboard, a specific bit pattern is electronically transferred to the memory. The bit pattern
transferred depends on the particular coding scheme used by the computer system. The common coding schemes are treated in chapter 6. To represent large numbers and set of characters most computers combine bytes to form words. Microcomputers typically use word
lengths of 2 bytes, or 16 bits; most mainframes and an increasing number of microcomputers
use 4 bytes, or 32 bits; and larger supercomputers and some powerful microcomputers use
word-lengths of 8 bytes, or 64 bits and larger.

The space into which data can be stored in the computer memory is measured in bytes and
expressed in kilobyte (K). 1 kilobyte is equivalent of 1024 bytes. "Kilo' should remind you of
one thousand as in the metric system, but you must remember that kilo here has 24 units
more. a 256k machine would store approximately 256,000 bytes or characters. Microcomputers are currently available with memories in the millions, or megabytes (MB). 1 megabyte is equivalent of 1 million byte is equivalent of 1 billion bytes memories, and in the new fifth-generation supercomputers, memories are expected to be in terabytes. 1 terabyte is equal to 1 million bytes. Secondary storage is additional memory. It is used to hold large
amounts of information outside the main memory. It is separate from the processor and is
contained in another box. A computer need not have any secondary memory although almost
all do. However, a computer is more useful if it has secondary memory.

The most common types of secondary storage are magnetic disks (disk pack) and magnetic
tapes. These are like gramophone records and cassette tapes. Records and cassette tapes hold
information which is usually music. When they are played the information on the record
produces music.   In computers, magnetic tapes and magnetic disks are used to hold numeric
and character information. When they are played, the computer can read the information held
on them. In microcomputers, secondary storage is usually either a Hard disk, a Diskette.

The magnetic disks used by microcomputer are called diskette. A diskette is a plastic disk in
the shape of a circle. The information is stored on the two surfaces of the disk. To protect the
surfaces of the diskette, it is sealed inside a jacket, which is in the shape of a square. The disk
cannot be taken out of its jacket. When you want to play a gramophone record you place it on
a turntable. When you want to play a diskette how place the jacket which contains the disk in
a box shaped device called a disk drive. The disk drive is connected to the processor of the
microcomputer.

Diskettes are widely available in two sizes: the "stiffly" 31/2-inch version, which is encased
in rigid plastic, and the "floppy" 51/4-inch size, which has flexible plastic covering.   In both
cases we have low and high-density versions, which determine how much they can store. For
example, the 31/2-inch low density can store about 72k, while a high-density 31/2-inch
diskette can store about 1.44 MB. A 51/4-inch low density can store about 360k, while a
51/4-inch high density can store up to 1.2MB.
A basic rule of thumb about storage is that you can never have enough. A page of text, for
example, uses about 2000 characters,   which means that a 51/4-inch diskette can store   about
180 pages of text, which may not be sufficient for some tasks. This means large programs or
data may need to be stored on numerous diskettes. A new type of diskette technology now
available is called Laser Servo Technology. This uses a special type of 31/2-inch disk drive
called LS disk drive and has capacity of up to 120MB.

The computer may also have a hard disk housed inside the computer's cabinet. Hard disks are
similar to diskettes except that they are rigid. They also have larger storage capacities and can
be written and read more quickly by the computer. Programs can be copied into the hard disk
from the diskette. So, this is a convenient way of putting new programs onto a computer.
Once on the hard disk the program can be read more quickly and easily. The device into
which a disk fits is called a disk drive. Most PCs have a combination of hard disk drive and
diskette drive.   If there are multiple disk drives they are often labeled 'A', 'B', 'C', etc. The
storage capacity of hard disk in microcomputers ranges from 1 gigabyte to hundreds of
gigabytes.

CD-ROM (Compact Disk Read Only Memory) is a relatively newer secondary storage
medium. It provides a huge storage capacity at a relatively low cost. It is slightly less than 5
includes in diameter. It can hold more than 800 million bytes of data. Information is stored
onto this device on a permanent basis.   Information CD-ROM,   you will require a CD-Drive,
which in turn is connected to the processor of the computer. Compact disks, as they are
commonly called, are used for storing large-sized software and reference information in place
of diskettes. Numerous are already available on CD-ROMs. The most recent secondary
storage devices are Zips and flash drives.

The major differences between main memory and secondary storage include-

1.   When you switch off your microcomputer, the information you put in the main memory (RAM) is lost. You cannot use it again. As a result, RAM is said to be
       volatile.   When you switch off your microcomputer, information in the secondary memory is not lost. It is held on the diskette or the hard disk. You can use it when
2.   you switch on your microcomputer again, since it is a non-volatile store.
       Fetching information from the main memory is faster than from the secondary storage

SELF ASSESSMENT EXERCIES 4

1.   What are secondary or auxiliary memories?
2.   List the types of secondary memory in microcomputers

4.0   CONCLUSION

In this Unit,   you have learned that input devices   are equipment used to   get instructions into the computer. Some common input devices are keyboard, mouse, light pen, and voice input. The keyboard contains alphabetical keys in the original layout known as the QWERTY. Mouse is a simple device that moves a pointer around the computer screen and enables simple commands to be sent to the computer screen. Light pen is attached to a computer; this attachment resembles a pen at the end of a length of electric cable, and read specially coded data called barcodes. Voice input means speaking to the computer. It provides the directness and "user friendliness". Multimedia is the combination of sound and images with text and graphics. To capture sound and image data, special input devices are required.

Output devices are equipment whereby the output of a computer can be viewed, heard or printed. Some common output devices are Cathode Ray Tube (CRT) Monitor, Printers, Microfilm, and Voice output. The most common   form of display monitor   is the CRT. They can output either text or pictures or both in monochrome. Printer is the most common output device which produces a permanent record in print. Voice Output is a specialist application using computer speech output. The most common multimedia output is sound including music. The System Unit of computer which is main functional parts of the computer and is made up of Central Processing Unit (CPU), Control Unit, the Main Memory and Arithmetic and Logic Unit (ALU).

5.0   SUMMARY

Computer Hardware comprises of all physical and tangible parts of the computers. These include input, output devices and Central processing Unit. The examples of input devices include keyboard, mouse, light pen, and voice input. Also, output devices are equipment whereby the output of a computer can be viewed, heard or printed. Some common output devices are Cathode Ray Tube (CRT) Monitor, Printers, Microfilm, and Voice output. The most common form of display monitor is the CRT. The System Unit of computer which is main functional parts of the computer and is made up of Central Processing Unit (CPU), Control Unit, the Main Memory and Arithmetic and Logic Unit (ALU). However, the smooth running of these devices depends solely on well written programmes called software. The next Unit is fully dedicated to the discussion of software.

6.0   TUTOR-MARKED ASSIGNMENT

1. Name the basic parts of the computer and describe how they work
2. Name one device that could be input or output device, and explain how
3. What are the differences between an' AND', 'OR', and 'NOT' gates? Explain with truth tables
4. What are the differences between main memory and secondary memory?

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UNIT 3   COMPUTER SOFTWARE

1.0   INTRODUCTION

In its most general form, software, in contrast to hardware, is the invisible part of a computer system. It refers to all programs that can be used on a particular system. More specifically, the term software is applied to all those programs which, in some way, can assist all users of a particular type programs written to solve the problems of any particular user.   Software is generally categorized as either Systems software, or Applications software/Software Package. The features and examples of each of this software as well as programming language are given in this Unit. A programming language is an artificial language designed to express computations that can be performed by a machine, particularly a computer. Other related information as regard the programming language are fully discussed in this Unit.

2.0   OBJECTIVES

At the end of this Unit, you should be able to:
    1.   Identify different types of software.
    2.   List various types of programming languages.

3.0   MAIN CONTENT

3.1   Systems software

System software is collection of computer programme written by computer manufacturers for the control and efficient performance of their computers. The features of systems software includes-

- They allow the end-users to make efficient use of the hardware facilities in solving their problems
- They are written based on the knowledge of the design of the computers that are use them
- They are designed to manage the resources of computer system.

The user of a computer has at his or her disposal a large amount of software provided by the manufacturer. Much of this software will be programs that contribute to the control and performance of the computer system. Such programs are given the collective name 'systems software', or 'utility programs'.

System software includes some of the under listed-software-
- The Operating System
- The Bootstrap Loader
- The diagnostic Routine
- Basic-Input-Output-System

Systems software can be further sub-divided into **Operating systems, Translators,** and **Utilities.**

Operating system: This is a collection of system programme that tell computer how to operate the various pieces of hardware, plans the execution of jobs on the computer and controls the operations of the computer.   The operating system is loaded into the computer
memory every time the computer is switched on. Therefore, operating system is the major software required by all computers. Without them, the computer cannot understand your instructions. The operating system is a set of programs designed to efficiently manage the resources of the computer system. It performs such functions as supervising input and output operations, communicating with the computer operator, and allocating the computer's resources to allow the operation of the computer to progress smoothly with minimum intervention. It contributions to the control and the performance of the system.   Examples of operating systems are:

1. *MS-DOS-* Microsoft Disk Operating System; commonly called DOS and is used with a single microcomputer.
2. *NOVELL-* Used in a network environment, where many computers are linked together-to share resources.
3. *UNIX:* Used in a multi-user environment where many people can use one big computer at the same time.
4. *Windows Operating System*: Used with a single microcomputer or in a network environment. It makes the use of the computer easier as you do not have to remember any command. Its graphical interface enables the user to have fun while communicating with the computer. Some software are Windows-driven. They will run only in a Windows environment. With the earlier introduced Windows like the versions 3.1 and 3.11, you still require another operating system such as DOS for the computer to function. Now, windows such as Windows 95, Windows 98, Windows NT, Window VISTA and lastly Window 7 are self-sufficient. **S**ome other examples of operating systems are XENIX, CPM and LINUX.

Mainframe and minicomputer manufacturers supply the operating systems for their computers. But personal computers use PC-DOS, UNIX, CPM, Windows and OS2 operating systems, which re supplied by organizations different from their manufacturer.

Translators are used to write other software and computer programs. Examples are FORTRAN; COBOL; BASIC; LOGO; C; JAVA, etc.   **Utilities** are used for general housekeeping on the computer: like backing up, copying, sorting and printing your data. Examples are Windows Explorer, Mozilla Firefox, PC-tools, DOS SHELL, Norton's utilities and Dr Solomon's Antivirus toolkit. Some of these utilities are normally included as part of the operating system.

SELF ASSESSMENT EXERCIES 1

1.   Distinguish between systems software and application software.
2.   What is the importance of systems software to applications software?

3.2   Applications software

Applications software consists of a number of programs designed to perform specific tasks for users. A computer program giving instructions for the steps involved in preparing and printing bills for the amount of electricity consumed by customers is an example of applications software.

Applications software may be provided by the computer manufacturer or supplier, but in many cases the users produce their own applications software called user programs (e.g. payroll programs, stock control programs, etc). Most applications software can only work if used in conjunction with the appropriate systems software. Applications software is used with systems software to perform specific tasks given to the computer by the user. Some groups of general-purpose applications software are spreadsheets, data management packages, graphics packages; word-processing packages; communication packages; presentation software and integrated packages.

Electronic spreadsheet packages: A spreadsheet is simply a way to keep track of and manipulate data- separating them into rows and columns. Each user can change the format to adapt a spreadsheet to various applications. You can use spreadsheets to display selected data graphically as well as to perform computations. An electronic spreadsheet program relies on formulas that fan be revised with great accuracy. These formulas allow the software to recalculate spreadsheet values automatically when the data are modified. Other changes, such as inserting and detecting rows and columns, are equally easy to make.

Any application where the problem can be written in mathematical terms can be used for electronic spreadsheet. A spreadsheet should be considered for any reports that:
- are recreated regularly, e.g. salaries of staff,
- edited;
- need calculation;
- need graphs, or
- consist of data that are of the same type, e.g. marks of students.

For example, a spreadsheet package can be used to analyze results of students in a class.
Common examples of Spreadsheet packages are LOTUS 1-2-3 and Microsoft EXCEL.

Data management packages: are packages that deal with creation and maintenance of data for enquiry and reporting purposes like keeping records of students, their birthdays, sex etc.
Common examples of software that can do this are DBASE IV, FoxPro, Paradox and Microsoft ACCESS.

Graphics Packages provide facilitates that allow the user to do various kinds of computer graphics. Some allow the user to produce drawings or diagrams and frequently use input devices such as the mouse. Some packages are aimed at particular application areas. For

example, a business graphics package might provide means of providing business charts and graphs. Common examples are Harvard Graphics, DrawPerfect, and PAINT.

Word processing packages: provide a number of options for the user. They allow the user to create (type) document, amend document, edit an existing document, copy a document, print document, etc. Some examples of word processing packages are WordStar, WordPerfect and Microsoft Word.

Communication software: are computer programs which can be sued to send memos, reports and messages to transfer computer data files, to access information stored at distant locations, and event have "electronic meetings" among people in dispersed locations. Examples of community software are E-mail programs, such as Pegasus mail, Outlook Express; and the Internet Bowers such as Netscape, Mosaic and Microsoft Explorer.

Presentation software: are used to design, produce and make presentations. Their output can be projected directly from the computer to a screen or used to make transparencies. They greatly simplify the process of preparing for business or academic presentations.

Integrated Software: The data generated by many packages designed for early microcomputers were not always transferable from one package to another. The programs were not integrated, i.e. data could not be electronically moved from one program to the other. Transferring data from one program to another was either impossible or complex and tedious. For example, if you were asked to analyze and make a report of the results of your classmates that have been entered using a database management system, you could transfer the data into a spreadsheet package to draw graphs, and later to transfer the graphs into your word processing package to write a report that you will submit

Integrated software allows several programs to share the same data. For example, a spreadsheet package can use data from a database package to draw commands among programs. However, in reality, this happens in varying degrees. The result of integrating is that the user can work faster, more efficiently and thus more productively than if non-integrated programs were used. Commonly, an integrated software package integrates software for spreadsheet, database, graphics, and word-processing packages.

Three examples of integrated programs are:
Microsoft Office: This comprises Microsoft Word, Microsoft Excel, Microsoft Access, Microsoft Power Point, Microsoft Outlook and Bookshelf Basics.
Corel WordPerfect Suite: This comprises Corel WordPerfect, Corel Quattro Pro, Corel Presentations, Corel CENTRAL and Corel Photo House.
Claris Works: This comprises a Word processor, a spreadsheet and a database.

Computer Professionals: Computer professionals are those who have undergone one form of formals computer training or the other. Such formal training includes certificate, diploma and degree programs in computing. These categories of people are involved in the development, maintenance and use of computer system. Various categories are the computer manager, systems analyst, programmers, computer educators, computer engineers and operators.

The computer manager: has the overall responsibility for the computer department. He ensures that the computer installation runs efficiently in satisfying the computing needs of the organization that it serves.

The systems analyst: look at the details of existing systems and the design of computer based systems. The systems analyst also implements and reviews the new system.
The programmer: encodes the produces detailed by the system analyst in a language suitable for the specified computer. A programmer must be able to reason logically and clearly.

Computer educators: are people that teach computing at various levels ranging from university down to the secondary school levels.

Computer engineers and technicians: are people that install, maintain and repair the computer.

Operators: are people that handle and operate the hardware in the computer room; they communicate with the operating system and try to keep system running smoothly. Today, the term 'operator' may be used to include data entry personnel, who do data input.

Computer Users: Computer users are those in other professions who make use of the computer to do their jobs. They are called end-users. Examples of such are managers, engineers, doctors, lawyers, bankers, teachers, typist and students. The outcome of the work of the computer professional is used by the end-users. Computer users are therefore very important in the utilization of computers.

Generally, software is very useful to the users. Each software must solve the user's problems. However, many users face the problem of finding the right software to solve their problems. Users do not even know where or how they can get the software to accomplish their tasks for them. There are basically two ways to acquire applications software.

1. The first is simply to buy pre-written software from one of the software shops or vendors. One characteristics of pre-written software is that they are designed to be general so   as to fit many situations.   It is like buying ready-made clothe, it might not fit the problem needs exactly and must e modified in some way before it can be used. Some are easy to modify while some cannot be modified all. One must therefore know the capabilities and limitations of software and be sure that it will solve one's problem before committing money to it.

In general, pre-written software, also called packaged software, is cheaper and easier to implement and usually comes with proper documentation. The major disadvantage is that the user must, to some extent, alter the procedures for doing the work to conform to the software, whereas normally it should be the reverse.

2. The second method of making software available is to obtain software that are made specifically for the intended application. This may be written by the user-if he is ready to master a programming language and write the necessary program himself, or he can hire a professional to do all or part of the work.

SELF ASSESSMENT EXERCIES 2

1. Who is a computer user?
2. List four categories of computer professionals

3.3   Programming Language

A programming language is an artificial language designed to express computations that can be performed by a machine, particularly a computer. However, computer language is used to write or code computer programs. For this reason, computer languages are also called computer programming languages or simply programming language; there are various levels of programming languages: these include machine language, assembly language and high level languages. A programming language's surface form is known as its syntax. Most programming languages are purely textual; they use sequences of text including words, numbers, and punctuation, much like written natural languages. On the other hand, there are some programming languages which are more graphical in nature, using visual relationships between symbols to specify a program.

The syntax of a language describes the possible combinations of symbols that form a syntactically correct program. The meaning given to a combination of symbols is handled by semantics (either formal or hard-coded in a reference implementation). Since most languages are textual, this article discusses textual syntax. Programming language syntax is usually defined using a combination of regular expressions

Machine Language: Generally speaking, there is only one language the computer can run without modification and this is called machine language. Machine language programs are nothing more than long sequences of binary digits that have meaning to the computer. Writing a complex program in such a language is terribly complex and tedious and one can make a lot of mistakes.

In machine language, to add values stored in computer storage labeled X and Y would look like this: 0110   001110   010101
Where 0110 is the machine operation code for "ADD", and 001110, 010101 are the addresses of X and Y respectively.

Because of the difficulty with machine language programming, some intermediate codes and high level languages have been developed to enable the programmer to write in a way that resembles his thought process rather than elementary steps of machine language. Generally, machine language is the only language the computer can run without modification

Assembly Language: The most immediate step from machine language is the symbolic **assembly language**. Thus a programmer could write instead of the machine language written earlier. A computer cannot execute this directly, the program would still have to be translated. The program that translates assembly program to machine language is called an **assembler.** Writing assembly language still requires understanding some machine language. Programmers must still specify both operations and storage locations. Programming in assembly language is still a tedious task. This has led to the development of English-like languages called high-level languages.

High-level Languages: High-level languages are designed so that a programmer's attention can focus on the problem itself, rather than on the details of computer operations. There are many different high-level languages used for programming.   Examples of programming

languages are FORTRAN, COBOL, PASCAL, C, C^{++} BASCI, LOGO, JAVA, Modula-2, Ada and PL/1.

The purpose of high-level languages is to establish easy communication between the computer and the programmer. High-level languages are much easier to learn and understand than assembly language. In this book, we shall learn how to use LOGO and BASIC language to communicate with the computer.

High-level languages may also have different dialects. The version of BAIC on one microcomputer may differ a little from the version on another, and this may also differ from the one on a mini-or mainframe computer. The differences may be small, and you may not notice them. However, the differences mean a lot for your program to work properly. Programs written in other languages such as FORTRAN, COBOL, BASIC and Assembly Language must be translated into machine language before they can be used to control the computer. This requires the use of translators.

Translators: is a program that takes as input a program written in one programming language and produces as output a program in another language. A translator reads an input program referred to as the source program, and converts the lines in the source program one by one into another language. The converted program is called the object code. This object code may be in the intermediate form, such as assembly language. A translator is a powerful tool for increasing the productivity of a programmer. Instead of giving detail instructions in machine language, the programmer can focus on the problem itself and give several directions in a programming language. The translator fills in the details, and contains the proper results in a shorter time. There are two types of high-level language translators-compilers and interpreters.

Compilers and Interpreters: The program that translates the high-level language into a language the machine understands is called a compiler. A complier reads the source program and generates machine code (called object code), and saves it in a file. The object code is then loaded in the memory for execution. A complier translates a high-level language by reading the source program and generating an object code. Examples of high-level languages with compilers are COBOL.

Another translator worth mentioning is the interpreter. The **Interpreter** reads the source program directly, line by line, and generates the machine codes necessary to carry out the instructions as they proceed through the program. An interpreter reads the source program line, and generates machine code. You get your result line by line as it is interpreters are BASIC and LOGO.

Compliers produce fast, compact and efficient machine language programs. They are the translators most frequently used by professional programmers. However, the compiling step takes extra time and attention. Compiled programs run much faster than interpreted programs. Interpreters are good for novice programmers and for professionals testing new programs. Errors can be corrected and the program reinterpreted again and again until the program is correct. BASIC, LOGO and some other high-level languages are usually interpreted. COBOL, FORTRAN, PASCAL and C are usually compiled.

High-level programming language resembles a combination of English and Mathematics. English keywords are used to make the language readable, and a certain amount of

mathematical formulates are used to remove ambiguity.   We will now take a closer look at some of these programming languages in order to understand their backgrounds and the reasons for which they were developed.

FORTRAN: The first widely used high-level language is the FORTRAN programming language. It is the oldest high-level language still being used today. FORTRAN is an acronym for   FORMULA TRANSLATOR**.** In the 1950s, most people using computers were scientists and engineers. The problems they wanted to solve were mathematical in nature and required a great deal of computation. FORTRAN was originally developed by International Business Machines (IBM) for their mainframe computers in the 1950s as a tool for solving scientific and mathematical problems. That is why FORTRAN is not well suited for solving typical business problems and does not have very good facilities for handling business applications requiring reading or writing large amount of data. FORTRAN compilers are now available for all types of computers. Program 7.1 shows a simple FORTRAN program, which calculates the profit on a given sale using a formula based on the number of items sold, the unit cost and the unit price.

COBOL: With the increasing use of FORTRAN and its success in solving mathematical and scientific problems, the business community began realizing that computers could be used to solve many of their own problems too. COBOL, an acronym from Common Business Oriented Language, was developed by a group of computer professionals called CODASYL (Conference on Data Systems Language), and was released in 1960. COBOL has some features which distinguish it from FORTRAN; it is English-like in structure, easy to learn, can handle large quantities of data easily, and is designed in such a way so that it could be adapted easily to work on different brands of computers. Languages having this last feature are said to be machine-independent. Program 7.2 shows a sample COBOL program equivalence of Program 7.1.

Processing Mode of FORTRAN and COBOL: FORTRAN and COBOL were considered by many people to be difficult to learn, and are normally used by professional programmers. In addition, these languages are not well suited for casual users as programmers traditionally submit both the program and data to the computer operator who then instructs the computer to execute the program. The results are printed on paper and returned to the programmer. During the execution of the program, there is no interaction or conversation between the computer and the programmer. When a program is executed in this manner, the program is said to be processed in batch mode. In interactive mode**,** processing takes place in conversational modes: you can give an instruction to the computer and get an instant response. In this mode, a conversational "dialog" is maintained between the user and the computer system. Each statement or request input by the user is processed immediately and an appropriate reply is sent to the user. The FORTRAN program in Program 7.2, however, is written in Microsoft FORTRAN, which is widely available for microcomputer, and when executed will perform the processing interactively

BASIC: BASIC, an acronym for Beginner's All-purpose Symbolic Instruction Code, was developed by two professors at Dartmouth College-Johnm Kemeny and Thomas Kurtz-in 1961 as an interactive computer language, which is easy to use and learn by non-technical students and professionals. Because of its interactive nature, it was possible for developers ad professionals. Because of its interactive nature, it was possible for developers of BASIC interpreters to include features that were not available in FORTRAN and COBOL, such as graphics and sound capabilities. BASIC is widely available on most computers, especially the

microcomputers. It is commonly found in schools and is the language that most students and computer enthusiasts learn first. Versions of BASIC commonly found on microcomputers include BASICA, QuickBasic, Turbo BASIC and Visual BASIC.

Most computers are equipped with a BASIC interpreter as part of the systems software. Suppose you want to compute the formula for calculating profit on the number of items sold, the lines in Program 7.3 in BASCI will achieve this.   The first four statements are used to reserve memory storage for four values: the first for a whole number (INTEGER), and others for decimal figures (SINGLE). When the program is executed, the statement in line 6 sends the prompt "Enter number of units sold" to the screen and waits for your response. Whatever number   you type is stored in the memory location identified by   the name UNITS SOLD. Statements in lines 7 and 8 do the same thing for PRICE and COST. The statement displays the answer on the computer screen.

PASCAL: was developed by Niklaus Wirth in the late 1960s. Nicklaus Wirth was concerned about the detrimental influence available programming languages (e.g. PASCAL, COBOL, and BASIC) had on the programming style of the students. PASCAL was originally developed as a teaching language for students of computer science. PASCAL is used to introduce the concept of structured programming**.** In structured programming, programs are written as blocks, which fit together to form larger blocks. These make them manageable, and the programmer can be more confident of the correctness of the programs since errors are easy to detect.

PASCAL has also become available on a variety of computers, ranging from mainframes to microcomputers. This has increased its use from only the classroom environment and it has become a general-purpose language that is suitable for use in many environments needing computer programs. PASCAL programs are divided into two sections: namely data definition and instruction processing. The data definition section is designated by the keyword VAR. All of the variables to be used must be declared at the beginning of the program inside the VAR section. A variable is a memory location that has been given a name. The processing section contains all of the actions to be carried out, and the order in which to carry them out. It begins with the keyword BEGIN and ends with the keyword END. Suppose we still want to compute the formula for calculating profit, the lines in Program 7.4 in PASCAL will achieve this.

The VAR section tells the computer to set apart memory locations for one whole number (INTEGER) and three decimal numbers (REAL), and to label them UNITS SOLD, PROFIT, PRICE and COST. The real numbers allow you to have the units in naira and kobo. The processing section follows. Because PASCAL programs are compiled rather than interpreted, you must go through the compilation process before any answer can be obtained.

Machine languages are referred to as first-generation programming languages because they were the earliest types developed. Assembly languages are one step above machine languages, so they are referred to as second-generation languages. All the high-level languages described or mentioned so far: FOTRAN, COBOL, BASIC, PASCAL, PL/I, C, MODULA-2, ADA, and LOGO are generally classified as third-generation programming languages because of their characteristics English-like commands. To use these languages to instruct the computer, the programmer must list each step to take and indicate the order in which instructions are to be executed. They are said to be procedural, because they require that you specify the step-by-step procedure to obtain the desire information.

The fourth-generation languages (4GLS), however, are called non-procedural languages, because they allow you to communicate with the computer by simple stating what you want done, but not how it should be done. Examples of fourth-generation languages are IBM'S Structured Query Language (SQL), Query-By-Example (QBE), FOCUS, NATURAL, SMARSTAR and INFORMIX-4GL. The 4GLs, also known as query languages, allow you to specify what to do, and not how to do it. With 4GLs, users can avoid having to go to professional programmers for their information needs. They do not require the training of a professional programmer. Their major limitation is that the user does not have as much control over what the 4GLs are doing as when using high-level languages.

Recent investigations and research into ways of making programming languages easier and faster to user are beginning of yield results in the form of natural-language systems and expert systems. These developments are regarded as launching us into the fifth-generation languages. Natural language systems permit the user to interact with the computer by entering requests in form of sentence or question. Their primary purpose is to allow people to carry on daily with the computer in "everyday language". Wouldn't it be nice to communicate with the computer in English, Hausa, French, Yoruba or Igbo? Definitely, that would be nice; however, these languages are still being developed and only a few are currently available commercially. Examples of natural language systems include Natural Link from Taxes Instruments, CLOUT from Microfilm and Q & A from Symantec. These languages bring a great deal of ease to inquiry into massive collection of data.

Programming languages have also been developed, which are used in artificial intelligence and expert systems. An expert system consists of a collection of data and software that simulate the knowledge and thinking process (analytical ability) of an expert in a particular field. Examples of languages that are used in designing expert systems are LISP, PROLOG and MYCIN.

SELF ASSESSMENT EXERCIES 3

1. List three examples of programming language
2. How does the computer understand a programming language?

4.0 CONCLUSION

In this Unit, you must have learnt that system software is collection of computer programme written by computer manufacturers for the control and efficient performance of their computers. The features of systems software includes allowing, the end-users to make efficient use of the hardware facilities in solving their problems, written based on the knowledge of the design of the computers that are use them, and designed to manage the resources of computer system. Some examples of system software include the Operating System, the Bootstrap Loader, the diagnostic Routine and Basic-Input-Output-System. However, the applications software consists of a number of programs designed to perform specific tasks for users. Some groups of general-purpose applications software are spreadsheets, data management packages, graphics packages; word-processing packages; communication packages; presentation software and integrated packages. Software is written in a special language called programming language. A programming language's surface form

is known as its syntax. Most programming languages are purely textual; they use sequences of text including words, numbers, and punctuation, much like written natural languages.

5.0   SUMMARY

Generally, software, in contrast to hardware, is the invisible part of a computer system. Software are the essential instruction that enable hardware to function properly. System examples of software include the Operating System, the Bootstrap Loader, the diagnostic Routine, and Basic-Input-Output-System. Similarly, the syntax of a language describes the possible combinations of symbols that form a syntactically correct program. A programming language's surface form is known as its syntax. Most programming languages are purely textual; they use sequences of text including words, numbers, and punctuation, much like written natural languages. Programming languages have also been developed, which are used in artificial intelligence and expert systems.

6.0   TUTOR-MARKED ASSIGNMENT

1. What is the importance of systems software to applications software?
2. List three examples of operating systems
3. What are the two ways by which a user can acquire applications software?
4. Differentiate between a procedural and a non-procedural language
5. What are the essential features distinguishing each generation of programming languages from the others?

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UNIT 4   SOFTWARE CLASSIFICATION

8.0 INTRODUCTION

Computer software, or just software, is the collection of computer programs and related data
that provide the instructions telling a   computer what to do. It   can   also be   said that software
refers to one or more computer programs and data held in the storage of the computer for
some purposes. Program software performs the function of the program it implements, either
by directly providing instructions to the computer hardware or by serving as input to another
piece of software. Generally, software are classified into two, Type I and Type II. In this
Unit, the classifications of software according to their functions are fully discussed.

9.0 OBJECTIVES

At the end of this Unit you should be able:

1. Classified a given software into either Type I or Type II
2. Articulate the features of each types of software

10.0   MAIN CONTENT

10.1 Type I Application

Although type I applications vary considerably, below are listed some characteristics they
usually share:

1. Type I applications generally stimulate relatively passive involvement on the part of the
user. The involvement we are referring to here is intellectual involvement. Type I
applications generally do not require a high degree of intellectually active involvement.
Although users are usually require to respond in some way, the response generally do not
involve higher-order, complex cognition.

We believe that intellectual passivity has played a major role in past failures of electronic
innovations in education. Educational television is an interesting case in point, although there
is nothing about educational TV itself that encourages or requires only passive user
involvement, network television fare has conditioned children to be intellectually passive
viewers. We have noted that our own children are frequently unable to recall what they have

just viewed on network television. It is not surprising that children which have become accustomed to network viewing far tend to adopt the same passive viewing style even when presented with more intellectually stimulating material.

Fortunately, the nature of computers and computing encourages more active user involvement than does other electronic media. Very little software has been written that would allow the child to simply turn on the computer and then sit back while the machine does all the work. Virtually all educational software, even the poorest Type I software, requires some user involvement. Children must hit the space bar, type YES, answer questions, or otherwise make choices at various points in the program. However, type I applications require less active intellectual involvement relative to that required by type II applications.

A good example of Type I software is any one of the many programs designed to drill children on math facts. Typically, problems are generated at random and displayed on the computer screen. The user types the answer and the computer checks the user's response and provides some feedback about correctness. Most programs keep a record of the number of correct and incorrect responses and provide that record on demand or at the conclusion of the program. Figure 2.1 is an example of such a program.

Such drill and practice programs (often called CAI, or computer-assisted instruction) can be highly useful and have a valuable role in educational computing. The point we are trying to make is that, although we would use type   I programs, they are not by themselves important enough to justify the time, effort, and money required to implement computers in schools. Although it is important that children learn their math facts, and the computer is an efficient way to provide math fact drill and practice, other non computer activities are less expensive and almost as efficient as the computer application.

2. With Type I application, the software developer predetermines almost everything that happens on the screen. The user may vary his or her answers or even make choices about difficulty level or speed of presentation, but the   majority of what happens on the screen is predetermined by   those who plan and develop   the software. In the math example cited above, the programmer decided where the problems would be placed, how the machine would respond to correct and incorrect answers, and all other aspects of program execution. Virtually the only time that control is passed to the user is when the program pauses and waits for an answer to be entered from the keyboard.

3. In Type I applications, the type of interaction between user and machine is predetermined by the developers of the software, and the contribution of the user must conform to a highly limited repertoire of acceptable responses. With math drill and practice software, for example, the only time the user plays a role is when the machine stops and waits for an answer. At that point, the only acceptable response is a single number.

4. Type I applications are   usually aimed at the acquisition of facts by rote memory. Once again we emphasize that drill and practice to develop rote memory can be very important. We find fault with such applications only if they are the only educational computing applications used.

5. With Type I applications, everything the software is capable of doing can usually be observed in a very short period of time, frequently in 10 minutes or less. The math drill and practice software described above   may be capable of generating   problems at several

difficulty levels using more than one computational process. The student can usually sample everything this software is capable of doing in 5 minutes or so

Type I applications make it easier, quicker, or otherwise more efficient to continue teaching the same things in the same ways as we have always taught them, but Type II applications make available new and better ways of teaching. When classifying a specific piece of software, the characteristics given for each type in the preceding discussion above should be used only as aids. Final determination about the category depends on adherence to one or the other of these definitions. Another aid to classification is the fact that certain kinds of educational software tend to fall consistently into one or the other category.

Typical type I software

Drill and practice Software designed to allow the user to practice a skill that has already been acquired is called drill and practice software. This software may drill the student on math facts, sight vocabulary, vocabulary, parts of speech, manes of the 50 states, or other skill dependent primarily on rote memory.

One of the authors once wrote a drill and practice computer program for a learning disabled adult who had obtained a job as a management trainee in a supermarket. The job required the trainee to learn a code number or every vegetable sold in the produce department. The program, written in the Logo computer language, randomly chose the name of one of the 75 vegetables, displayed the name on the screen, and required the trainee to type in the code number. Alternatively, the trainee could elect for the computer to display the code number. The trainee's role then was to type in the name of the vegetable that corresponded to the code number. The program kept track of right and wrong answer and then provided a summary of performance.

This program represents a Type I application. The most important indicator of category is that the software makes it more efficient to practice the number/name associations in a highly traditional manner. The drill strategy employed is the same as what would probable be used if the skill were practiced with off-computer activities, that is, presentation of half the desired association followed by the user supplying the other half.

In support of Type I classification, note that the program has all five of the common characteristics of type I software discussed previously: (1) relatively passive user intellectual involvement, (2) predetermined control of most of what happens on the screen, (3) predetermined interaction between the user and computer and a highly limited repertoire of acceptable user responses, (4) a goal of acquisition by rote memory, and (5) all capabilities of the software evident after only a few minutes of operation.

The vegetable drill software (1) required only that the trainee associate a vegetable name with a number or a number with a vegetable name; (2) employed a predetermined scheme for problem placement, answer placement, reinforcement, and the like; (3) limited acceptable user responses to either a vegetable name or a number type in at strictly defined, limited, and predetermined points in program execution; (4) was aimed entirely at the acquisition of the rote association of specific numbers with specific vegetable names; and (5) has such limited capability that everything it was capable of doing (displaying numbers and accepting vegetable names or vice verse) could be seen in only a few minutes.

Tutorial software: Whereas drill and practice software is designed to provide a way to practice a skill that has already been learned, tutorial software is designed to teach the skill in the first place. Figure 2.2 shows a tutorial program designed to teach keyboarding skills.

Most available tutorial software falls into the Type I category, although there is really no reason why Type II tutorial software could not be written. (It would be Type II if it use new better methods of teaching the material, methods that would not be possible without the computer.) Other   examples of Type I tutorial programs include any of the commercial programs available to tutor students in preparation for taking the Scholastic Aptitude Test and the programs intended to orient users to the use of a specific computer or specific software. These tutorial   programs, like most such programs, take the user   through a series of steps by emulation traditional methods of lecture, demonstration, and   student trial activities,   and most could be   easily transported into workbook format without significantly changing the overall methodology or diminishing the effectiveness of the instruction.

Assessment Uses: **Assessment software** seems to be growing in popularity. This class of software is designed to (1) administer, (2)score, (3) summarize, and/or (4) interpret the results of standardized tests. The first three   of these functions represent Type I applications by definition, since they are intended to make it more convenient, more accurate, or   less time consuming to administer a test that was originally   developed   for minicomputer implementation. (Some characteristic of type I or Type II applications are difficult to apply to this class of software because such characteristics were developed for use with educational software designed for direct teaching. As always, the final determination of category depends not on consistency with the characteristics, but on adherence to the definitions of Type I or type II applications.)

Some of the fourth type of assessment software, that designed to interpret the result of standardized testing, is in a class by itself. This kind of software would be classified as Type II since it is intended to make the judgments of the most knowledgeable experts in a field available to anyone who has access to a computer and the software. Software intended to perform this function falls into a category known as expert systems. **Expert systems** have not yet fulfilled their initial high expectations. Most authorities agree that no expert systems have yet been developed that do an acceptable job of emulating the judgment of educational or psychological experts.

Administrative Uses: Administrative applications include software for producing, calculating, coordinating, or   compiling registration information; attendance records; graphics; student grades; room, teacher, or school   schedules; mailing labels; filings; or other secretarial tasks to aid administrative activity. Figure 2.3 depicts one screen form a piece of **administrative software** designed to help teachers create different test formats.

It should be obvious form this discussion that the use a piece of software is put to can determine whether the application falls into the Type I or Type LL category. For example, although word processing used properly to teach composition skills is a type II application, word processing as a secretarial substitute for typewriting is a Type I application.

Computer- Managed Instruction: **Computer- Managed Instruction** (CMI) is a mixed bag of applications designed to perform tasks or combinations of tasks such as organizing student date, monitoring student progress, testing student mastery   and prescribing further instruction

or remediation, recording student progress, and selecting the order of instructional modules to be completed.

The term computer-managed instruction is a good one, because only human beings, not computers, can be mangers and because no direct instruction takes place. Regardless of terminology, CMI should probably be considered a Type I application, for it is usually used to make it more efficient to teach something as it has always been taught.

SELF ASSESSMENT EXERCIES 1

List three example of Type I application software and fully discuss their characteristics.

10.2   Type II Application

Type II applications

Type II application of software provides new and better ways of teaching and learning available to teachers and students. if use of the computer improves teaching or learning and if it would be impossible (or extremely   difficult) to teach or learn in this manner with \out the use of the computer,   then the application in question is most likely a Type II application.

Type II applications, like Type I applications, vary considerably. However, some characteristics are shared by most type II applications. Generally, these characteristics are in contrast to those listed for type I applications:

1. Type II applications generally stimulate relatively active intellectual involvement on the part of the user. A good example of a type II application is the use of word processing to teach or to improve skills in composition. Compare the degree of intellectual involvement need to compose a passage with the involvement needed to respond to a type I drill and practice program, such as the math facts software described above.

2. With Type II applications, the user, rather than the software developer, is in charge of almost everything that happens on the screen.   In with a bland screen and a powerful way to put various contents on that screen.   Such is the case with word processing, for example.

3. In Type II applications, the user has a great deal of control of the interaction between user and machine, and there is an extensive repertoire of acceptable user input. For example, in word processing, the user determines when (or whether) to invoke the spelling checker, the thesaurus, and various editing aids such as global searches, replacements,   and block moves. By contrast, a Type I math fact drill and practice program controls both the schedule and the type of user interaction allowed.

4. With Type II applications are usually aimed at accomplishing more creative tasks than are Type I applications. Writing a narrative passage using a worded- processing package is obviously a more creative task than learning the multiplication facts.

5. With Type II applications, it   generally takes many   hours of use before the user has seen everything   that the specific software is capable of reliable published reviews of Type II software, but it is relatively easy to find good reviews of Type I software. Unfortunately, staff writers and others who prepare software reviews   for computer magazines are frequently not regular users of the software   they review. In fact, they are often totally unfamiliar with the software when they begin their review, and they rely on what they find out through using the software for a few minutes before beginning to write. This may work well with Type I software, but it may take days, weeks, or even months of use before a user can take advantage of all features of a Type II application such as word processing.

Typical type II software

Word processing   the use of word **processing** to teach written composition is a Type   II application because it makes possible the teaching of composition in a way that is not possible without the use of the computer. The ease of revision made possible by word processing cannot be duplicated with non-computer activities. Although researchers are still attempting to determine exactly which student writing achievement outcomes are most favorably influenced by instruction employing word processing, there is little doubt that word processing results in more positive achievement   gains than traditional instruction. Researchers have also found that student attitudes toward writing are improved following instruction using word processing. Since both student achievement and attitude are favorably influenced and   since word processing takes the drudgery out of the composing and revising process, it would be sufficient if effects on student achievement were only equal, rather than superior, to traditional instruction. Subjected word processing research to **meta-analysis,** a statistical technique that permits analyzing the collective results of a number of individual research findings. She concluded that word processing is one of the most potentially powerful uses of microcomputers for instruction.

In addition to conforming to the definition   of Type II software, word processing also possesses all the characteristics common to applications in this category: (1) relatively active intellectual involvement, (2) user control of almost everything that happens on the screen, (3) user control of interaction with the machine and an extensive repertoire   of acceptable   user input, (4) focus on creative instead   of rote tasks, and   (5) many capabilities that require hours, days, or even weeks to view full.

In our previous discussion of the characteristics of type II software, we used word processing as the example. Suffice it to say that composing a written passage using word processing requires a high level of intellectual involvement, places the user in charge by providing a blank screen and a powerful way to place whatever text the user chooses on that screen, and is a highly creative act. In addition, full investigation of a word processor's capabilities cannot be accomplished in a few minutes; it may require days or weeks.

Two related Type II applications are the use of spreadsheet and database management software. **Electronic spreadsheets** are accounting ledger sheets that allow the user to create complex displays consisting of rows and columns of numbers. Electronic spreadsheets greatly simplify accounting tasks because of the ease of changing individual entries and all related entries. This is important, since entries in accounting ledgers are highly interdependent. Because of this interdependence, changing a handful of numbers may require the revision of thousands of other   entries, since complex formulas may be used involving specific entries that are then used to calculate other entries. For example, if one entry represents the wholesale cost of a raw material used in the manufacture of a certain product, a change in this number requires changing numerous other numbers, such as tax paid on each item, percentage of profit, and commissions to be paid to salespeople.

1. Electronic spreadsheets allow the user to enter formulas that are then used to calculate
   other entries. When the user changes any of the involved entries, the program automatically and almost instantaneously changes all affected entries. Thus, managers may pose complex hypothetical business scenarios that can be answered with only a few key- strokes. These same scenarios might require dozens of accountants   days, weeks, or even months to analyze without the help of computers. Figure 2.5 shows a portion

of a
spreadsheet that has been used to enter student grades. The spreadsheet automatically

totals the points earned and, in the final column, assigns a grade based on a user-entered formula.

2. Spreadsheets can also be used for a variety of teaching tasks. These would be classified as Type II uses for the same reasons that word processing is so classified.

3. Database management software is another Type II application somewhat similar to word processing and electronic spreadsheets. Data-system. Once dates are correctly entered, the user can then search the date for all cases conforming to some predetermined criteria or combination of criterion.

For example, a social studies class might research data about tropical rain forests. Once the date are found and entered in the date base, it is then possible to search the file for all cases of tropical rain forests that conform to some criterion (such as all rain forests between certain latitudes, or with a given range of annual rainfall, or with certain flora or fauna).

Programming languages Controversy continues over the issue of whether or not there cognitive benefits to be gained by teaching a programming language to children and, if so,
what these benefits are.

Although final determination of category depends on the resolution of this controversy, we believe for two reasons that computer programming should be considered a Type II activity. First, benefits are involved in learning to program (although we feel these benefits have been exaggerated by some advocates). Second, the benefits are unique to computer programming and are not easily available through non-computer activities.

In addition, programming a computer possesses all the characteristics unique to Type II applications: (1) programming requires a high level of intellectual involvement as the user attempts to supply the code to accomplish some task; (2) the user is completely in charge of determining what will happen on the screen, since a computer language, like a word processor, provides a blank screen and a powerful way to enter and revise whatever code the user chooses; (3) the user is in charge of the interaction with the computer and there is great flexibility in and an extensive repertoire of acceptable user input (all commands provided by the specific language); (4) programming is a highly creative problem solving act; and (5) the full capabilities of a programming language cannot be viewed in only a few minutes.

Simulations computer simulations make available experiences that are too expensive, too dangerous, or otherwise unavailable to students. Thus, simulations are type II applications almost by definition.

Some of the most sophisticated and complex simulations have been developed for use by the military. Examples of these simulations are any of the complex computer flight simulators currently in use. The cost and safety advantages of filing simulators over actual flight are obvious. A single actual flight in a modern jet fighter is dangerous and cost thousands of dollars for the fuel alone. The same flight in a jet simulator is completely safe and involves only the cost of the computer and software, which can be used for years. In addition, flight simulators make it possible for trainers to systematically confront trainees with a wide variety of flight conditions, such as severe weather, equipment malfunctions, and attack by enemy planes or ground weapons.

Generally, educational simulations are not as well developed as are highly complex and sophisticated simulations like flight simulators. Nevertheless, we believe that simulations represent one of the most exciting potentials in education.

Although scarce, some excellent educational simulations are available. Examples include controlling the ecology of a small pond, designing a machine for a factory, managing the fossil fuel reserves of the United States, leading a wagon train across the Oregon Trail, controlling osmosis in a living cell, and operating a hot dog concession at high school football games for a year. (Sunburst Communications markets many excellent educational simulations).

In the cell membrane example, users are shown minimum and maximum concentrations of substances that can move into and out of a or decrease concentrations as the cell "lives." When this simulation is started, concentrations vary due to cell metabolism, and the user must adjust these concentrations to keep them within acceptable limits. Care must be taken, because allowing one substance to diffuse into the cell can have unexpected and potentially catastrophic effects on concentrations of other substances. The user attempts to keep the cell "alive" as long as possible. This software makes an experience available that is not available in real life due to the small size of the cell and to the difficulty in controlling exactly what will diffuse across the cell membrane in a real laboratory.

Most of the qualities of typical Type II software are present in simulations. In the cell membrane simulation, for example, (1) active intellectual involvement is required for the user to avoid altering one concentration in such a way that another reaches a lethal level, (2) the thing within acceptable levels, and (3) the simulation is complex enough that a user would probably never see all possible combinations requiring all possible solutions.

Two characteristics of most type II software may not be applicable to some simulations. For example, in many simulations, most of what happens on the screen is predetermined by the software developer instead of the user (although it could be argued in our example that the manipulation of the various concentrations is completely controlled by the user). In addition, the developer of the simulation predetermines the nature of the interaction as well as acceptable responses. (Again, it could be argued that the user- chosen concentrations in the cell simulation can range over extremely wide numerical common qualities Still, the user is restricted to numbers alone, and they must fall within the predetermined acceptable range.) Therefore, these two common qualities of Type II software do not seem to apply to educational simulations. However, the simulations are one of the most exciting and promising applications in educational computing.

SELF ASSESSMENT EXERCIES 2

List three example of Type II application software and fully discuss their characteristics.

11.0 CONCLUSION

In this Unit, you ought to have learnt that computer Software is generally classified
into two- Type I and Type II. While Type I applications generally stimulate relatively

passive involvement on the part of the user, the Type II. Type II application of software

provides new and better ways of teaching and learning available to teachers and students. Some examples of Type I include Drill and practice ,Tutorial software, Assessment Uses, Administrative Uses, and Computer- Managed Instruction. Similarly, some of examples of Type II are word processing, spreadsheet and database management software. Therefore, these two common qualities of Type II software do not seem to apply to educational simulations. However, the simulations are one of the most exciting and promising applications in educational computing.

12.0 SUMMARY

The software applications are classified into two- Type I and Type II. Type I applications generally stimulate relatively passive involvement on the part of the user, and Type II application of software provides new and better ways of teaching and learning available to teachers and students. It must be noticed that programming a computer possesses
all the characteristics unique to Type II applications, some of which include- programming requires a high level of intellectual involvement as the user attempts to supply the code to accomplish some task; and the user is completely in charge of determining what will happen
on the screen, since a computer language, like a word processor, provides a blank   screen and
a powerful way to enter and revise whatever code the user chooses.

13.0 TUTOR-MARKED ASSIGNMENT

1. List three examples of Type I and Type II application software and fully discuss their characteristics.
2. Fully describe the features of Type I application software

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MODULE 3   COMPUTER AND INSTRUCTIONAL PROCESSES

Unit 1   Computer Usage in Education Process
Unit 2   Mode of Computer Lesson Presentation
Unit 3   The Use of Network and Internet for Instruction
Unit 4   Issues in Computer Usage in Education

UNIT 1   COMPUTER USAGE IN EDUCATION PROCESS

1.0   INTRODUCTION

We are now in the age of computer revolution which has to large extent, widened the gap between the developed and developing nations originally created by the industrial revolution. The computer has the potential to become education's single most useful teaching and learning tool. However, the value of any tool does not depend solely on the qualities of the tool itself. If the tool is to be useful, a necessary (but not sufficient) requirement is that the tool's users must choose to apply the tool to important tasks. Therefore, as a teacher,   you need to   know the kinds   of teaching and learning task to which the computer tool can be best applied. In this Unit   you will be exposed to the general overview   of computer usage in education as   well as the teaching capacity of computer.

2.0   OBJECTIVES

At the end of this Unit, you should be able to:
     1. Articulate the uses of computer in teaching and learning processes
     2. Articulate the teaching capacity of computer.

3.0   MAIN CONTENT

3.1   Overview of Computer usage in Education

Computer has presented a new challenge in the use of instructional material for teaching and learning. Since the advent of microcomputers in the 1970s, computer use in schools has become widespread, from primary schools through the university level and in some preschool programs. Instructional computers either present information or fill a tutorial role, testing the student for comprehension. By providing one-on-one interaction and producing immediate responses to input answers, computers allow students to demonstrate mastery and learn new material at their own pace. A disadvantage is that computerized instruction cannot extend the lesson beyond the limits of the programming.

Computers can be a powerful tool in a teacher's repertoire. With the advent of microcomputers, computers have become commonplace in modern society. Their popularity and educational value has had an irreversible impact on schools. Indeed, with their world processing and record-keeping capabilities, quick and easy spreadsheets, and high-quality graphics programs, computers have established their effectiveness as management and instructional tools.

Software has gradually improved in quality and variety and is now available for all subject areas and grade levels. Indeed, current software presents whole units and courses of instruction. The newer software permits a variety of student responses, with branching to appropriate levels of instruction based on the correctness of students' responses. If students fail to master intended skills or concepts, the software breaks down the concept using analogies, examples, and suggestions rather than simply repeating presentation of the subject matter. Moreover, overall instruction is made more appealing and enhanced through the use of graphics and sound.

The selection, evaluation, and purchase of classroom software should be based on how well the program sustains students' interest and, more important, how well it addresses intended goals and objectives. More specifically, you should focus on (1) how well the software appeals to students and acts as a motivator, (2) how well the software helps students master intended skills and concepts, and (3) how well the software encourages and develops higher-level thinking.

Computers can greatly expand the types of instruction received by students; improve on current teaching modes, and free teachers to increase their personal attention to students. Indeed, positive experiences can come from meaningful interactions with computers as students learn concepts concurrently with the training exercises are integrated into computer programs that actually call for students to use spreadsheets while using the training programs in business education classes.

Computers and computer labs have become less expensive and more versatile, and if schools know their potential and have the proper software, the capabilities are

limitless. However, interest in adapting computers to serve as instructional tools needs to be nourished.

Computer characteristically offers many advantages as management and instructional tools. Their success has flourished with the increase in availability at less cost. Computers permit the use of flexible, practical, and effective self-contained units of instruction; allow vast amounts of data and information to be quickly stored and used for reference, manipulation, and problem solving; and provide serial sources of output, including by screen, printout, and signals passing over wires to remote places. Also, as noted earlier, they may be used for controlling other instructional tools, such as slides, filmstrips, motion pictures, and video programs.

Generally, computers represent good motivational tools. They encourage students to become actively involved in the learning process. Further, they make fewer errors than teachers and do not get irritated, tired, angry, distracted, or impatient. Indeed, computers have become so sophisticated that they can mimic human instructors in response to students. Moreover, computers also benefit students by helping them develop a sense of accomplishment, and in so doing improve their self-confidence.

Additionally, computers and computer software are available to serve the unique needs of students from diverse backgrounds, including the advanced, the below average, the learning disabled, those from low-income families, and those with limited English skills. Another major instructional advantage of computers is that, with the appropriate software, they can be used by both teachers and students for word processing, record keeping, and desktop publishing. As such they permit teachers and students to produce, save, retrieve, edit, and print both text and visuals for term papers, let frames. Utility programs are now available specifically for teachers and administrators that facilitate such functions as scheduling, record keeping, test writing and analysis, or puzzle generation. The instructional role computers have assumed in the classroom has taken two forms: computer-managed instruction (CMI) and computer-assisted instruction (CAI), which is sometimes referred to as computer-based instruction.

Computer-Managed Instruction: The primary purpose of computer-managed instruction (CMI) is to help both the instructor and the student in the management of records. Specifically, teachers use it for handling student records, diagnosing and prescribing materials, monitoring about students and about relevant instructional materials. Students can take tests on the computer or input information into a personal portfolio. Moreover, computers can diagnose the learning needs of students and prescribe optimal sequences of instruction for them. Essentially, computer-managed instruction but it may contain instruction programs or activities; that is, the programs can provide activities that focus on identified student needs.

Some computer-managed instruction packages will include instructional objectives, instructional activities, corresponding test items, and instructional support. In such systems, computers often are used for testing students' competency mastery; for

recording each student's mastery progress; for diagnosing weaknesses, recommending remedial work if necessary, and indicating when the student is ready to move on to the next step; and for providing needed additional practice.

Teachers who have become proficient with the appropriate computer-managed instructional software can manage instruction with these computers and maintain sophisticated records on students. Indeed, as teachers develop lessons and test items for the units they teach, they can be programmed into the computer for random selection when the time comes for use. Moreover, teachers will find word processing programs useful in producing course outlines handouts, and tests. Furthermore, teachers will find the use of database information systems in collecting and recording information and spreadsheet information extremely useful in recording grades and calculating end-of-term grades.

Computer-Assisted Instruction Computer-assisted instruction (CAI)   usually serves one individual student at a time, as part of the instructional activity. The major strength of computer-assisted instruction is that it is interactive: Information, questions, and other stimuli flow from computers to students, but then the students can provide input that shapes the next computer output.

With computer-assisted instruction, acquisition of information and development of skills is accomplished through the use of a computer system and a computer software program. The computer system usually consists of a CPU, a data-storage system such as a disk drive or hard drive, a monitor or display unit called a cathode ray tube, and a keyboard. Programs may be designed to fit individual needs at any desired ability level, pace, or degree of complexity. The four main types of programs for computer-assisted instruction are drill-and-practice, tutorial activities, simulation, and games.

Drill-and-practice programs are the lowest level of computer use. They lead students through a series of examples to increase dexterity and fluency in a skill. That is, they contain exercises that repeatedly put the student into contact with quantities of information, facts problems, and relationships for the purpose of learning and mastering concepts and skills or committing material to memory. Drill-and-practice is used predominantly for math drills, foreign language drill, vocabulary building, and the like.

Tutorial programs are designed to emulate a human tutor: The computer acts as the teacher. The computer initially presents new information; depending on student responses, it may present additional or supplemental information. The initial presentation and follow-up responses to the student may take the form of written explanation and descriptions, questions and problems, or graphics and visual illustrations. Tutorials are generally more sophisticated than drill-and-practice programs.

Simulation programs call on the students to role-play and model reality. Essentially, students confront real-life situations. That is, they make decisions while emulating or

interacting with "real-life" or "close-to' life" situations and processes in order to learn from their responses. Simulations are especially helpful and thought provoking when they ask students to make decisions concerning situations or processes involving risks or dangers. Students can now conduct experiments; experience past events, current happenings, or future possibilities; and consider what-if problems through simulations.

Gaming programs engage students in activities where they must follow specific rules that differ from those of real life in order to reach a specific goal. Attaining the goal usually entails competition-group against group against group, as in volleyball; individual against individual or machine, as in chess; or individual against a standard, as in bowling. To be challenging, goals should have a roughly 50 percent probability of success.

Whatever form of computer-assisted instruction is used, it is usually appealing to students. Programs involve students and give them some control over the rate of their learning. Moreover, they can often improve instructional effectiveness and efficiency.

Although there are definite advantages associated with computers as instructional tools, some educators criticize them because of what they consider characteristic limitations. For one thing, computers are still expensive; critics suggest that Naira spent on hardware, software, and maintenance would be better spent for more teachers, higher salaries, or other instructional materials. Some fear that computers may replace teachers. Others fear that they stifle creativity, limit social interaction, emphasize narrow facts at the expense of broad generalizations, limit the imagination, and dehumanize instruction.

The use of computers is also criticized because of perceived instructional limitations and problems, such as the limited range of objectives being taught by computers. Most computer-based instruction cannot effectively teach affective, motor, or interpersonal skills. Even in the cognitive domain, current programs tend to teach at the lower levels of knowledge and understanding. Copyright problems, the poor quality of some software programs, and incompatibility among software programs also can limit their effectiveness. Further, some teachers fear using computers because they are too complex to understand.

Additionally, logistical environmental concerns may limit the use of computers. For example, having to deal with issues like placement of the computes, supervision of users, maintenance, and acquisition of supplies, may cause some teachers not to bother using computers as instructional tools.

The introduction and use of technology in schools and classrooms will not automatically increase student learning. To accomplish this end, educators must rethink how schools are organized and rethink curriculum and instruction. Teachers and administrators must know how to use the hardware and software. More importantly, they must know how to use these tools to create appropriate learning

experiences for students. As teachers gain easier access and receive training in the use of the Internet and as technology resources expand through electronic networking, instruction will be enhanced and we should see students becoming more active, confident, motivated, and achieve at higher levels.

SELF ASSESSMENT EXERCIES 1

1. List two challenges posed by the use of computer in teaching and learning.
2. List two benefits of the students for use of computers in education.

3.2   Teaching Capacity of computer

Computers have some unique teaching capabilities that can be practically exploited to achieve great educational effectiveness. They provide powerful intellectual tools for calculation, for the word processing involved in writing, for designing some technological artifacts or artistic creations. These potentialities can be exploited to shift educational emphasis from the teaching of routine skills to the teaching of more sophisticated thinking skills of the kind that has become increasingly important in the technological society.

Computers can be used to design special 'learning environments' that can significantly student leaning foster, even with the absence of any formal instruction. They can be used to act as private non-human tutors available to any student at any time or place of his or her choice. They can be flexible adapted to the student is individual capabilities and rate of learning. Most importantly, they can be superb teachers (sometimes superior to human teachers) if the teaching programme incorporated in to the computers had originally been designed by the best available talents. By incorporating the techniques of artificial intelligence, computers can increasingly   act as non-human tutor with genuine subject   matter experts and human-like intelligence.

Computers can potentially be used to provide detailed diagnostic information about an individual student's existing knowledge, thinking skills, and learning capability; such diagnostic information can greatly help teachers or students to advise appropriate activities for teaching or learning. Computers, used in conjunction with modern communication technologies, can be connected together, whereby individuals may readily communicate and interact with each other.

Computers can be very effectively agents for distributing good education on a large scale. Educational programmes and methods incorporated into computers can penetrate almost everywhere, especially as computers become increasingly widespread. The educational programmes may be used effectively not only in schools but also in less formal environmental such as homes, offices, museums and community centres. They can greatly help and supplement human teachers, but may be quite effective even in the absence of such teachers. Computers can potentially make excellent instruction available to students. The instruction prepared for delivery

by computers can be repeatedly used, readily modified and cumulatively improved to remedy observed deficiencies or to reflect changing circumstances.

The increasingly widespread availability of computers is likely to foster greater popular interest in their use and thus also to enhance people's motivation understand the quantitative and analytical modes of thing required for their effective use. Such motivation can potentially be exploited by deliberately designing computers to be readily usable by people in all walks of life, to provide such people with appealing opportunities to engage in quantitative thinking, and thus to promote greater mathematical and scientific literacy.

Computers can greatly facilitate many of the burdensome record-keeping and administrative tasks carried out by teachers. Tools for educational research: Computers can be powerful research tools in education. The recent past has seen very fruitful applications of computers in the basic studies of human thought processes relevant to education.

Computers, available as tools for students, can help them carry out many relatively simple tasks which they traditionally spent years learning to do unaided (e.g. making arithmetical computations, manipulating symbolic expressions in algebra, implementing the syntax rule in complex programming). Various resulting implications may usefully be explored. Computers can be used to design learning environments that can foster student learning even in the absence of any formal instruction. Such learning environments have been designed for various educational levels (e.g. LOGO computer language and 'turtle geometry' for use by quite young children, computer environments for learning to troubleshoot electronic circuits, and others).

Computers can provide learning environments where students have access to real data (e.g. data about populations and demographic trends, and economic data about various countries) and can they use computers to facilitate computations with such data. Besides, such learning environments could also be exploited to teach students useful knowledge about modern computer-implemented databases and techniques needed to work with such databases. Computers can be very profitably used to create learning environments' simulating laboratory situations. Such laboratories may simulate real situations that might be encountered in an actual laboratory.

However, the simulation has the following advantages: It is usually much less expensive than a real laboratory. It allows the quick exploration of many possibilities and the systematic variation of many relevant parameters; it allows active exploration without danger or harm to students; and it allows students to focus their attention on centrally important issues without being distracted by many logical details of real experiments. Effective learning is greatly fostered when students are actively and learn by doing. Computers also permit the design of learning environments that help students acquire mental models to deal with complex phenomena or devices. Computer tools, such as word processors, spreadsheets and programming languages

can be used by students for writing activities, for entering and manipulating data obtained in science and social studies activities, or for exploring number patterns. Each computer software tool has a variety of uses in the classroom. Today, through the use of technology tools, students can create their own learning micro-worlds as well as share data and concepts with the global community.

Traditionally, human teachers in face-to-face contact have implemented most educational tasks, predominantly with students, even when the teachers faced students in large classes and had little time to give them individual attention. But modern information technologies permit educational tasks to be approached from a more efficacious point of view. Effective education can be provided not only by human teachers but also by books, movies, audio and video technologies, and computers acting as private non-human tutors in other capacities.

Each of these instructional means, including the human teachers, has some unique strength and some appreciable limitations. However, better educational effectiveness can be realized by careful design, which uses and optimum combination of such instructional means to attain desired educational goals. Such an instructional design would judiciously aim to exploit the unique capabilities for each instruction means and try to minimize its limitations.

Human teachers would then be used to maximum advantage in those situations where their unique capabilities are most valuable. Education would then become less synonymous with schooling, with more education effectively provided in homes and other information setting. Therefore, now that we have the technology tools that can promote alternative learning strategies, we will produce citizens who are equipped academically to be educated participants in today's and tomorrow's world.

But, it seems apparent that school system sometimes buy computers in response to parental pressures or because they want to gain prestige by being at the forefront of new trends rather than because they have a vision of the educational goals the computers will help them achieve or of how the change process can be handled in away that maximizes the potential benefits of using microcomputers in instruction while minimizing negative effects. The historical innovations in education have revealed that changes must not be undertaken just for change's sake. It is an error to yield to the temptation of acquiring technology without planning for its use. In fact many innovations introduced in schools have failed, because teachers were not prepared ahead of the introduction of such innovation. The computer is neither a complete teacher nor a panacea for educational problems. The teacher clearly has a central role in assuring that Computer-Assisted Instruction is balanced by one kind of experiences.

The feverish rush towards acquiring microcomputers mean that many teachers now have computers available to them as tools which they have little or no familiarity. Further, the fact that major expenditures are being made on computer hardware at a time when many school system have been feeling a financial pinch has led many

systems to skimp on teacher training and support services. However, it is important to make teachers more familiar with computers and their use. Teachers must know some of the potentialities and limitations of computers encouraged by them in their teaching position and must have a level of computer literacy, not too inferior to that of many students.

The education of teachers should make them adequately knowledgeable about the educational application of computers; about new educational approaches made possible by computers and recent insights into human thought processes, and about new educational goals needed to prepare students to function in a technological society. Moreover, computers should be exploited as teaching tools in the actual education of teachers. This might not only improve the education of teachers, but also make them directly familiar with the educational applications of computers. Has the computer any specific role in mathematics? This and some other related questions are discussed in the next section of the literature review.

SELF ASSESSMENT EXERCIES 2

List five teaching capacities of computer.

4.0   CONCLUSION

In this Unit you ought to have learnt that computer use in schools has become widespread, from primary schools through the university level and in some preschool programs; and that computers can be a powerful tool in a teacher's repertoire. Software has gradually improved in quality and variety and is now available for all subject areas and grade levels. The newer software permits a variety of student responses, with branching to appropriate levels of instruction based on the correctness of students' responses. Similarly, computers can greatly expand the types of instruction received by students; improve on current teaching modes, and free teachers to increase their personal attention to students. Computers have some unique teaching capabilities that can be practically exploited to achieve great educational effectiveness. They provide powerful intellectual tools for calculation, for the word processing involved in writing, for designing some technological artifacts or artistic creations. Computers can be used to design special 'learning environments' that can significantly student leaning foster, even with the absence of any formal instruction. However, the education of teachers should make them adequately knowledgeable about the educational application of computers.

5.0   SUMMARY

The computer has the potential to become education's single most useful teaching and learning tool. There is no doubt that computers can greatly expand the types of instruction received by students; improve on current teaching modes, and free teachers to increase their personal attention to students. Effective learning is greatly fostered when students are actively and learn by doing. Computers also permit the design of learning environments that help students acquire mental models to deal with complex phenomena or devices. The capacity of computers notwithstanding, the education of teachers should make them adequately knowledgeable about the educational application of computers.

6.0   TUTOR-MARKED ASSIGNMENT

1. What will you consider to be the challenges posed by computer to the teaching and learning processes?
2. State three advantages of the use of computers in education
3. List and discuss three capacity of computers in education.

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UNIT 2   Mode of Computer Lesson Presentation

43.0   Introduction
44.0   Objectives
45.0   Main content
        45.1   Computer as Tutor
        45.2   Computer as Tool
        45.3   Computer as Tutee
46.0   Conclusion
47.0   Summary
48.0   Tutor-marked Assignment
49.0   References/Further readings

1.0   INTRODUCTION

There are three modes of computer lesson presentation; these are computer as tool,
computer as tutor, and computer as tutee. Each mode has its own purpose and application. The various modes were fully discussed to enable you know how computer could be used in teaching and learning. This discussion will also equip you with the knowledge that will enable you appreciate computer in its ramification.

2.0   OBJECTIVES

At the end of this unit, you should be able:

1. Identify the three modes of computer lesson presentation
2. Articulate the features and functions of each of the modes

3.0   MAIN CONTENT

3.1   Computer as tutor

Computer could be used as a tutor in education. According to Taylor (1980) computer could be applied in education in three modes which are as a tutor, tool and tutee. In using computer as a tutor, the computer performs a teaching role. In effect, the student is tutored by the computer. Tutor applications are further classified as:
   (1)   Computer-based instruction (CBI), computer-assisted instruction (CAI) or computer-assisted learning (CAL).
Taylor outlined the processes as follows:
   (1)   The computer presents same information
   (2)   The student is asked to respond to a question or problem related to the information.
   (3)   The computer evaluates the students' response according to specified criteria.
   (4)   The computer determines what to do next on the basis of its evaluation of the response.

Tutor application can equally be classified into five categories: drill and practice application, tutorial applications, simulations, problem-solving applications and games.   These various applications of the computer as a tutor will be discussed to enable you understand how they are applied and what each application is for.

Drill and Practice Applications: This is one of the most common applications of the computer as a tutor. The application involves any exercise, physical or mental that is performed regularly and with rote-memory learning. The primary purpose is to help students memorize the appropriate response to same stimulus. For example, drill on spelling words, like Envelop or Mathematics drill like 3+4 =?. The computer can display to this by responding to it. Drill and practice can be inform of flash cards with the stimulus on the front and the correct response on the back are presented to the learner one at a time. After the learner/student must have responded to each stimulus, he/she is shown the correct answer on the back of the card.

Tutorials and drills are examples of situations in which the computer controls or structures student learning and achievement. In tutorials, the learner who wishes to master a subject or acquire certain skills interacts with a teacher or tutor. Just as it is theoretically possible for a learner to acquire information or skills by merely reading a good book on the subject, without ever consulting a teacher, it is also theoretically possible to acquire information from a properly programmed computer without ever consulting a teacher. However, students learn best when they interact with teachers at critical times during the learning process instead of only reading textbooks. In the same way, a computer will become an effective means of instruction only if a competent teacher can employ it as a useful supplement to the overall curriculum. Likewise, counselors or librarians can tell students to "go read a book" in order to acquire some information or some form of self-help, but they are more likely to use books to supplement their own services and expertise. The same thing is true of the computer: it is best viewed as a valuable supplement   to rather than as a replacement for teachers, counselors, and other educational personnel.

You ought to be familiar with the concept of branching programmed instruction, which presents small segments ("frames") of instruction to which a student is asked to respond. The learner is directed to the next relevant frame or branch of the instructional sequence based on each response. Tutorials and drills based on branching programmed instruction have been developed to teach concepts and processes in such areas as science, mathematics, social studies, and language arts. Despite the obvious benefits of such a strategy, researchers have been hard pressed to demonstrate its effectiveness. One deficiency in many such programs is that most written materials do not branch very effectively, and this is when the computer can implement and improve such programmed tutorials. The computer is able to evaluate a learner's performance very quickly and then off the next piece of information that will be most helpful. Although it is possible to incorporate entire courses of instruction into such computerized programs, the most practical approach seems to be to program only those instructional units that will benefit from the interaction and branching that the computer can provide.

A similar application appears in counseling and various educational support services. Computers can be used to give to a learner or client information based on the response to a previous question. For example, the computer can help students make career choices or select colleges by systematically offering pertinent information. (SIGI is a professionally developed program that does just this). Likewise, librarians can use computer programs to help library patrons select appropriate reference books. Another library application is to provide a tutorial program that can teach a patron how to use a reference book once it has been selected.

Drills: In recent years drills have become unpopular among both students and teachers. This is partly because they often focus on factual information that can be boring to students, especially those who have already mastered it. In addition, devising a large number of drills (especially individualized drills) presents a for minable task for the teacher. But despite such unpopularity, repeated practice in understanding and applying concepts and principles is often an important teaching method, and therefore drills can often have a useful purpose. A properly programmed computer can offer drills that are varied and are interesting and that can easily be tailored to the needs of the students who will use them. These drills can be used as remedial work for students who have trouble understanding a concept, as individualized practice for a wide range of students, and for makeup work missed during a class session.

Tutorial application involves teaching new information. For example in a tutorial dealing with the concept of a verb, the computer presents the definition of a noun, shows severed examples of a verb and then asks students to practice identifying a verb in a given sentence.

Tutorial applications are similar to a programmed textbook. The rule is that a piece of information is given and the learner is expected to respond while the computer gives a feedback based on the students reference. The cycle is then repeated. The tutorial programs are capable of tailoring the material to the needs of the individual student. What this is saying is that, in tutorial program each student is being taken care of to the extent that if a particular student is finding a particular problem difficult, the computer can present remedial material for such student. But students who are doing well will move on without any remedial.

Simulations are representations or models of real systems. It is another form of tutorial application where models are used to represent real system and the same purpose will be achieved.

Problem solving applications provide settings in which students can learn and improve their problem solving skills.

Game applications are used to bring interest and motivation to the learning situation. It could involve a competition between a student and another or one group of student and another.

Condition for selection of the package

Teachers should review the computer program or the online activity or game to understand the context of the lessons and determine which ones fit the needs of their students and how they may enhance instruction.

- Can this program supplement the lesson, give basic skills practice, or be used as an educational reward for students?
- Is the material presented so that students will remain interested yet not lose valuable instruction time trying to figure out how to operate the program? Does the program waste time with too much animation?
- Is the program at the correct level for the class or the individual student?

Teachers should also review all Web sites and links immediately before directing students to them. Web addresses and links frequently change and become inactive. Students might become frustrated when links are no longer available.

Students may be scheduled for instructional or remedial time with the computer. The computer program may also be a learning station in a classroom learning center or a reward for positive behavior or work completion. Applications software are used with systems software to perform specific tasks given to the computer by the user.

Some groups of general-purpose applications software are spreadsheets, data management packages, graphics packages; word-processing packages; communication packages; presentation software and integrated packages.
Electronic spreadsheet packages**:** A spreadsheet is simply a way to keep track of and manipulate data- separating them into rows and columns. Each user can change the format to adapt a spreadsheet to various applications.

You can use spreadsheets to display selected data graphically as well as to perform computations. An electronic spreadsheet program relies on formulas that fan be revised with great accuracy. These formulas allow the software to recalculate spreadsheet values automatically when the data are modified. Other changes, such as inserting and detecting rows and columns, are equally easy to make.

Any application where the problem can be written in mathematical terms can be used for electronic spreadsheet. A spreadsheet should be considered for any reports that:
- are recreated regularly, e.g. salaries of staff,
- edited;
- need calculation;
- need graphs, or

- consist of data that are of the same type, e.g. marks of students.

For example, a spreadsheet package can be used to analyze results of students in a class. Common examples of Spreadsheet packages are LOTUS 1-2-3 and Microsoft EXCEL. We shall learn how to use Microsoft Excel later in this book.

Data management packages are packages that deal with creation and maintenance of data for enquiry and reporting purposes like keeping records of students, their birthdays, sex etc. Common examples of software that can do this are DBASE IV, FoxPro, Paradox and Microsoft ACCESS.

Graphics Packages provide facilitates that allow the user to do various kinds of computer graphics. Some allow the user to produce drawings or diagrams and frequently use input deices such as the mouse. Some packages are aimed at particular application areas. For example, a business graphics package might provide means of providing business charts and graphs. Common examples are Harvard Graphics, DrawPerfect, and PAINT.

Word processing packages provide a number of options for the user. They allow the user to create (type) document, amend document, edit an existing document, copy a document, print document, etc. Some examples of word processing packages are WordStar, WordPerfect and Microsoft Word. We shall learn how to use Microsoft Word later in this book.

Communication software are computer programs which can be sued to send memos, reports and messages to transfer computer data files, to access information stored at distant locations, and event have "electronic meetings" among people in dispersed locations. Examples of community software are E-mail programs, such as **Pegasus mail, Outlook Express;** and the Internet Bowers such as **Netscape, Mosaic** and **Microsoft Explorer.**

Presentation software are used to design, produce and make presentations. Their output can be projected directly from the computer to a screen or used to make transparencies. They greatly simplify the process of preparing for business or academic presentations.

Integrated Software: The data generated by many packages designed for early microcomputers were not always transferrable from one package to another. The programs were not integrated, i.e. data could not be electronically moved from one program to the other. Transferring data from one program to another was either impossible or complex and tedious.

For example, if you were asked to analyze and make a report of the results of your classmates that have been entered using a database management system, you could transfer the data into a spreadsheet package to draw graphs, and later to transfer the graphs into your word processing package to write a report that you will submit

Integrated software allows several programs to share the same data. For example, a
spreadsheet package can use data from a database package to draw commands among
programs. However, in reality, this happens in varying degrees. The result of
integrating is that the user can work faster, more efficiently and thus more
productively than if non-integrated programs were used. Commonly, an integrated
software package integrates software for spreadsheet, database, graphics, and word-
processing packages.

Three examples of integrated programs are:

Microsoft Office: which comprises Microsoft Word, Microsoft Excel, Microsoft
Access, Microsoft Power Point, Microsoft Outlook and Bookshelf Basics.   Corel
WordPerfect Suite: which comprises Corel WordPerfect, Corel Quattro Pro, Corel
Presentations, Corel CENTRAL and Corel Photo House. Claris Works: which
comprises a Word processor, a spreadsheet and a database.

Software are very useful to the users. Each software must solve the user's problems.
However, many users face the problem of finding the right software to solve their
problems. Users do not even know where or how they can get the software to
accomplish their tasks for them. There are basically two ways to acquire applications
software.

The first is simply to buy pre-written software from one of the software shops or
vendors. One characteristics of pre-written software is that they are designed to be
general so as to fit many situations. It is like buying ready-made clothe, it might not fit
the problem needs exactly and must e modified in some way before it can be used.
Some are easy to modify while some cannot be modified all. One must therefore know
the capabilities and limitations of software and be sure that it will solve one's problem
before committing money to it.

In general, pre-written software, also called packaged software, is cheaper and easier
to implement and usually comes with proper documentation. The major disadvantage
is that the user must, to some extent, alter the procedures for doing the work to
conform to the software, whereas normally it should be the reverse.
The second method of making software available is to obtain software that are made
specifically for the intended application. This may be written by the user-if he is ready
to master a programming language and write the necessary program himself, or he can
hire a professional to do all or part of the work.

SELF ASSESSMENT EXERCIES 1

1. List the four classes of tutorial applications
2. What are the conditions for the selection of the packages?

3.2   Computer as Tool

The second mode of computer application is as a tool according to Taylor. Tool application involves using computer as an instructional material. Computer as a tool performs tasks that should augment our performance as human. It is similar to the use of instructional tools like pen, pencil, slide rule, typewriter and others.

It equally involves the use of word processing computer program to type and edit papers. This mode of computer usage is widely used in schools to day. Almost all the schools now use computer in doing one thing or the other. For example, in working out students' results, typing examinations and keeping records. As a tool, the computer takes the role of an assistant or a helper.

The computer can help the teacher or learning in performing routine tasks such as writing, calculating, filing or presenting information. In that case, the computer serves as a tool. Teachers may employ computers as labour saving devices to produce instructional materials and manage their instruction. Learners may also employ the computer to help with their school work. Examples of such use include word processors, graphics packages, presentation soft ware spreadsheets and databases. When computers are used as a tool in work places, they are often used to help the worker. For example, societies prepare document using word processors, business people store custom records in database, accountants use spread sheets to calculate balance sheets, teachers use computers to teach in order to augment their lessons.

In addition to drills and tutorials, the computer can often simulate a real-life situation or event. There are numerous settings in education in which it would be desirable for a student to engage in some sort of problem-solving activity but in which practical considerations such as time, money, or danger prohibit it. For example, students could learn a great deal about various scientific and mathematical concepts if they could land a vehicle on the moon, and it is possible for a computer to simulate such landing and for students to apply their knowledge and skills. Likewise, studying the comparative numbers of predators and prey in forests, fields, and open woodlands is important to understanding population boil-forests, fields, and open woodlands is important to understanding population biology. Students could learn about predator-prey interactions, ethics, and economics if they could manipulate such variables as the density of forest vegetation, initial numbers of predators and prey, and human interference. This scientific manipulation would permit them to examine the impact of these variables on the balance of organisms in a natural environment. With the assistance of the computer, a learner can easily perform such experiments and can replicate them as often as necessary and with variations in order to understand the concepts, principles, and scientific processes under investigation.

The computer also can be used to search data bases to find bibliographic citations or find and evaluate information that enables learners to make various decisions. The computer can also be used as a sophisticated calculator for complex mathematical computations. The computer has the advantage over the simple calculator that once a student enters a formula into a program, the amount of work

needed to repeat similar computations is greatly reduced. Likewise, the computer can be used as a word processor. Students can enter essays or term papers into the computer, store their work, make revisions, and generate a final copy without a lot of unnecessary drudgery. By introducing the computer as a tool in such situations, students can spend their time thinking about and solving problems rather than having to focus on the details that such activities often entail.

SELF ASSESSMENT EXERCIES 2

1. List two way computers can be used as tool.
2. How computer as a tool can performs tasks that should augment human activities?

3.3   Computer as Tutee

The third mode of computer usage is as tutee. This is a situation where the learner becomes the teacher and the computer becomes the learner. In this case, the learner is expected to teach the computer to perform same task. The teacher will talk to the computer in the language that the computer understands. That is the programming language, (for detail, see Module 2, Unit 3.3).   However another way to implement this approach is to have students develop interactive multimedia/hypermedia products is using authoring tools such as hyper-studio. Using computer as a tutee requires organization, logical thinking and problem-solving skills. Examples include; computer programming, hypermedia authoring and web page development. For you to teach the computer, you must learn how to write computer programs.

A similar phenomenon occurs when learners at any level teach the computer to do something. Rather learning about teaching, learners come to understand the process that the computer must "learn". Students who can program a computer to draw a circle must understand the mathematics behind the circle. Students who can program a computer to simulate a horse race or baseball game will better understand the dynamics of those activities-as well as the theory of probability required to make the simulations resemble the actual activities. Likewise, students who can program a computer to simulate the balance between predator and prey in nature will be able to understand the principles involved in this balance better than will students who just read a textbook or watch a film.

By teaching the computer to do something, the learner acquires not only specific information about the subject itself but also (and perhaps more importantly) generalized thinking skills. Because computers are always logical, learners who program computers learn to diagnose problems and synthesize knowledge to solve problems.

LOGO is commercially available programming languages that can help young children develop generalized thinking skills. Not only can LOGO be used to teach

programming skills it can also serve as a modeling tool that young children can use to simulate real-world activities and processes. In one of LOGO's applications, the child directs a "turtle moves, it makes geometric patterns on the screen. As young children become more proficient at LOGO, they can create more and more intricate geometric patterns. Children painlessly and almost automatically learn increasingly complex rules of logic, art, geometry, computer programming and the like.

Finally, it is possible to use the computer as what Taylor has called a tutee. Nearly all teachers can cite examples of concepts or principles that they never really understood until they   were required to teach them to someone else. But a computer can do only what it is taught to do. Therefore, the person who does the programming has to understand the principle well enough to be able to teach it to the computer. During this teaching (programming) process, programmers often learn the concept or principle more thoroughly than ever before and even explore ideas that had not previously occurred to them.

As you read this book and try to write programs of your own, you will probably find yourself benefiting from teaching the computer to teach someone else. For example, to write a good drill or tutorial, you must consider each of the following questions:

1.   What kinds of questions should   you ask, and how can   you formulate these questions clearly enough that the learner's focus will be exactly where you want it to be?
2.   What is the correct answer, and how can you recognize its many variations?
3.   What are the incorrect answers that could be given?
4.   What feedback will you provide for both correct and incorrect answers?
5.   What will you do after the learner gives the correct answer?
6.   What sort of remediation will you provide if the answer is incorrect?
7.   What can you do to enable the learner to have all the necessary information to make a response?
8.   How long should be learner be allowed to continue, and who should terminate the learning session?
9.   How should information regarding the learner's performance be stored (if at all), and to whom should this information be given?

These are questions that must be answered by both teachers who programme the computer and those who work without computers. However, when teachers programme a computer to teach something, they learn how to teach more effectively.

SELF ASSESSMENT EXERCIES 3

1. The use of computer requires programming language. Explain.
2. What is the major advantage of the use of computer as tutee?

4.0 CONCLUSION

The application of computer in education involves three modes and each of the modes is important for the smooth running of educational system. The use of computer is so important that there is no field of work or establishment that will not employ the services of the computer. The application requires a lot of organization, logical thinking and problem-solving skills. As a teacher, you need to make effective use of the computer in the teaching and learning processes; hence, you also need to be very familiar with these modes of computer usage in educational system.

4.0 SUMMARY

In this unit, you have actually learnt how computer could be used in our education system as tutor (teacher), as tool (assistant) and tutee (learner). You have equally seen that the idea of modes of computer originated from Taylor. The next Unit will expose you to packages for instructional presentation.

5.0 TUTOR-MARKED ASSIGNMENT

1. State the modes of using computer in our educational system
2. Outline the five levels that are involved in the application of computer as tutor.
3. List three ways computer could be used as a tool.
4. Who was the brain behind the modes of computer?

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UNIT 3   THE USE OF NETWORK AND INTERNET FOR INSTRUCTION

1.0   INTRODUCTION

The interconnectivity among various computers is described as networking. This arrangement provides scores of educational resources for your teaching and learning activities. The network s are of three folds-Local Area Network, Wide Area Network and International Network (Internet). In this Unit, you will learn about the use of network and Internet in the teaching and learning. You will equally be exposed to some terminologies related to Networks and Internet.

2.0   OBJECTIVES

At the end of this Unit you should be able to:
1. Identify types of Network and how they could be used in teaching and learning.
2. Define terminologies related to Internet.

3.0   MAIN CONTENT

3.1   Networks

Network is the system of connecting two or   more computers together. As a result   of this connection, stand-alone computers (computers with full resources like input unit, processor and output units) can share resources and files with each other. It affords the possibility of communicating with each other. Connections are made in two ways-Local Area Network (LAN) or Wide Area Network (WAN).

Local Area Network: A local Area Network is the system of connecting hardware, software and communication channels (cables and accessories that connect equipment together) in a close range such as in building. The Local Area Network allows the movement of data between mainframe computers and personal computers. Personal computers can be connected to one another or to mainframe computer in orders to share resources such as printers and files. The distance between devices in a LAN system may be few meters if in a building or some more considerable meters in the

same city. With this system, telephone lines are not used for linking of computers,
rather communication channels such as cables are used.

Wide Area Network: Wide Area Networks are more sophisticated compared with LAN. With Wide Area Networks, it is possible to have a system of interconnection of mainframe, microcomputers and other peripheral devices. Connection from several buildings is possible. More than this, equipment can be located in different towns, countries and even continents. The use of telephone line and wireless radio communication equipment are employed in transfer of instructions, sending and retrieval of data it is impossible to transfer data directly through radio or telephone line, modems (Modular Demodulator) are used to achieve this. A modem is placed at the end of the telephone line before it is linked with the computer. When sending out data, it is changed to telephone readable form by the modem at the sending end and changed back to computer readable from by the modem at the receiving side before going to computer.

The Learning and Teaching Support Network (LTSN) was an initiative of the United Kingdom higher education bodies to promote high quality learning and teaching in all subject disciplines in higher education. It was intended to support the sharing of innovation and good practices in learning and teaching including the use, where appropriate, of communications and information technology.

Similarly, the Teaching for Learning Network (TfLN) grew out of pedagogical development activities funded by the Cambridge-MIT Institute (CMI), collaboration between the University of Cambridge and the Massachusetts Institute of Technology (MIT). TfLN was established in order to extend and expand these activities. Both the University of Cambridge and MIT have distinctive educational characters. Part of the goal for TfLN was to determine what specific practices and approaches to teaching and learning contribute to these – while at the same time seeking to identify areas of commonality across the two institutions and higher education as a whole.

SELF ASSESSMENT EXERCIES 1

1. What do you understand by the word LAN?
2. What is the difference between LAN ad WAN?

3.2   INTERNET

The internet (also called International network) is a global collection of many different type of computers and computer networks that are linked together. It can also be called a network connection of many computer network based on a common addressing system and communications protocol called TCP/IP (Transmission Control

Protocol/Internet Protocol). Just as a telephone enables you talk to someone on the other side of earth who also has a phone, the internet enable a person to exchange information with another computers and computer user anywhere in the world. Some call the internet superhighway. As a road allows travel through different parts of a country, so the internet allows information to travel through different interconnected computer network.

Origin and design of internet

The idea of the internet began as an experiment by the United State of America (USA) Department of Defense on the 1960's with the primary goal of helping scientist and researchers from widely dispersed (remote) areas to work together by sharing scarce and expensive computers and their files. This need for Internet arose when it became apparent that there was a need for a bomb proof communications system during the cold war of the mid 60's. A concept was designed to link computers together throughout the US with such a system in place, large sections of the country are reached and massages could still got through.

The internet was actually an emergency communications system operation by the military department of defense's Advanced Research Project Agency (ARPA). The whole operation was referred to as ARPANET. In time ARPANET computers were installed at every university in the U.S. that had defense related funding. Gradually, the Internet had gone from a military pipe-line to a communication tool for scientists. As more scholars came online, the administration of the system was transferred from ARPA to the National Science Foundation. Years later, business began using the Internet and the administrative responsibilities were once again transferred. At this time on one party operates the internet there are several. Today the internet has turned the whole world into a global village as far as information in all aspect of human endeavour is concerned.

Internet offers a collection of information of information with topic ranging from business to science and technology. It also possesses materials on arts and research material for students, entertainment, sports, shopping, dictionaries, encyclopaedias, and maps. In addition, it offers other services and resources as stated below.

Some important internet language

Modem: A modem is a small device connected to a computer of installed inside it, which converts the digital signals from your computer into a form that can be sent down a telephone line.

Internet service provider- An ISP is a company that sells you a connection to the internet.

www- (World Wide Web) The world wide web or the web makes looking round the internet easy. The web consists of screens, each screen is called a page, each page contains words, pictures and sometimes animation and all kinds of sound and music.

Web Browser- this is the software programme that allows you have access to the world wide web. It displays web pages on the computer screen and allows you to follow hot links, download information etc. Examples of web browsers are: Microsoft

internet explorer (part of Microsoft windows). Netscape navigator (part of netscape communicator suite of programmes), opera, neoplanet, and Firefox-Mozilla.

URL- the address of a website is what is referred to as URL. (Uniform Resource Locator). Example of a ULR.\ is http://www.clipart.com

SPAM- it is an unsolicited commercial e-mail found in your mail box.
LINK- it is a word or phrase emphasized in a hypertext document that acts as a pointer to related information. Links in a web browser are usually underlined and are
in different colours from the rest of the text.

Search Tools- two main search tools are used in internet. They are Search Engines and Directories. Though they perform the same operation, they are created differently.

Search Engines- the search engines is a lot of index of millions of web pages and their addresses. A programme called robot, spider or crawler visits every link on a web site, copies the text of the page to its index together with address details. This process is done frequently to update the index. When a user keys in a request, the engine list pages that match the request. Population search engines are: Google (developed by Stanford University), Excite, AltaVista, KotBot and Lycos.

Directories- A directory search for information like search engine. The difference between it and search engine is that a directory is manually compiled, whereas the search engine index is created by computer. If a web designer submits the details of web page to be include in a directory, a short description will be added. This is reviewed by human editor and examines the web sites. If seen suitable, the details of the web site will be included in the directory. Known directories are yahoo! and LookSmart.

HTML- Hypertext Markup Language is the language in which the computerized instructions behind the things you see on the web   are written.

ICON-it is a small abstract graph representation of an objective or idea.
http: Hypertext Transfer Protocol. This is the protocol or set of rules used by web servers. Another popular protocol is ftp or File Transfer Protocol.

Internet offers a collection of information with topic ranging from business to science and technology. It also possesses material on arts and research material for students, entertainment, sports, shopping, dictionaries, encyclopedias, and maps. In addition, it offers other services and resources.

E-mail (Electronic Mail)- E-mail is a   common resources provided   by   internet. It is a worldwide system for sending and receiving messages through electronic system. E-mail is like the way you send a written latter to somebody you know through the post-office system. It is a system where a mail is sent through the computer network. As soon as you send this electronic letter, it travels from your computer, usually through a

device called a modem, which connects your computer to internet via the telephone

network. Unlike the regular mail system, e-mail may reach its destination, even on other countries and continents in minute or less except some part of the network is congested or out of order. The speed of e-mail and the world makes it a popular form of communication.

It is inexpensive but convenient to send mail through e-mail. All that will require is the normal charge for using the system if one uses the cybercafé or the normal charge for someone who is connected to the internet. It also gives the opportunity to send multiple copies to several people. E-mail has the following advantage.

It is not necessary to pay for packing and posting as the case with the postal system. All one needed to do is to pay the telephone charges if using personal system or pay for time in a cybercafé. There are different rate for different distances in the postal system but whatever the distance in an internet system, the charge remain the same.

Another benefit of e-mail is that, it is possible to send several copies of a particular document to several recipients without using envelops and addresses.

It is also possible to have only a display of a message on screen without printing a hard copy of it. This saves time and money. However, a printed copy may be required sometimes.

Lastly, a user can design a text to his taste by using desired fonts when using Outlook Express. It also possible to add graphics in such a situation.

Research- the internet is provided with special tools that assist in searching for information. Users can make research on the following: companies producing a product, information for projects, excerpts from journals etc.

Business connection- Business connections can now be done with anyone or any company in any part of the world through the use of internet, contact such and then proceed to make arrangement for order and payment.

Registration and checking of results- Most examination bodies now make their candidates to register through the completion of forms on the internet, Results after examination can also be checked on the Internet. Example is West African Examination Council (WAEC), National Examination Council (NECO) and Joint Admission and Matriculations Council (JAMB).

Education- Several learning material are available on the internet. Some software companies offer training on their products via the internet. Likewise, some educational institutions are doing the same.

Advertising- Organisation advertises their products on the internet.   This can be done by having a web-site. Prospective customers can visit the site to view the product.

Online transmission of programmes- the invention of internet has made it possible to watch entertainment and religious programmes live.

Benefits of the internet:

1. You can create a website on the internet for yourself or your business.
2. You can search for information on any topic dealing with humanity and nature.
3. You can carry out research project.
4. You can apply for admission, scholarship or employment with any institution that is hooked to the internet in any part of the world.
5. You can carry out business transactions with any company that is hooked to the internet. You can also advertise your business.
6. You can choose or make friends from any part of the world.
7. You can play games, watch latest films and musical videos.
8. You can read current news on the internet from international media organization
9. You can send and receive e-mail text messages
10. You can have live chat and take part in discussion group with any body/group in any part of the world.

Similarly, Internet can play an important role in education. As it is an enormous information base, it can be harnessed for the retrieval of information on a wide variety of subjects. The Internet can be used to refer to information on various subjects to be taught to the students. Moreover, computers facilitate an electronic format for storage of information, thereby saving paper. Homework and test assignments submitted as soft copies save paper. Electronically erasable memory devices can be used repeatedly. They offer a robust storage of data and reliable data retrieval. The computer technology thus eases the process of learning.

The Internet is the global interconnection of computers and computer networks using common network standards and protocols. Standards the means by which different computer devices and systems exchange information, while the protocols are rules designed to enable different computers on Internet to connect with one another and to exchange information with little or no error.

What is called internet today began with a project called ARPANET, which was initiated by the United States department of defense Advanced Research Projects agency. The original motive behind ARPANET, was to build a network capable of carrying military and government information from one point to another during any nuclear war. the project, which was initiated in 1968, soon went wider than its original scope to become a project for building a large-scale network called, the internet that we have today.

The Internet resources have enormous advantages and below are some of the advantages of the resources.

1. With the INTERNET, communication has become cheaper and quicker. For example to send a letter to the US from Nigeria, takes two weeks and to receive a letter from that end, also takes another two weeks and at different prices depending on the method used in sending the mail. Today, with the INTERNET, it takes just minutes if not seconds, to send and receive a mail and at an affordable price.

2. Products and services advertisement is now cheaper and affordable with the advent of the INTERNET. What you pay for advertisement and publicity on the INTENET is not only cheaper but also the advert and publicity   carried on the INTERNET, reaches a large audience than adverts and publicity carried by newspaper, radio and television stations.

3. Now with the INTERNET, people don't consider how far away other people are from them any longer. This is because the INTERNET has closed the distance between people of different continents of the world and thus making the entire world a global village.

4. With the INTERNET, trade and commerce all over the world has entered a booming era. With the INTERNET, import and export procedures are made easy as things like Proforma Invoice, Bill of lading, Price list and Funds transfer can now be provided electronically on the INTERNET.

5. With the INTERNET, you can have access to information whose source you don't know. With the help of a special tool(search engine), the INTERNET will check its electronic directory and display the sources, locations or addresses from where you can get what you want.

6. With the INTERNET, better education and training for everybody across the globe is guaranteed. For example, an expert can train a number of participants on how to use the computer at their different locations once they are linked to the INTERNET. Lectures and teachers can now have access to educational materials easily on the INTERNET.

As there are advantages in using the INTERNET, so also are a number of disadvantages in using it. The advantages in using the Internet definitely outweigh the disadvantages. Here are some disadvantages inherent in the use of the INTERNET.

1. On the INTERNET, you can access and download data and program files from a remote computer. The files so copied, if infested with computer viruses may destroy what you have on your computer. Ensure that you have anti-virus software installed on   your computer before   you attempt to download program and data files from the Internet onto your system.

2. A lot of unwholesome things exist on the INTERNET. The availability of computer phonographic materials on the INTERNET is one of the unwholesome things.

3. Once a user understands how to surf the INTERNET efficiently, it becomes an addictive activity and once it becomes addictive, other activities of the user will start to suffer.

4. Your privacy could be infringed on as an INTERNET user. An unauthorized person for example, could read your mail.

There are number of services that are available on the INTERNET. They include:

1. E-mail
2. World Wide Web
3. Web Search Engine
4. Usenet
5. Anonymous FTP

SELF ASSESSMENT EXERCIES 2

1. What do you understand by Internet?
2. List four advantages and disadvantages of Internet.

4.0   CONCLUSION

In this Unit, you ought to have learn that network can be used for teaching and learning due that the provision of abundant educational resources that can be shared among the users. The network can be in form of LAN, WAN and Internet. You were also exposed to the advantages and disadvantages of Internet. Also, discussed were the benefits of the Internet.

5.0   SUMMARY

To be able to use network for teaching and learning, you need the knowledge of LAN, WAN and that of Internet. More so, benefits of Internet as well as advantages and disadvantages of internet will go a long way as assist you on the use of network in the process of teaching and learning. However, the next Unit presents information on issues on computer usage in education.

6.0   TUTOR-MARKED ASSIGNMENT

1. How do you think network could promote the teaching and learning processes?
2. What are the benefits derivable from the use internet in the teaching and learning processes?

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UNIT 4   ISSUES IN COMPUTER USAGE IN EDUCATION

1.0   INTRODUCTION

A life without computers would seem almost unimaginable for many. The importance of computers is evident today and having the perfect know-how of computers can only propel one's career in the right direction. Today, computers are a part of almost every industry. They are no more limited to the software industry. They are widely used in networking, information access, data storage and the processing of information. Introducing computers in education lays the foundation of most of the major competitive careers. However, the there are issues that users of computers in education must be at home with. These issues include computer crime and virus as well as packages for instructional presentation. Therefore, this Unit is presented to acquaint you with this knowledge.

2.0   OBJECTIVES

At the end of this Unit you should be able to
1. Articulate issues in computer usage in education.
2. Identify packages that could be used in instructional presentation.

3.0   MAIN CONTENT

3.1 Computer crime and Virus

Computer crime includes all activities in which a computer is used in a criminal act. Such crimes include information destruction, theft of service, theft of information, physical destruction, alternation of data, theft of money, and software piracy.

An information destruction crime is the erasing of information stored in a computer. Several information destruction incidents involving disgruntled ex-employees have been reported. A theft of service may be accomplished by an intruder who uses a company computer for private purposes. Theft of information may be committed by competitors interested in confidential trade information. The TRW Information

Service, the largest United States credit bureau, reported that an intruder had accessed confidential information involves destruction of computer files. The Red Brigade, an Italian terrorist group, reportedly destroyed vital computer files of several large Italian corporations, universities, and government agencies. An example of alteration of information is when a student uses a home computer and modern to access a school database to alter undesirable grades.

As the number of people who use computers increases, the probability of computers being use for criminal purposes increases. As far as can be determined, computer crime is relatively limited, although experts indicate that reported computer crime is relatively limited, although experts indicate that reported computer crime represents only a small percentage of total computer crime. Even though perpetrators are generally authorized insiders who take advantage of the system, unauthorized individuals who gain entrance to computer systems have also created damage.

In 1986 and 1987 two Pakistani brothers had the distinction of becoming the first individuals to unleash a computer virus on the world. A computer virus "is a program that infects other programs by modifying them to include a version of it. And like real viruses, these carry a genetic code which is recorded in machine language. The code tells a 'host' system to place the virus into its main logic, usually on a hard disk"

Once the virus infects a computer system, it lies dormant but infects any other program it can reach. So, disks initialized on that computer or programs that are sent over telecommunication lines will carry the virus to other computers.

More than 25 viral strains have been discovered with new ones expected. Presently, the viruses act in different ways and are typically placed into several categories: the Brain or Scores virus attacks the operating system and affects other programs on the disk; the Trojan Horse virus disguises itself and damages the user's data; Worms are viruses that gradually eat away files as the disks are used; and time Bombs wait until a particular date and leave a message or destroy a disk.

Viruses have been used as pranks and as weapons of destruction. Examples include a West German computer club called "Chaos" that introduced a virus into the NASA computer network, although the virus reportedly did not influence data critical to operations. A message for international peace was implanted on thousands of unopened Macintosh software programs, and IBM computers have also had their share of viruses. "Viruses have been reported by a major aerospace company, an air traffic control system, a newspaper and several government agencies".

Fortunately, just as a continual battle is being waged against computer piracy, software developers and users are waging war against computer viruses with "vaccines". A growing number of vaccine programs are for sale or are available at no cost through users' groups. Unfortunately, vaccine programs may not be effective against new viruses.

When discussing computer viruses, recommendations range from, "Don't worry about it. It will never happen to you" to "Routinely use a variety of antiviral programs to check out all your disks, be careful of downloading programs from electronic bulletin boards, and don't use a disk until you have checked it out "If you do uncover a virus in your system, it is recommended that you use a viral "disinfectant" program. If this does not work, you should erase your infected floppies and hard disks by reinitializing them. Then reload your virus-free programs.

SELF ASSESSMENT EXERCIES 1

1. What are the common crimes in the use of computer?
2. What is virus with reference to computer usage?

3.2   Packages for Instructional Presentation

By looking into the workplace now, we can see the need for skilled labor capable of using technology on the job. Many of our students will use technology in occupations that will require little or no training, such as using scanners in supermarkets. Other students will need to know how to use word processors to meet employer needs. Database management software is used by financial, management, and engineering personnel to solve problems generated on the job. If the students have an understanding of what this software can accomplish and how its application can save time, energy, and money, they will be able to make greater contributions to productivity more quickly than their predecessors could.

We are in a transition   period in which educators can choose to ignore or to embrace the responsibility of teaching with and about technological tools, tools that can be used to increase personal and nationals' productivity. If the decision is to take up this responsibility; if it is appropriate to infuse technology into our classrooms, we have another issue to confront: Do we teach computer literacy only as an independent subject, or do we expect students to learn how to use computer applications as learning tools across the curriculum?

Many educators believe that if we consider computer use in the same way that we think of reading and writing, we will create a population that is more computer literate. By teaching the computer and other technological tools as part of our normal curricula and then asking students to use these tools to complete educational activities, we develop students who are better prepared to use technology in later life. Just as we teach them how to use a computer.

Because the computer has such a wide variety of educational uses, the process of learning how to use the computer as learning and problem-solving tool takes a number of years. Educators and researchers are still learning how and when this can best be done, but there is no doubt that it is necessary.

There are some packages that are commonly use in the presentation of educational instruction, these include Microsoft Word, Microsoft excel and Microsoft Power Point.

Word Processing is the art of using Computer to type, edit either a memo, letter and to document words in a   most presentable and neat form into appropriate file which can be printed at any time there is the need for it.   Some of the advantages of word processor are-

1. The use of Computer allows for neat job.
2. It makes typing pleasurable.
3. There is room for corrections such that does not leave any scar on the document.
4. With the use of computer, text could be formatted to suit the user's taste.
5. It allows Mail merging operation thereby relieving the secretary of the problem of having to type a particular document a number of times.
6. It allows the production of as many copies of the document as the owner will need and each appears as the original.
7. It has the capability of storing text for as long as it will be needed.
8. Document can be enhanced with graphics (pictures).

Microsoft Excel is a powerful electronic worksheet program for entering data, organizing data, calculating data, analyzing data and reporting financial and other documentary data. It has five main features:

1. Worksheets for entering, analyzing, and calculating data.
2. Charts for representing data graphically.
3. Databases for managing large amounts of information.
4. Macros for automating tastes and customizing Microsoft Excel.
5. Advanced formatting and Graphics for creating printed and outline reports.

A worksheet is a document that can turn disorganized information into well ordered data. Data is organized into lettered columns and numbered rows forming a grid of cells. You can enter all kinds of dates and times. You can move and copy cells on worksheet by dragging them with mouse.

Microsoft PowerPoint is an application software or package that creates presentations of different kinds, and can also animate a presentation created. It comes in different versions therefore their operations differ from one another slightly.

Creating a new presentation can be done in several ways.

1. By working with the Auto content wizard- This will give a set of suggested contents and designs that can be chosen from.

2. By working with existing presentation- This is a system whereby a set of suggested existing presentations are given to be selected from, and then modified to one's taste.
3. By working with the template- This will give a set of suggested designs without the contents.
4. By working with a blank presentation- This has no suggested designs nor are contents, therefore presentations created beginning with a blank background on the hard disk.

SELF ASSESSMENT EXERCIES 2

1. List three packages that can be used for instructional presentation
2. In what ways can the new presentation be done in PowerPoint

4.0   CONCLUSION

The there are issues that users of computers in education must be at home with. These issues include computer crime and virus as well as packages for instructional presentation. Therefore, from this Unit you have been exposed to some of these issues as well as packages that can assist   you in the presentation of   your instructions in the classroom.

5.0   SUMMARY

The knowledge of computer crimes and virus will not only assist   you on how to use computer in teaching and learning processes, but also inform you on how to combat the menace. The information on the packages for the instruction will equally equip you with varieties of presentation modes of your instructions.

6.0   TUTOR-MARKED ASSIGNMENT

1. What effect do you think that computer crime will have on the use of computer in education?
2. In what ways do you think computer virus could influence the use of computer for teaching and learning?
3. What are the uses of PowerPoint presentation in education?

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MODULE 4 COMPUTER BASED INSTRUCTIONS

Unit 1 Developing Computer Science Scheme of Work for Secondary Education
Unit 2 Lesson Notes for Science/Information Technology

UNIT 1 COMPUTER SCIENCE SCHEME OF WORK IN SECONDARY EDUCATION

64.0 Introduction
65.0 Objectives
66.0 Main content
    66.1 Importance of Scheme of Work
    66.2 Process in Developing Scheme of Work in Secondary Education Computer Science
67.0 Conclusion
68.0 Summary
69.0 Tutor-Marked Assignment
70.0 References/Further readings

1.0 INTRODUCTION

The translation of the school curriculum into action is the sole responsibility of the
classroom teacher. The computer science teacher needs to plan on how to implement
the computer science curriculum at the secondary education level. At the planning
stage, the computer sciences teacher needs to prepare and arrange his work in
accordance with the time to execute such work. The development of computer scheme
of work in secondary education level requires the teacher to understand the processes
involved. Therefore, this Unit will expose you to the required skills needed for
developing the scheme of work

2.0 OBJECTIVES

By the time you completed this Unit, you should be able to
- State and explain the importance of scheme work
- Outline the processes involved to developing computer science scheme of work.
- Develop a two weeks computer science scheme of work.

3.0   MAIN CONTENTS

3.1   Importance of Scheme of Work

Schemes of Work refer to guidelines designed to make the teaching of subjects more manageable. They provide supporting information about planning and teaching the subjects and form important documentary evidence about course delivery. However, Schemes of Work are also extremely flexible teaching guides that can be molded to take account of local teaching needs and resources. There is no set method for developing schemes. Schemes of Work can be used to plan for any subject and at any level.

Schemes of Work allow you to organise your work so that subject delivery remains on target and in accordance with the syllabus content. It is quite easy to see Schemes of Work as an unnecessary administrative burden, in addition to all the other paperwork that you have to complete. However, this view, underestimates the importance of Schemes of Work. Besides, as planning tools, Schemes of Work can also be seen as way markers for subject delivery by determining the prerequisites for moving on. For example, the scheme may specify the material that should be covered before a practical test. It may determine what is needed before a project can begin.

As a teacher, you must have seen a secondary school computer science curriculum in the recent past. Therefore, you are expected to get hold of a secondary school computer science curriculum and study the arrangements   of its contents. Identify the main topics, contents, activities and material, and evaluation guide contained in the curriculum.   The curriculum indicates the content or main topics to be taught but do not specify in most gases the sub-topic or give details of the works to be covered by the teacher. Therefore, you are expected to use the curriculum in working out a detailed plan showing what you will teach or cover each week of the term.

For Schemes of Work to be useful, it is important that they contain some key information that has formative value. It is important, first, to define the learning objective. This is about describing, in a logical order, the steps necessary to build up the knowledge and understanding of a subject or topic. After this come the teaching activities, which help the acquisition of knowledge and understanding. A flexible approach should be taken to defining teaching activities- the same topic can be approached in different ways in different school. For example, a school may be located in an area rich in local resources useful for a particular subject, such as history or geography. Another school may need to cover the same topics using other resources, such as ICT based learning material. Schemes of Work do not restrict the variety of learning styles and teaching resources.

The contents of computer science at the secondary school levels arrange in a hierarchical order with lower concept learning to the understanding of the higher one. The computer science teacher is therefore, expected to present his/her lesson in a logical sequence according to a well structured timetable and this should be belief into

the scheme of work. The scheme of work should clearly show; the objectives of each topic, instructional materials or teaching resources, teaching method/technologies, and evaluation guide students' activities.

The scheme of work, therefore, is a guide for teachers teaching a subject. It is a proposed statement of activities the teacher has tabulated and is to be accomplished within a specified period of time. The teacher has the right to change, supplement and vary the content of the scheme according to the needs and abilities of their students. New innovations in the subject by the teacher are welcome and should be sue in modifying the scheme of work.

The importance/usefulness of the scheme of work is strongly tied to purpose it serves and this includes:

1. You can use it as a guide to know what is expected to cover within a given period
2. The scheme of work helps you to select appropriate instructional materials that may facilitate effective teaching and learning of a given topic and when a particular topic is to be taught.
3. There is continuity in the students are learning. This is because each topic leans on the learning of previous ones.
4. The topic outline/objectives in the scheme will help you to evaluate the students.
5. Head teachers, principals and school supervisors used it to determine the extent of topic coverage in a class by the teacher.
6. If there is a change of subject teacher, the scheme of work enables the succeeding teacher to know exactly where his/her predecessor has covered and were to start from.

Schemes of Work are used widely in school as planning tools. The exact design of the schemes can vary, but most seem to capture key information about the subject and how it will be delivered. Whatever the design, it is better to adopt a standardised, but flexible, template. They should not be seen as rigid modes of delivery that restrict creativity

SELF ASSESSMENT EXERCIES 1

State five importance of the scheme of work.

3.2   Developing Scheme of Work in Secondary Education Computer Science

The syllabus/curriculum indicates the content or main topics to be taught but do not specify in most gases the sub-topic or give details of the works to be covered by the teacher. The computer science teacher is therefore expected to use the curriculum in working out a detailed plan showing what he/she will teach or cover each week of the term. a scheme of work is seen by many authors as:

1. Units or list of sub-topics drawn from major/broad topics in the syllabus/curriculum.
2. A detailed outline showing the topics the teacher intends to cover in a particular order. These detailed outlines are usually drawn from the syllabus and it contains the assessment or evaluation of the student as well as teaching resources.
3. The listing of a series   of topic to be taught in the classroom within a term and the order in which they are to be taught.

The contents of computer science at the secondary school levels arrange in a hierarchical order with lower concept learning to the understanding of the higher one. The computer science teacher is therefore, expected to present his/her lesson in a logical sequence according to a well structured timetable and this should be belief into the scheme of work. The scheme of work should clearly show; the objectives of each topic, instructional materials or teaching resources, teaching method/technologies, and evaluation guide students' activities.

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1. The teacher use it as a guide to know what he/she is expected to cover within a given period
2. The schemes of work help the teacher to select appropriate instructional materials that may facilitate effective teaching and learning of a given topic and when a particular topic is to be taught.
3. There is continuity in what the topic lean on the learning of previous ones.
4. The topic outline/objectives in the scheme will help the teacher to evaluate his/her student.
5. Head teachers, principals and school supervisors used it to determine the extent of topic coverage in a class.

6. If there is a change of subject teacher, the scheme of work enables the succeeding teacher to know exactly where his/her predecessor has covered and were to start from.

Similarly, the following steps are necessary when developing scheme of work.

Step I: Undertake a careful study of the prescribed computer science syllabus/curriculum.

Step II: List out the broad topics in the syllabus/curriculum

Step III: Develop your sub-topics from the broad topics

Step IV: Allocate periods to the topics depending on the length of the term and the time allocated to the subject

Step V: Adjust or modify the period in which certain topics are to be taught so as to enhance efficiency.

Step VI: Sequence of the topics should be from simple to complex, known-to unknown, concrete idea-to-abstract one.

Step VII: Each topic should have evaluation guide.

Typical Example of Computer Science Scheme of Work

Duration no of Weeks	Topics	Learning Objectives	Learning activities	Resources	Assessment
Week 1 – 3	INTRODUCTION TO COMPUTER • A computer • Parts of a computer • Hardware and software. • Types of computer • input/output and storage devices	•Be able to state the meaning of computer • Be able to name the various components of a computer system. • Be able to differentiate between hardware and software. • Be able to list different type of computers. • Be able to identify and state the function of input, output and storage devices.	Take students ato where they can touch the computer. Show students various components of computers, input/output devices and storage devices.	Various kinds/types of computer including phone, digital cameras etc.	• Define computer • List different parts of computer. • Differentiate between input and output device.

Sample Scheme of Work

Week No.	Objectives	Content
1	To introduce students to key skill requirements, evidence collation and portfolio building	Introduction to IT Key Skills • Read through Chapter 1 • Distribute log books and explain • Show sample portfolio and discuss • Discuss opportunities for collecting different types of evidence 2 & 3 To demonstrate the importance of good housekeeping routines

		Housekeeping – Windows
2 &3	To demonstrate the importance of good housekeeping routines	Housekeeping – Windows • Use slides to explain basic principles • Work through activity in Chapter 2 • Complete sample test questions and discuss
4 & 5	To introduce word processing techniques	Word Processing • Use slides to explain basic principles • Work through activity in Chapter 3 • Complete sample test questions and discuss
6 & 7	To introduce spreadsheet techniques	Spreadsheets • Use slides to explain facilities • Work through activity in Chapter 4 • Complete sample test questions and discuss
8 & 9	To introduce database techniques	Databases • Use slides to explain facilities • Work through activity in Chapter 5 • Complete sample test questions and discuss
10 & 11	To investigate research techniques	Research Techniques • Use slides to explain facilities • Work through activity in Chapter 6 • Complete sample test questions and discuss
12	To explain health & safety issues involved with the use of IT	Health & Safety • Use slides to explain basic principles • Work through Chapter 7 • Complete sample test questions and discuss
13	To explain legal issues surrounding the use of IT	Legislation • Go through chapter 7 plus additional information on sample cases • Use slides to discuss: o Copyright o Data Protection Act o Computer Misuse Act • Complete sample test questions and discuss
14	To test Knowledge base	Sample test paper • Use sample paper in Appendix B or from the Payne-Gallway web site (to be marked by teacher/lecturer from answers provided on web

		site)
13	Revision for test	More sample test questions and 'mock' test

SELF ASSESSMENT EXERCISE 2

   (1)   What is scheme of work?

4.0   CONCLUSION

In the Unit, the concept of scheme of work has been discussed. The students have been exposed to how to develop computer science scheme of work. For Secondary Education Teachers of Computer Science should get hold of the curriculum for each year of secondary school and study it properly. It is only a teacher who it knowledgeable about the curriculum that will produce a valid scheme of work.

5.0   SUMMARY

The scheme of work is obtainable from the National Curriculum. The scheme of work provides supporting information about planning and teaching the subjects and form important documentary evidence about course delivery. Moreover, schemes of Work are also extremely flexible teaching guides that can be molded to take account of local teaching needs and resources. However, from the scheme of the lesson note could be prepared. The next Unit centred on the lesson plan.

6.0   TUTOR-MARKED ASSIGNMENT

   (1)   Outline the steps involve in develop scheme of work
   (2)   Why is scheme of work necessary to you as a computer science teacher?

7.0   REFERENCE/FURTHER READINGS

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UNIT 2　　LESSON NOTE FOR COMPUTER BASED INSTRUCTION

71.0　　Introduction
72.0　　Objectives
73.0　　Main content
　　　　73.1　Unit lesson plan
　　　　73.2　Weekly lesson plan
74.0　　Conclusion
75.0　　Summary
76.0　　Tutor-marked Assignment
77.0　　References/Further readings

1.0　　　　INTRODUCTION

Planning in Education is an essential and necessary panacea for successful implementation of school policies/activities one of such activity that needs to be thoroughly planned is instruction. The content of this instruction is always mapped out in the curriculum and categorized into years. The curriculum planners are directly in-charge of these mapping into years. Once the curriculum has been developed and handed over to schools, the teachers' first task is to break it into scheme of work. The next thing　you do as a teacher is to organize the contents into teaching unit(s) which are handling termly, weekly or daily. In organizing the content, you are expected to determine the number of terms in an academic year, number of weeks in an academic term and lesson periods allotted to computer science in the school per week. The computer science teacher is therefore, expected to understand the meaning of termly plan, unit plan, weekly and daily plan. The computer science/information and technology lesson cannot be properly written without adequate planning. This Unit provides you with required knowledge that you need to be able to write your computer science/information technology lesson notes.

2.0　　　　OBJECTIVES

　　　By the time you completed this unit, you should be able to
　　　　　1.0　　Explain the meaning of unit, weekly and daily plan
　　　　　2.0　　State the features of computer science lesson plan
　　　　　3.0　　Describe the standard format for writing computer science/information technology lesson notes.

3.0   MAIN CONTENTS

3.1   Unit lesson plan

The role of a computer science teacher is not, different from that of other subject
teachers. Generally, the teacher is seen as a leader in the class, and a role model to the
students. He should have purpose, direction good grasp of the topic he/she intend to
teach, as well as sound understanding of his/her students. When the teacher display
these characteristics with a well planned and delivered lesson, he/she attracts the
students' attention, love and respect.

Computer science is one of the subjects that were recently integrated into the
secondary educations curriculum in Nigeria. It is one of the subject whose aim is to
give the student life long skill and it is activity-based as well as students/learners-
centred. The teacher can only accomplish through planning. Planning helps the
teacher to break down the content of his teaching to manageable size. The sequence of
thought, activities and content development of topic are well organized.

You are to prepare the unit lesson plan in computer science for a number of lessons to
cover a particular topic or set of ideas that are related. The major aim of unit plan is to
put the daily lesson into broader perspective. It enables you to have a deeper
understanding/analysis of the content to be taught. For instance, the learning unit in
the secondary school curriculum "Introduction to computer, cannot be taught
effectively in two lessons.

The following consideration should guide the writing of unit lesion plan

(i)   Importance of the unit, objectives of the unit, Students interest, and keys to
        future progress
(ii)   Central idea and unifying concepts around which activities may be
        organized, emphasis of certain concepts and subdivision of allocated time.
(iii)   Appropriate teaching strategies, students' first contact with idea, students
        ability to develop ideas by themselves, are availability of resources to
        enhance unit understanding.
(iv)   Previous concept, skills or experiences needed for the unit, modification of
        content to accommodate various students, remediation and enrichment
        techniques and further activity for the bright students.
(v)   Difficult areas that require special attention, and lesson that require practical
        work
(vi)   Required teaching materials/resources
(vii)   Suitable assessment techniques
(viii) Students learning independently or cooperatively

The above considerations are very important for unit lesson planning.
Elements of unit lesson plan. A unit plan should contain the following elements:

(a)   Statement of the objectives
(b)   Description of the skills and the prerequisite knowledge of the students.
(c)   Content outline to be taught, the basic skills and important ideas selected for mastery,
(d)   Selection of possible learning activities and stating briefly the teaching procedures and techniques, (This should the mode of presentation)
(e)   A list of materials to be used
(f)   Description of the assignment and evaluations instruments.

SELF ASSESSMENT EXERCIES 1

What are the elements of a unit lesson?

3.2   Weekly Lesson Plan

All teachers use lesson plans in one form or another. Some teachers merely organize the lesson of the day in their heads. Others jot down a few bullet points about what they plan to do each day. And still others write detailed instructions by using lesson plan templates or guides. Depending on the experience level of the teacher or the complexity of the lesson, any one of these three methods may work.

However, creating a detailed written lesson plan can help even the most experienced teacher prepare and present a more effective lesson. High-quality written lesson plans can help you organize and communicate a strategy so that students can reach a stated learning objective. These lesson plans are also important when a substitute teacher teaches your class and are often required when you are being observed or evaluated by the principal.

As stated before, a well-thought-out lesson plan will help you to organize thoughts and instructional practices. This, in turn, will help you move students toward achieving the goal or goals behind the lesson. Most lesson plans are a part of a larger unit plan and include:

- A descriptive **lesson title**
- The relevant **unit title**
- One or two distinct **learning objectives**
- **Prior learning** required by students in order to begin the lesson
- The relevant **subject area** and **grade level** of the lesson, as well as any **cross-curriculum connections**
- The necessary **time allotted** to complete the lesson
- The **materials needed** to complete the lesson
- The instructional **procedures** used in the lesson
- Any **modifications** required for individual learning needs

- Student **assessments**
- Any **instructional notes** that will help the teacher teach the lesson

The first step in lesson planning is to identify the learning objective that will be the focus of the lesson. The objective should be clear so that the students can determine what they should know and be able to do at the conclusion of the lesson. For example

Procedures:

1. *Warm-up Activity:* Using Microsoft Office Word, a computer, and a computer projection device, creates a two-column table. Then compose sentences; break each into two parts (one part containing the noun and one containing the verb), and place the two parts of each sentence into the two columns. Mix nouns and verbs in each column. Then have students use the computer to put the sentences together by dragging one part to its matching part. Your list might look like the following:

   Monkey   *Distance from home to market*
   Was too short   *ate banana   from the basket*
   played football for five hours   *Musa*
   Mabel   *went to the store with her dad*

2. After the warm-up, divide students into groups of two or three at the classroom computer workstations, and ask each group to work on putting sentences together.
3. After the groups are finished, ask each student to select one sentence and write it on a separate piece of paper, leaving room for an illustration.
4. When all students are finished, have each student present his or her sentence and illustration.

Timing, Materials, and Instructional Notes: Now that the procedures are identified, it's time to determine the amount of time the lesson will take and to list the materials and instructional notes. The instructional notes help the teacher prepare for the lesson and provide some transitional strategies for implementing the lesson.

For example:

Time Allotted: 30 minutes

Materials:

- *Word document with a two-column table of sentence parts for warm-up activity*
- *Word document with sentence parts*
- *Sheets of paper with space for sentence and illustration*

- *Crayons*

Instructional Notes:

- Before students arrive, copy the Word document with the sentence parts to each computer's hard disk drive.
- Set up the "teacher station" computer and projection device.
- Place paper and crayons on tables.
- On each computer desktop, create a shortcut to the document with the sentence parts so that the students can open it right away.
- Divide students into groups to facilitate moving from the whole-group demonstration to the small-group demonstration.

Assessing your students: The last item of the lesson is to evaluate students, based on the goal of the lesson. In this example, the learning objective is "Students will construct a complete sentence from two sentence parts." During the lesson, students are putting together parts of a sentence and illustrating that sentence. The assessment, however, should be on only the sentence itself, not the illustration. The assessment section should also include what will happen should a child receive a failing or unsatisfactory mark on the lesson.

For example:

Assessment: The teacher will observe the students presenting their finished sentences. Students will receive a "satisfactory" or "unsatisfactory" mark for their work. Students receiving an unsatisfactory mark will be given feedback and may present their sentence again.

Integrating technology into your lesson: There are many ways to integrate technology into a lesson plan. In the preceding example, computer technology was used for the demonstration and for the student work. The use of technology in lesson plans generally falls into three categories: Instructional (teacher), Demonstration (teacher and/or student), and Student Work (student).

The following chart lists ways technology may be used within each category.

Instructional	Demonstration	Student Work
Lecture including Microsoft Office PowerPoint 2010	Use the Track Changes feature in Word to demonstrate sentence parts	Write a story in Word
Show a short video clip with Microsoft Windows Movie Maker	Show students how to conduct a search with using Internet Explorer	Create a table in Microsoft Office Excel 2010
Use links in Word for the daily schedule	Have students use PowerPoint to demonstrate steps of the	Create a flyer in Microsoft Office

	Scientific Method	Publisher 2010

Putting it all together: Creating written lesson plans takes   time —   but they are great tools for teachers. Lesson plans can guide you in organizing your thoughts, materials, and strategies to help your students meet the desired outcome. When you finish teaching a lesson, take notes to help you "fix" or improve the parts that didn't go as planned. In this way, you can get the most out of the time you invested in creating the plan by using it again in following years.

SELF ASSESSMENT EXERCIES 2

List the futures of a lesson plan

4.0   CONCLUSION

In this Unit, you have been exposed to the preparation of lesson unit and lesson plan. . The curriculum planners are directly in-charge of these mapping into yeas. You also learnt that once the curriculum has been developed and handed over to schools, the teachers' first task is to break it into scheme of work. The next thing the teacher does is to organize the contents into teachable unit(s) which are handling termly weekly or daily. Some features of unit lesson and lesson plan were also discussed. Similarly, there are elements that must be contained in a lesson plan, though all lesson plans may not necessarily exactly the same.

5.0   SUMMARY

The curriculum planners are directly in-charge of these mapping into yeas. Once the curriculum has been developed and handed over to schools, the teachers' first task is to break it into scheme of work.   In organizing the content, the teacher is expected to determine the number of terms in an academic year, number of weeks in an academic term and lesson periods allotted to computer science in the school per week. The computer science teacher is therefore expected to understand the meaning of termly plan, unit plan, and weekly plan.

6.0   TUTOR-MARKED ASSIGNMENT

(i)   Explain the meaning of unit, weekly and daily plan.
(ii)   Describe the standard format for writing computer science/information technology lesson notes.

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MODULE 5 **PROBLEMS MILITATING AGAINST THE USE OF COMPUTERS IN THE CLASSROOMS**

Unit 1 Global Problems
Unit 2 Problems in Nigerian Schools

UNIT 1 **PROBLEMS MILITATING AGAINST COMPUTER-BASED INSTRUCTION GLOBALLY**

78.0 Introduction
79.0 Objectives
80.0 Main Content
81.0 Conclusion
82.0 Summary
83.0 Tutor-marked assignment
84.0 References/Further readings

1.0 INTRODUCTION

Computer is part of our everyday lives. They have an effect on almost everything you do.   The computer has the potential to become education's single most useful teaching and learning tool. However, the use of computer in the teaching and learning processes is faced with some challenges. Your knowledge of these challenges will assist   you a great deal. More so,   you may also participate in seeking the solutions to these challenges. This Unit therefore, will expose you to some of these challenges that are globally affecting the use of computer in the teaching and learning processes.

2.0 OBJECTIVES

At the end of this Unit, you should be able to identify problems militating against the global use of computer in the teaching and learning processes.

3.0 MAIN CONTENTS

By far the major factor inhibiting computer use in the classroom is the insufficient amount of computer hardware and software available due to budgetary constraints. It often takes a school three to six years to obtain even the minimum number of computers necessary for one teacher to effectively incorporate CAI and MBLs into the curriculum. Although just one or two computers can be incorporated into classroom activities, this number will support a very limited number of strategies. Moving computers in and out of a classroom is time consuming and significantly inhibits their use. Moving students to a "computer lab" also has several constraints, the two major ones being that the typical computer lab is too small and that teachers must compete for limited lab time.

Although there are definite advantages associated with computers as instructional tools, some educators criticize them because of what they consider characteristic limitations. For one thing, computers are still expensive; critics suggest that dollars spent on hardware, software, and maintenance would be better spent for more teachers, higher salaries, or other instructional materials. Some fear that computers may replace teachers. Others fear that they stifle creativity, limit social interaction, emphasize narrow facts at the expense of broad generalizations, limit the imagination, and dehumanize instruction.

The use of computers is also criticized because of perceived instructional limitations and problems, such as the limited range of objectives being taught by computers. Most computer-based instruction cannot effectively teach affective, motor, or interpersonal skills. Even in the cognitive domain, current programs tend to teach at the lower levels of knowledge and understanding. Copyright problems, the poor quality of some software programs, and incompatibility among software programs also can limit their effectiveness. Further, some teachers fear using computers because they are too complex to understand.

Additionally, logistical environmental concerns may limit the use of computers. For example, the issues like placement of the computes, supervision of users, maintenance, and acquisition of supplies may cause some teachers not to bother using computers as instructional tools.

The introduction and use of technology in schools and classrooms will not automatically increase student learning. To accomplish this end, educators must rethink how schools are organized and rethink curriculum and instruction. Teachers and administrators must know how to use the hardware and software. More importantly, they must know how to use these tools to create appropriate learning experiences for students. As teachers gain easier access and receive training in the use of the Internet and as technology resources expand through electronic networking, instruction will be enhanced and we should see students becoming more active, confident, motivated, and achieve at higher levels.

Teachers react to the use of computer in teaching in that they do not want their jobs to be taken over by the computer. Teachers are afraid that the computer will replace them. Teachers will like to fulfill the essential needs of custody and socialization instead of being a resource person and learning manager. Teachers have little time or incentive to keep up to date with developments in computing and feel unable to make proper use of computer in teaching. Teachers do not want their normal routine to be disrupted. They do not want to change the way they have been teaching to suit the use of computer. These are generalizations, but there are exceptions as it was reported during the TICCIT and PLATO experiments that teachers were most concerned with their own autonomy and their interaction with students.

Most commercially available computer assisted learning materials were of poor quality.   Most of the materials were based upon the impoverished theories of learning and reflected little programming skills. The materials do not actually fulfill the set objectives for the use of computer in teaching and learning.

The reliability of any educational device is a major detriment of its acceptability in the classroom. To a teacher, an unreliable material will only led to a waste of time and embarrassment. The reliability is based on the hardware malfunctioning and program error. Apart from the reliability of the machine and software not being ascertained, cost of material is also high. The cost of purchasing the machine and cost of software are very high that it is not affordable to all parents and schools.

Computer-assisted learning has faced peculiar difficulties in the attempt to provide evidence of its contribution to the learning process. The use of computer faced the problem of not evaluating properly as it failed to meet the set objectives. Apart from these problems highlighted, other problems being faced by the use of computer in schools. They are: (1) equal access- this is because there are hardware and software shortage all schools does not have equal access to the use of computer. Rich school will have computers while poor schools will not have. Legal Issues: That as computers increasingly pervades the society, people should be educated about the ethics and legalities of computer, but this training is not forthcoming.

By far the major factor inhibiting computer use in the classroom is the insufficient amount of computer hardware and software available due to budgetary constraints. It often takes a science department three to six years to obtain even the minimum number of computers necessary for one teacher to effectively incorporate CAI and MBLs into the curriculum. Although just one or two computers can be incorporated into classroom activities, this number will support a very limited number of strategies. Moving computers in and out of a classroom is time consuming and significantly inhibits their use. Moving students to a "computer lab" also has several constraints, the two major ones being that the typical computer lab is too small and that teachers must compete for limited lab time.

Despite the advances computers and technology have given education, there are areas which the technology has been used in a poor manner. One of the largest problems is interactive computer learning and long distance learning.   Being that they range from somewhat impersonal to very impersonal, there is a loss of interaction with fellow students and faculty. Everyone wants to experience warmth, human interaction, the thrill of discovery, and solid grounding in essentials: reading, getting along with others, training in civic virtue. Only a teacher, live in a classroom, can bring about this inspiration ... Yet, everywhere [you can] hear parents and principals clamoring for interactive computer instruction.

The use of computers in classrooms themselves also has problems, especially dealing with content viewed online. "Schools must protect students without stifling their

creativity or putting too much control on what they can view. There are many ways to do this but none are fool proof.

Being that there is quite a large amount of negative feeling about computers in education, it is not possible to remove or fix all the problems. Removing computers would be a larger shift and would cause much more havoc than bringing them into use was. This would hurt the educational system more than help the problem of isolation.

The most overlooked fact is that computers should be used as an educational tool, rather than a means of education. Nothing can replace the interactions between students and teachers. Once the process of learning from a fellow person has been automated to something mechanical many things will be lost. Automated grading loses the ability to see just where a student went wrong, or what the student was trying to achieve in an answer. Online courses remove the ability to deal with truly great teachers in a personal way, and it also removes the ability to truly interact with other students. Automated education also hinders getting help when it is needed. Online books are also a problem. No one enjoys trying to read long documents and papers online. It is also not reliable. Should the internet connection be lost, or the site be removed, the book is unavailable. There should be as much human interaction as possible in education. "Although computer technology surely has a place in the curriculum, the presence of [technology] remains disturbing. Educators must not succumb to the illusive rhetoric that obscures the unquestioned assumptions that the computer is essential to every classroom and that learning cannot take place without the latest version of electronic hardware."

4.0   CONCLUSION

Change is inevitable, and because of the complex nature of change in schools system computer technology, there is bound to be problems associated with its implementation. There are a lot of problems facing the implementation of computer in education system globally.

5.0 SUMMARY

In this unit, you have learnt some of the problems facing the implementation of computers in education. These problems are not only in Nigeria but in the whole world. Some suggestions were made on how to solve these problems.

6.0.   TUTOR-MARKED ASSIGNMENT

(1)   List 5 problems of using computer in Nigeria and the global world
(2)   State ways of solving three of the problems listed in question number 1.

7.0   REFERENCES/FURTHER READINGS

Aduwa-Ogiegbaen, S. E., & Iyamu, E. O. S. (2005). Using Information and Communication Technology in Secondary Schools in Nigeria: Problems and Prospects. *Educational Technology & Society*, 8 (1), 104-112.

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UNIT 2   PROBLEMS   MILITATING   AGAINST   COMPUTER-BASEINSTRUCTION IN NIGERIAN SCHOOLS

1.0 Introduction
2.0 Objectives
3.0 Main content
4.0 Conclusion
5.0 Summary
6.0 Tutor-Marked Assignment
7.0 References/Further readings

1.0   INTRODUCTION

Nigeria like any other nation in the world also use computer in the process of teaching and learning. However, aside the global challenge of the computer usage in education, Nigeria is faced with series of problems. This Unit present to you some of the problem faced Nigeria in the use of computer for instructions in her schools.

2.0   OBJECTIVES

At the end of this Unit you should be able to articulate the problem militating against based instruction in Nigeria schools.

3.0   MAIN CONTENT

In Nigeria, a formidable obstacle to the use of information and communication technology is infrastructure deficiencies. Computer equipment was made to function with other infrastructure such as electricity under "controlled conditions". For the past fifteen years Nigeria has been having difficulty providing stable and reliable electricity supply to every nook and cranny of the country without success. Currently, there is no part of the country, which can boast of electricity supply for 24 hours a day except probably areas where government officials live. There have been cases whereby expensive household appliances such as refrigerators, deep freezers and cookers have been damaged by upsurge in electricity supply after a period of power outage.

Generally speaking, the low rate of computer adoption and application in Nigeria schools is attributable to several factors. Such factors are:

- Information and technology imbalance
- Quality of news and culture
- Cyber-crime
- Poverty
- High cost of equipment and machinery

- Illiteracy and ignorance
- Limited/poor information infrastructure
- Lack of/inadequate inadequate computer facilities in schools
- Frequent electricity interruption
- Non integration into the school curriculum
- Poor ICT policy/project implementation strategy
- Inadequate ICT manpower in the schools
- High cost of ICT facilities/components
- Limited school budget
- Lack of/limited ICT skills among teachers
- Lack of/poor perception of ICTs among teachers and administrators
- Inadequate educational software Poor management on the parts of school administrators and government

Information Technology imbalance: Information Technology plays a paramount role in international relations, both as a means of communication between families and as an instrument of understanding and knowledge sharing between nations. Yet it is characterized by basic imbalance that affect international network. The imbalance is first created by disparity   in the volume of news and information emanating from the developing country and intended for the consumption of families both male and female in the developing countries and verse- versa. Almost 80% of world news emanates from the major transitional agencies, however only 20%to 40% of news is assessable to the developing countries despite the fact later account for almost three quarters of humankind. The five major agencies monopolize essential share of materials in human potentials, countries are yet to possess a single national agency. In supporting this,   position described the situation succinctly, as nothing but a   one way flow compounded with autocratic measures and monopolistic trend, whereby certain powerful and technological advance state exploit their to exercise a form for cultural and ideological domination which jeopardizes the national identity of other countries.

Limited/poor information infrastructure ranks highest with 112 respondents (64 percent) in his work. Research confirms that computer development and application are not well established in Nigeria because of poor information infrastructure that more than 40 percent of the population of Africa is in areas not covered by telecom services. Schools located in such areas will experience network connectivity problems.

Lack of/inadequate computer facilities in schools" ranks second with 108 respondents (61 percent). This finding is corroborated who discovered that insufficient numbers of computers and peripheral devices inhibit deployment of computer by teachers and who observed that inadequate computers was a challenge to integration of technologies in Canadian schools. Similarly,   unavailability of some   ICT components in the schools hampered teachers' use of ICTs. This problem may be due to underfunding.

Electricity failure has been a persistent problem militating against computer application and use globally and in Nigeria schools. This makes the few schools with computer facilities unable to use them regularly.

Poor computer policy/project implementation strategy: The Nigerian Federal Government's 1988 policy introduced computer education to the high schools. The only way this policy was implemented was the distribution of computers to federal government high schools, which were never used for computer education of the students. No effort was made to distribute computer to state government or private schools. Although the government planned to integrate computers into the school system and provide schools with infrastructure, concerted efforts have not been made to provide facilities and trained personnel. Thus, most schools do not yet offer computer training programmes.

The NEPAD e-Schools Project is expected to take care of an estimated 600,000 African schools. This means that not all schools will benefit from this initiative. Most countries participating in the NEPAD e-Schools Project have computer development policy or are creating one, but very few have clear implementation plans observes that despite the recognized role of computers in improving education, computers remain a low financial priority in most educational systems in Africa. He further observes that most countries in the region lack resources for a sustainable integration of ICTs in education, and that African countries face numerous competing development priorities. These range from budgetary constraints, management challenges, and shortage of teachers and other educational resources, to the dreadful impacts of HIV/AIDS on education. These are issues that vie for the attention of local policy makers. While all countries in the region acknowledge the strategic role of ICTs in development, only a few have established a comprehensive policy. When such policies exist, they tend to remain unclear and make little reference to implementation.

Inadequate ICT manpower in the schools: The main problem facing global and Nigeria schools and its ICT programme is workforce training. Teaching as a profession in the world is considered to be for poor people, therefore the few professional that are available prefer to work in companies and industries where they can earn better salaries. With this deplorable condition, teachers are not motivated to go the extra mile in assisting the students to acquire computer education

High Cost of computer Facilities: Cost has been reported as one of the factors, which influence provision, and use of computer services. The cost of computers is too high for many to afford. Monthly Internet rates are exorbitant and the charges for satellite television are unaffordable for most people in Africa. This has made it difficult for Nigerian secondary schools to acquire and install computer facilities for the use of teachers and students.

Lack of/poor perception of computer among teachers and administrators" There is widespread ignorance and misconception about computer amongst teachers. One of the major inhibitors to globally embracing computer is the average general lack of

exposure to them. For most Nigerians, information technology is still something unfamiliar, distant, and mysterious. Rather than being seen as a tool for personal and national development, information technology is seen as a hurdle. Some Nigerians are not aware of the existence and importance of the Internet. It has been reported that 75 percent of the teachers in the NEPAD's e-Schools Project have no or very limited experience and expertise regarding computer in education.

There are several impediments to the successful use of information and communication technology in secondary schools in Nigeria. These are: cost, weak infrastructure, lack of skills, lack of relevant software and limited access to the Internet.

The price of computer hardware and software continues to drop in most developed countries, but in developing countries, such as Nigeria, the cost of computers is several times more expensive. While a personal computer may cost less than a month's wages in the United State, the average Nigeria worker may require more than two years' income to buy one.

Nigeria has over 6,000 public secondary schools. Majority are short of books, paper and pencils. Many of the schools lack adequate infrastructure such as classrooms and only few are equipped with television or radio. Apart from the basic computers themselves, other costs associated with peripherals such as printers, monitors, paper, modem, extra disk drives are beyond the reach of most secondary schools in Nigeria. The schools can not also afford the exorbitant Internet connection fees.

Electronics equipment such as radio, television, video recorder and even computers has been damaged due to irregular power supply. When electricity supply is not stable and constant, it is difficult to keep high-tech equipment such as computers functioning, especially under extreme weather conditions as obtained in Nigeria. The high levels of dust during the dry season in Nigeria also make electronic equipment to have short live span.

In rural Nigeria most inhabitant do not have access to electricity, thereby denying rural secondary schools opportunity to benefit from the use of electronic equipment such as radio, television, video recorders and computers. The few Internet access available in Nigeria is found in urban centers. These environmental realities are difficult to manage because fans, sealed rooms and stable electricity are lacking in many urban homes and rural areas.

Another obstacle to ICT development in Nigeria is inadequate telecommunication facilities. Though the International Telecommunication Union (ITU) has rated Nigerian's Telecommunication Sector as the fastest growing in Africa, majority of Nigerians have no access to telephone. At the end of 1999, total private investment in telecommunication industry in the country was $50m and there were over 700, 000 lines with 450,000 connected. The government officials and officers acquired more

than half the lines connected. On the Global System of Mobile Communication (GSM), Nigeria is also ahead of most African countries with more than 2 million subscribers connected. The telecommunication sector in Nigeria has attracted more direct foreign investment hence the growth rate is faster than any other sector of the economy. Between 2001 and 2003, about $3.8 billion new investment by foreign private investors have been recorded. As at the moment, more than 3 million landlines have been added to the existing telephone capacity.

Though Nigerian's telecommunication sector is growing faster than in most African countries, the over 3 million landlines and 2 million GSM subscribers are a far cry from the ideal when such figures are meant to serve Nigeria's nearly 124 million population. Again, most of the subscribers to the Global System of Mobile Communication (GSM) and landlines owners are found mostly in urban centers.

It is also on record that the connection fees for telecom facilities have reduced drastically over the years, the current rate is still too high for many Nigerians. In 1997, connection fees for telephone lines were about $1,500; today it is about $148. The current rate is too high in a country where the minimum monthly wage is about $51. To change this situation, Nigerian needs to figure out new ways of building necessary infrastructure to support ICT in the country.

Nigeria does   not only   lack information infrastructure, it also lacked the human skills and knowledge to fully integrate ICT into secondary education. To use information and communication technology (ICT) in secondary schools in Nigeria, the need for locally trained workers to install,   maintain and support these systems cannot be over emphasized. There is acute shortage of trained personnel in application software, operating systems, network administration and local technicians to service and repair computer facilities. Those who are designated to use computers in Nigeria do not receive adequate training, at worst, do not receive any training at all.

In Nigeria also, most secondary school teachers lack the skills to fully utilize technology in curriculum implementation hence the traditional chalk and duster approach still dominates in secondary school pedagogy. Information transfer using ICT is minimal or non-existence in secondary schools in Nigeria. Secondary school teachers in Nigeria need to be trained on educational technologies and the integration of computers into classroom teaching. Teachers need effective tools, techniques, and assistance that can help them develop computer based projects and activities especially designed to raise the level of teaching in required subjects and improve student learning.

There is no doubt that the ultimate power of technology is the content and the communication. Though, software developers and publishers in the developed countries have been trying for long to develop software and multimedia that have universal application, due to the differences in education standards and requirements, these products do not integrate into curriculum across countries. Software that is

appropriate and culturally suitable to the Nigerian education system is in short supply. There is a great discrepancy between relevant software supply and demand in developing countries like Nigeria. There are clear indications from many countries that the supply of relevant and appropriate software is a major bottleneck obstructing wider application of the computer. Even if Nigeria tries to approach this software famine by producing software that would suit its educational philosophies, there are two major problems to be encountered. First, the cost of producing relevant software for the country's educational system is enormous. Second, there is dearth of qualified computer software designers in the country. To overcome this, people need to be trained in instructional design.

In Nigeria there are few Internet providers that provide Internet gateway services to Nigerians. Such Internet providers are made up of Nigerians who are in partnership with foreign information and communication companies. Many of these companies provide poor services to customers who are often exploited and defrauded. The few reputable companies, which render reliable services, charged high fees thus limiting access to the use of the Internet. The greatest technological challenge in Nigeria is how to establish reliable cost effective Internet connectivity. In a country where only about 0.6% of the populace has home personal computers, the few reliable Internet providers who have invested huge sum of money in the business have a very small clientele. They have to charge high fees in order to recoup their investment in reasonable time. Nigeria has about 500,000 Internets subscribers.

Secondary schools in Nigeria are not given adequate funds to provide furniture, requisite books, laboratories and adequate classrooms let alone being given adequate funds for high-tech equipment (computers) and Internet connectivity.Again, due to the lack of adequate electricity supply, especially in rural areas in Nigeria, secondary schools located in those areas have no access to the Internet and are perpetually isolated and estranged from the world's information superhighway. Nigeria in lagging behind other African countries such as Uganda, Senegal and South Africa who are already helping secondary school students in those countries to become better information users. All Internet service providers in Nigeria are based in the urban areas.

For many years, the Nigerian government had a monopolistic control of telecom service, which does not allow for the competitive environments that reduce telephony rates. The penetration of Internet hosts is five times greater than in monopoly markets and that Internet access in countries with telecommunication competition enjoyed a growth rate five times higher than the monopoly environments. All that may change for Nigeria now as the government had invited private participation in the telecom industry and many investors are already in the Nigeria markets but it will take many years to know their full impact on Nigeria education system.

4.0   CONCLUSION

The peculiarities of Nigerian school problems in the use of computers for instruction have been full discussed in this Unit. These problems rang from hardware availability to lack of necessary skills among the teachers. Another major worry is that of electricity that is not steady. Finally, some of the efforts made to address the problems were also articulated

5.0   SUMMARY

In this unit, you have learnt some of the problems facing the implementation of computers in education. These problems are not peculiar schools in Nigeria but in the whole world. Some suggestions were made on how to solve these problems.

6.0   TUTOR-MARKED ASSIGNMENT

1. List 5 problems of using computer in Nigeria and the global world
2. State ways of solving three of the problems listed in question number 1.

7.0   REFERENCES/FURTHER READINGS

Aduwa-Ogiegbaen, S. E., & Iyamu, E. O. S. (2005). Using Information and Communication Technology in Secondary Schools in Nigeria: Problems and Prospects. *Educational Technology & Society*, 8 (1), 104-112.

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