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$$\text{Intelligence quotient} = \frac{\text{Mental age}}{\text{Chronological age}} \times 100$$

$$\bar{X} = \frac{\sum fx}{n}, \quad \sigma = \sqrt{\frac{\sum (X-\bar{X})^2}{n}}$$

Bernard Numgwo Atsumbe

CHAPTER SIX

APPLICATION OF COMPUTER TECHNOLOGIES IN THE IMPLEMENTATION OF CONTINUOUS ASSESSMENT

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Introduction

The increasing number of students enrolling into our Higher Institutions of learning (and Examination bodies like JAMB, WAEC, NECO and NATEB) and the corresponding increase in stress and time spent by staff on assessment has encouraged interest into how computer technologies can assist in the implementation of continuous assessment. Computerized testing/examination facilities can provide a rapid and effective means of assessing and providing feedback and/or result to large numbers of students.

The Uganda National Examination Board (2010) defines continuous assessment as a systematic objective and comprehensive way of regularly collecting and accumulating information about a student's learning achievement over a period of study and using it to guide the student's learning and determine their level of attainment. This Chapter is informed by the usefulness of continuous assessment in measuring learning outcomes and practical skills that cannot be assessed at the end of a course through pen and paper. The use of computer technologies can aid assessment of both process and product, a

thing that cannot be achieved by using one end of study period examination.

This chapter takes a look at the justification of the use of computers in continuous assessment, points of computer application in continuous assessment and the basic computer skills needed by teachers for the implementation of continuous assessment.

Justification of the Use of Computers in Continuous Assessment

"**Assessment** consists of taking samples of behaviour (in this case, academic behaviour) at a given point in time and estimating the worth of those behaviours. Thus the underlying assumption of assessment is that it provides a representative sample of behaviour of the person being assessed. On the basis of the kind of sample taken, inferences are made about a person's achievements, potentials, aptitudes, intelligence, attitudes and motivations. All forms of assessment provide estimates of the person's current status" (Learning Technology Dissemination Initiative, 1999). This process can be so demanding, tasking and time consuming. Computer technologies can and is being used to aid this process.

Generally speaking, computer technologies have the following advantages which also bear on the implementation of continuous assessment:

i. **Time:** Computers save time. Teachers, especially in the higher institutions need great time for their research works. Employing computers to aid in marking, computation and reporting of results can save great deal of time for them

ii. **Speed:** A task that can take several hours to do manually can be done in few seconds by computer if properly instructed. A simple code on a computer can accomplish great task in few seconds. This is applicable to marking of quiz, test and examinations which can be done by computer in split of seconds

iii. **Repetitive Tasks:** computers have the advantage of doing one thing for several (millions) of time without getting bored. Repetitive tasks have the inherent nature of continuous assessment using mistakes, which are completely eliminated in computers. Infact computers specialize in doing one thing for millions of time exactly without a mistake. This is applicable in the implementation of continuous assessment in which one method, the same question, the same reporting pattern is used for all students (which may be very many-hundreds or thousands)

Points of Computer Application in Continuous Assessment

The following are the points at which a teacher can apply computer in the implementation of continuous assessment:

i. Computer administration of all forms of assessments and tests such as

    a. Formative Assessment: this is an ongoing evaluation such as quizzes and immediate feedback

    b. Summative Assessment: this is an after-learning evaluation such as a major test or grade

    c. Criterion-Reference Tests: these are tests such as measuring how well a student learns a specific knowledge or skill

Shift – In addition to <Shift> being used as a Control key, it also selects the upper case letters for the alphabetic keys and produces the symbols that share the number keys.

Caps Lock – A "toggle" key that locks only the alphabetic keys to produce the upper case versions of each letter.

Arrow keys – Used to move the cursor (or pointer) up, down, left, or right.

Insert – A "Toggle" key that switches the data input from the insert mode to "type over" mode

Home – Moves the cursor to the beginning of the line of data.

End – Moves the cursor to the end of the line of data.

Page Up and Page Down – Used when scrolling through documents or screens to move up or move down one screen at a time.

Num Lock – A "toggle" key that changes the mode of the Cursor and Numeric Keypad.

Number Keys – Used to enter numeric information, similar to a calculator pad.

Windows Key – Opens the Start menu on the taskbar.

Application Key – Functions in some applications to produce a shortcut menu.

Print Screen, Scroll Lock and Pause/Break – Keys used mostly in DOS applications to manipulate screen display.

iii. **Mouse** – a small, hand-held device that is used to control the pointer on the screen. The pointer (or mouse pointer) is the arrow on the screen that moves with the mouse as you slide it over a flat surface. The pointer shape changes

depending on the job it is doing at the current time. A mouse usually has at least two buttons:

a. Primary button (usually the left button)

b. Secondary button (usually the right button)

There are five main mouse actions:

i. Point - Move the mouse until the tip of the mouse pointer is over the item you want.

ii. Click - Quickly press and release the left mouse button. It is essential to hold the mouse firmly while you click so that it does not slide out of position.

iii. Right-click: Quickly press and release the right mouse button.

iv. Double-click: Quickly press and release the left mouse button twice. This must be done in rapid succession.

v. Drag: Point to an item, press and hold down the left mouse button, slide the pointer to a new location, and release the mouse button.

The computer case holds the electronic chips and devices that make the computer to work such as

i. **Power button** – turns the computer on. Often the power button will light up indicating the computer is on.

ii. **Power light** – lets you know the computer is processing.

iii. **External Ports** – provides the availability to plug in speakers, headphones, microphones, and more.

iv. **Disk Drives** – There are not always two Disk Drives. These provide the capability to use CD-ROMs, DVD-ROMs, and also to write/save/burn on to CD/DVD-R's and CD/DVD-RW's.

v. **3.5 Floppy Drive** – Many new computers do not have this floppy drive, but it can be added internally to your computer, or externally with a USB cable.

vi. **Memory Card Reader** – reads Memory cards which are small storage devices used to hold data such as text, images, audio, and video for use on small electronic devices.

vii. **USB Ports** (Universal Serial Bus) – special receptacles that allow you to connect devices to the computer to transfer data.

The Processor (Central Processing Unit) coordinates the flow of data in the computer. Many times called the brain of the computer, it contains some of the following:

i. **Motherboard** – holds the computer's circuitry and components.

ii. **Memory (RAM)** – this is memory that you use when working on the computer.

iii. **Video card** – allows images to be displayed on the computer.

iv. **Sound card** – allows input and output of sounds

v. **Network card** – allows computers to communicate with one another over a computer network.

vi. **System Software** – refers to the operating system and the instructions used to power up the computer. System software usually comes with the computer.

vii. **Application Software** – programs such as Microsoft Word and power point. Application software (programs) can be copied from CD-ROMs and/or downloaded from the Internet onto the hard disk drive for convenience and speed.

The computer has two types of memory – **ROM** and **RAM**

i. **ROM** (Read Only Memory) stores data permanently and you cannot change this information. ROM is used to start up your computer

ii. **RAM** (Random Access Memory) is memory that a computer works on a temporary basis. The information is erased once the computer is shut down unless saved

Additional Computer Terms

CD-ROM (Compact Disk-Read Only Memory) - A portable memory device. It is used in the computer's CD-ROM drive and typically holds 640 megabytes of information.

Crash – A serious computer failure. The computer stops working or a program quits unexpectedly. A crash may result from a hardware malfunction, a serious software defect, or a virus.

Database – A collection of information organized in such a way that a computer can quickly select and/or sort desired pieces of data.

Desktop – The computer screen or background that contains components such as the Taskbar, My Computer, Recycle Bins icons, any other shortcut icons, and any Windows and Dialog Boxes that have been opened.

Flash Memory – non-volatile computer memory that can be electronically erased and reprogrammed. Used primarily in Memory cards.

Hard Disk – The large spinning plate that is usually sealed inside the computer and holds a large amount of information, typically in the gigabyte range, for quick access.

Hard Drive – The disk drive that houses the hard disk. The hard drive and the hard disk are often referred to as the "hard drive"

Hardware – the physical, touchable parts of a computer (CPU, monitor, disks, modem, cables, mouse, keyboard, etc.)

Icon – A small picture that represents a file or a program. Clicking or double clicking on the icon will activate it.

Memory card – small, thin storage devices used with digital cameras, handheld and laptop computers, telephones, music players, video game consoles, and other electronics. Flash memory is used for this type of storage device.

Modem – A device, internal or external to a computer that enables one computer to talk to another computer using telephone or cable lines.

Operating System – The master software program of a computer that controls the hardware of that computer, runs programs, manages files and documents.

Reboot – To "reset" or restart a computer.

Software – Programs used to operate computers and related devices. Software tells the hardware what to do.

USB Flash Drives – This device go by many names (thumb drive, flash drive, and jump drive). A data storage device that is small, but it can hold up to 2GB of information. It is used with the USB Port.

USB Port – special receptacles that allows you to connect a string of up to 127 devices to a single receptacle.

Window – A viewing area on a computer display screen. The Windows Operating System has a graphical user interface and allows for multiple viewing areas (Greene County Public Library, n.d.).

Computer Skills Needed by Teachers for Continuous Assessment Implementation

A teacher who will be able to successfully apply computer technologies in the implementation of continuous assessment must have basic computer skills in the following areas:

1. The Use of a Word Processing Package

Sometimes abbreviated as **WP**, a **word processor** is a software program capable of creating, storing, and printing documents. Unlike the standard typewriter, users using word processors have

the ability of creating a document and making any changes anywhere in the document. This document can also be saved for modification at a later time or to be opened on any other computer using the same word processor.

Note that a word processor should not be confused with a text editor such as **Microsoft Notepad** that only allows editing and creating **plain text** documents. Examples of commercial word processors include Apple **iWork**, Corel **WordPerfect**, **Microsoft Office - Microsoft Word**, **Microsoft Works** and **Sun StarOffice** (Wikipedia, 2013).

The teacher with WP skills will be able to create (type) document, store and print the document at any time of need.

2. The Use of a Spreadsheet Package

A **spreadsheet** is an interactive computer application program for organization and analysis of information in tabular form. Spreadsheets are developed as computerized simulations of paper accounting worksheets. The program operates on data represented as cells of an array, organized in rows and columns. Each cell of the array is a model–view–controller element that can contain either numeric or text data, or the results of formulas that automatically calculate and display a value based on the contents of other cells.

The user of the spreadsheet can make changes in any stored value and observe the effects on calculated values. This makes the spreadsheet useful for "what-if" analysis since many 1ses 1n be rapidly investigated without tedious manual recalculation. Modern spreadsheet software can have multiple

interacting sheets, and can display data either as text and numerals, or in graphical form.

In addition to the fundamental operations of arithmetic and mathematical functions, modern spreadsheets provide built-in functions for common financial and statistical operations. Such calculations as net present value or standard deviation can be applied to tabular data with a pre-programmed function in a formula. Spreadsheet programs also provide conditional expressions, functions to convert between text and numbers, and functions that operate on strings of text.

A list of current spreadsheet software can be seen below:

i.   Microsoft Excel

ii.   IBM Lotus Symphony (2007)

iii. Corel Quattro Pro (WordPerfect Office)

iv.   KSpread

v.   Kingsoft Spreadsheets

vi.   Mariner calc is Mariner Software's spreadsheet software for MacOS and iOS.

vii. Numbers is Apple Inc.'s spreadsheet software, part of iWork.

viii. ZCubes-caci

ix.   Resolver One

x.   GNU Oleo – A traditional terminal mode spreadsheet for UNIX/UNIX-like systems

(Wikipedia, 2013)

A teacher with skills in a spreadsheet package can create his/her own program-like database in implementing continuous assessment of his/her students

3.   The Use of Internet

The Internet is a global system of interconnected computer networks that use the standard Internet protocol suite (*TCP/IP*) to serve billions of users worldwide. It is a *network of networks* that consists of millions of private, public, academic, business, and government networks, of local to global scope, that are linked by a broad array of electronic, wireless and optical networking technologies. The Internet carries an extensive range of information resources and services, such as the inter-linked hypertext documents of the World Wide Web (WWW) and the infrastructure to support email.

The following are some of the advantages offered by Internet that are applicable to the implementation of continuous assessment if the teacher is armed with the skills:

i.   **Operating 24 hours per day, 7 days a week.**

You don't need to wait until all are confined in a class room to be able to conduct continuous assessment. From a student's perspective as well as a teacher's continuous assessment can be conducted at any time. The fact that the Internet is operational at all times makes it the most efficient continuous assessment machine to date.

ii.   **Relatively Inexpensive**

It is relatively inexpensive to publish information on the Internet. At a fraction of the cost to publish information by traditional methods, teachers can now distribute information

to their students. It will be even more beautiful if academic institutions establish · an Internet presence in their environment and campuses.

iii. **Create Online Discussion Forums**

By using applications such as WebBoard, it is possible for a teacher to set up an online discussion forum with his/her students on the Web.

iv. **Immediate Feedback**

The interactive nature of the World Wide Web is ideal for obtaining immediate feedback from students about an exercise, assignment or a particular topic of concern. Because the feedback submitted by students can be read immediately, it is possible to respond to various students' concerns in a timely manner, increasing students' confidence and quality of teaching (InVirCom, 2007).

4. **The ability to Use Developed Computer Packages For Continuous Assessment**

There are computer packages for implementing continuous assessment in several institutions of learning in the world and Nigeria today. Some are customized for the departments or institutions and the staff of such departments or institutions must become familiar with the use of such packages. Others can be found in the (internet) market, provided as templates. Some examples of such packages are as seen below:

i. **STI Assessment**

This is a web-based system that enables educators to create and administer formative and benchmark assessments online as well as on paper. This solution allows for instant results, generates customized reports, and monitors student progress.

An important component to STI assessment is STI Achievement Service, a customized professional development and coaching program educating teachers on how to create valid tests, collect and analyze data, and modify instruction accordingly.

Through STI Achievement Service and STI Assessment, Victor Rivero (2010) has made it known that; educators are able to do the following:

a. Develop formative assessment or benchmark tests for any subject using the system's large bank of questions that are correlated to state standards in order to create their own questions or use the combination of both.

b. Conduct tests online or on paper and receive immediate results regardless of the testing method as well as administer assessment to see where their students are vast and where they need to be assisted.

c. Create a living record of students' progress over the span of their academic careers.

d. Quickly and easily create meaningful assessment reports of aggregate and disaggregate data to meet local needs and reporting requirements that can be accessed online by administrators, teachers and parents.

e. Implement the assessment system district-wide if desired since the system is sealable to any school level or district size.

ii. **Gradecam**

Offered by Gradecam Corporation, Robert Porter is the original creator and patent holder of gradecam. Teachers are well known for having massive amount of paper work to grade and tediously enter into result books, more often at a deadline. gradecam

image-recognition software (www.grade1m.com) works with a camera to grade tests from bubble forms and to generate statistics and reports on student performance. Users purchase it at $98. It also works with insight and other built-in computer cameras (Victor, 2010).

iii. AIMSweb

This is a comprehensive system perfectly suited for Response to Intervention implementations and differentiated instruction. AIMSweb (www.aimsweb.com) provides multiple assessments for universal screening and progress monitoring as well as web-based data management, charting and reporting. Results are reported to students, parents, teachers and administrators through a web-based management and reporting system to determine response to instruction. Initially, it was created by Gary Germann in the late 1990s, AIMSweb is now a product offered by Pearson.

AIMSweb has a variety of subscription options. Customers receive unlimited access to downloadable, reproducible assessment probes for reading, language arts, mathematics and early literacy skills; use of online data management and reporting system; and self-produced training materials. Cost ranges between $3 and $6 per student, depending upon the options or how many academic areas a customer wants to assess (Victor, 2010).

iv. The ACME project

According to Soler. J., Poch J. et al (n.d), ACME (the Catalan for "continuous assessment and Improvement of Skills") project is a tool for the assessment of the students' skills. The Department of Mathematics and Computer Science of the Universitat de Girona in Spain has been developing ACME since 1998. It is intended for

the teaching of mathematics in the first years of technical/ engineering studies and it is aimed at combining the possibility of fast and reliable communication with the use of symbolic manipulation software in order to improve and assess the students' skills. The project has a bearing on two general aspects of the educational activity: personalized attention to each student, and assessment of his/her skills. Its leading ideas can be summarized in two main lines:

- Communication through the internet, which allows the student to communicate with the system from any computer with a standard internet connection.

- Use of symbolic manipulation software (Mathematical) to create and correct online the exercises of an intermediate-level mathematics course in technical/engineering studies. The use of the internet as a very convenient means for distance learning is already a standard issue. The use of symbolic manipulation software makes possible a high level of interactivity and flexibility and is the main novelty introduced by the ACME system.

An inter-mediate level mathematics course in technical/ engineering studies has a great deal of "mechanical" work for the tutor as far as the assessment of the students' skills and progress is concerned. The main objective of the project is to render this mechanical work as fully mechanical as possible, and have it done by a computer. Some of the goals of the system are:

a. Implement a system of continuous assessment of the student's progress.

b. Make personalized attention to the student easier.

c.   Free the tutor from the task of marking a great number of exercises. The time saved in this way can be dedicated to personal attention to the student.

d.   Assess the degree of participation of the student.

e.   Encourage personal work in the student.

Brief Description of ACME

Soler. J., Poch J. et al (n.d.) further explains the ACME to be a system that provides each student with a personal exercise book, under the general principle of "all exercises are different but all are equal." They are different as far as their formulation, values of parameters, functions involved, are concerned, but they are equal in the sense that the method to be used in the solution of each particular exercise is the same. The progress of the student through his/her personal exercise book provides the basis for the assessment of his/her skills and gives valuable information on the difficulties he/she meets. This information can be used to guide the student through those subjects which present a greater difficulty to him/her.

The whole course is divided into chapters. Each chapter has a traditional collection of exercises and each exercise must be solvable with a standard method that can be implemented in a Mathematical code. Of course this rules out exercises in which a mathematical proof is asked for, but these are not the main objective of an intermediate-level mathematics course in engineering studies. Different versions of each exercise are written, which include different formulations as well as a wide range of possible values of the parameters involved. These parameters can be numbers, functions or even names or words (the particular wording of the formulation can actually be thought of as a parameter). The different formulations of an exercise, together with a number of lists for the possible choices of the

parameters and the Mathematical code for solving it, is what we call a *source exercise*, according to Soler. J., Poch J. et al (n.d). Each source exercise is then a definite mathematical exercise, with a definite solving method, which is formulated differently, with different values of the parameters, to different students. The set of all source exercises is the collection of exercises of the course and the system generates a personal copy for each student, at the beginning of the course, with a random choice of formulation and values of the parameters involved.

Each student can enter his personal exercise book through the internet and can have any number of exercises open for answer at a given time, though there may be a deadline for answering some or all of the chapters. When the student thinks he/she has got the right answer, he/she enters it and the system executes online a Mathematical code and answers back whether the solution is or is not correct. The Mathematical code is built from the values in the student's book and the code in the source exercise. All this information is registered by the system. Tutors can enter the system in a matrix-like way: either they can choose a student and look at the state of his/her work or they can select a chapter and look at its state with respect to the whole group of students. Finally, there exists an *Edition Modulus* which makes easy the creation of source exercises.

The departments of Mathematics and Engineering from higher institutions in Nigeria can embark on a project such as ACME in order to assess the progress of their students through the courses and the results in the students' exercise book (which is created in the system) can be made to enter the mark given at the end.

v. Other packages include:

a. EJ659660 - A Computer Package for assessment Practice in Primary Classrooms.

(http://www.eric.ed.gov/ERICWebPortal/recordDetail?accno=EJ659660)

b. **BlueNight® Screener** - Sleep Oximetry Assessment PC Package (http://www.intermedi1ldirect.com)

c. **PLATO** – A subscription-based software as a service provider. Pricing varies depending on the number of student licenses, solutions provided and professional services.

d. **GlobalScholar's Pinnacle Suite** – A classroom solution allowing educators to enhance student learning by providing access to the right information through user-friendly yet robust technology

e. **Discovery Education Assessment** – A comprehensive collection of academic progress monitoring tools for kindergarten through high school students that helps teachers to access student knowledge, focus information and predict student performance on high-stakes examinations with a reported 80% - 90% accuracy.

Conclusions

Computers have made life easier and better in almost all sectors of living, and it is not an exception in the implementation of continuous assessment. I see Nigeria lagging behind in this respect. In a fully automated assessment system, all aspects of the system from the assessment which the student completes to the processing and administration of the marks, including the overall management of assessment information, can be computer-based.

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