

Trajecting Teacher Education through Computer Assisted Instruction for

National Development

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Abstract: Education is recognized as a basic right and a central element in human development and thus a prerequisite for achieving the wider social, cultural and economic goals. Therefore, human capacity development through strong learning systems is central to the attainment of national development as natural resources has become less important than human endowment in the face of globalization, ICT revolution and knowledge economy. Hence, adoption of innovative technique such as CAI in teaching-learning process will not only facilitate learning but make learning relatively-permanent. However to make the techniques effective and widely acceptable, the limitations to its adoption such as non-availability of supportive infrastructure, inadequate personnel, poor funding etc must be dealt with through a public-private partnership initiatives.

Key words: teaching, learning, teaching-learning environment, computer assisted instruction

1. Introduction

In a typical teaching learning environment, there are three main actors, these are the teacher(s), the learner(s) and the subject matter. The person or the material that does the teaching is called teacher who tries to influence the other person to change his knowledge, attitudes and skills with the subject matter through certain method(s) of teaching.

What a teacher does is to utilize his knowledge, skills, abilities, attitudes and competences to influence a changed behaviour in the recipients (learners) who are usually human being. The learner in a functional and efficient teaching-learning environment is nothing but human being who lacks knowledge, skills, experience, attitudes, abilities and competencies in a definite field of study. The teacher and the learner(s) in teaching-learning condition interact mutually to exchange ideas, knowledge, attitudes, behaviour, skills, competencies and abilities to the extent that the teacher facilitates or enhances the upgradement of the learner(s) in the aforementioned domains.

According to Oluokun (2009) the task of teaching entails two main processes, preactive teaching and the interactive teaching. There cannot be a solid, sound and effective interactive teaching without a preactive one. The

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pre-active teaching involves all the activities a teacher engages himself before coming into classroom setting. This involves selecting the topic and sub-topics of the lesson, the instructional objectives, materials, ascertaining the learners previous knowledge and the actual teaching of self the content of instruction by the teacher. The pre-active teaching dovetails into lesson plan which the teacher uses in classroom interaction with the presumed learners.

Amazingly, a well thought and prepared, pre-activated teaching may fail in the course of interactive teaching and the objective(s) of the activity lost. Host of factors may be accountable for a gap in-between the pre-active and interactive lesson presentation. Among such factors are the students' mood, emotion, attitudes, interests, academic self-concept, self-efficacy and the teachers strategy of instruction (Okebukola, 2013; Adesina & Ayanwoye, 2011; Obanya, 2010; Okebukola, 2007).

The intricacy of teaching-learning process involves the teacher strategizing the concepts of instruction in a more appealing and enticing manner to the learners who may be unwilling to learn.

Research findings (Fasasi, 2012; Igboegwu, Egolum & Nnoli, 2011; Gyuse, Olorukooba, Lawal, Lawal, Olanrewaju & Yero, 2011; Ajeyalemi, 2011; Ariyo, 2006; Aina, 2006) have shown that Nigerian students have negative attitudes towards teaching and learning process and "attitude to learning" has been known to be the most important factor in students' performance in teaching-learning environment.

Another vital issue germane to bridging the gap between the pre-active and interactive teaching processes which will enhance optimum achievement of the instructional objective is the understanding of the limitation of human teachers. A well pre-activated teacher, thoroughly engulfed through advanced preparation because of that "human limitation" may during the interactive teaching if unaided fail dismally.

Rationally, this is a clarion call for the supports of the teacher in the teaching-learning process. The clarion call is in hegemony with the Constructivists and Behaviourists Instructional theories. To the constructivists, the human learning is constructed, that learners build knowledge upon the foundation of a prior or previous knowledge. The view of teaching-learning process paradigm shift from the passive transmission of information from one individual (teacher) to another (learner) into a participatory situation in which no stereotype of status as teacher and learners; everybody becomes active.

The constructivists like Glaserfeld, Vygotsky, Gagne, Piaget, Bruner, and many others believe that instructors or teachers or lecturers act as facilitator and not as teachers (Wikipedia, 2007). Where a teacher gives a didactic lecture that covers the subject matter, a facilitator helps the learners to get to his or her own understanding of the content. Learners play an active role in learning process.

Brownstein (2001) affirmed a dramatic role a facilitator needs to display which are totally different from that of a teacher or lecturer. A teacher tells, a facilitator asks; a teacher lecturers from the front, a facilitator supports from the back; a teacher gives answers according to a set of curriculum, a facilitator provides guidelines and creates the environment for the learner to arrive at his or her own conclusions, a teacher mostly gives a monologue, a facilitator is in a continuous dialogue with the learners.

This is what takes place in the computer based instruction where computer is being used with appropriate designs and modes that support learners to learn meaningfully.

The psychological theory of "reinforcement" and "behavioural modification" as presented by Thorndike (1931) and Skinner (1954) among others also bears relevance to use of computer in teacher education.

Naturally, when didactic lecture method is used to instruct the learners, they are unconditionally unresponsive, unstirred and passive to learning but whenever computer is utilized, the message structure into their

brain stimulated and conditioned their attitudes to learning and the achievement of the instructional objectives (Patel, 2013; Abimbade, 2006, 2011; Mangal & Mangal, 2009; Chaung & Slavin, 2011; Erhan & Okan, 2011; Afolabi, 2006; Oduwaye, 2009). This is unlike computer assisted instruction.

2. Computer Assisted Instruction (CAI)

Computer-assisted instruction (CAI), as the name may suggests, stands for the type of instruction aided or carried out with the help of a computer as a machine. Mangal and Mangal (2009) allude to the fact that Computer-assisted instruction has now taken as so many dimensions that it can no longer be considered as a simple derivative of the teaching machine or the kind of programmed learning that Skinner introduced. Bhatt and Sharma (1992) stated that CAI is an interaction between a student, a computer controlled display and a response entry devise for the purpose of achieving educational outcomes. The definition brought into limelight the following things:

(1) In CAI, there is an interaction between an individual student and the computer just as it happens in the tutorial system between the teacher and an individual student.

(2) The computer is able to display the instructional material to the individual student.

(3) The individual student takes benefit of the displayed material and responds to it. These responses are attended by the computer for deciding the future course of instruction displayed to the learner.

(4) The interaction between the individual learner and the computer device helps in the realization of the set instructional objectives.

"CAI is a self-learning technique, usually offline/online, involving interaction of the student with programmed instructional materials. Computer-assisted instruction (CAI) is an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place. CAI uses a combination of text, graphics, sound and video in enhancing the learning process. The computer has many purposes in the classroom, and it can be utilized to help a student in all areas of the curriculum." (Patel, 2013).

The possibilities of Computer Assisted Instruction (CAI) for various utilization are demonstrated in several instructional modes. These modes include:

(1) Tutorial mode;

- (2) Informational Instruction;
- (3) Drill and Practice Programmes;
- (4) Educational Game Type;
- (5) Stimulation Type of Instruction;
- (6) Problems-solving Type;
- (7) Practical work-oriented Instruction;
- (8) Learning Affairs-managing Types;
- (9) Power Point Presentations types.

2.1 Tutorial Mode of Computer Assisted Instruction

Tutorials are one of the most effective instructional strategies (Cronin & Cronin, 1992 in Oduwaiye, 2009). In their simplest form, they are similar to textbooks, interspersed with predetermined questions and responses. The basic components of a tutorial programme are:

(1) Gives information on the target audience;

(2) The opening screen which provides information on the programme to guide learners on how to use it;

(3) The main menu which is the main content to be studied by the learners. This is divided into units or lessons. Each unit is broken down into small bits which are called frames in programmed instruction. Each bit of lesson or unit should consist of two or three screens;

(a) the text only;

- (b) interactive questions and answers;
- (c) graphics, drawing, maps and charts where applicable.

The tutorial mode of CAI programmes are prepared not only to have instruction in topics such as demand and supply, production possibility curve, cost analysis but also to provide sufficient practice, having proper track of the student's difficulties and performance and move the students on the path of progress according to their own pace, abilities and requirements. If the student has been able to master a concept, the CAI programme provides the next step of instruction, if he is not able to achieve mastery, the programme provides remedial instruction.

2.2 Information Instruction

It helps the learner to get the desired information he needs. Here the computer can serve the role of an enquiry officer to respond to the student's enquiry with answer it has stored. It provides minimal interaction between the student and the computer programme. The sole purpose of this type of CAI is to provide essential information for the acquirement of concepts and skills. However, the individual learner can learn a lot by adopting an enquiry or discovery approach towards self-learning of such instruction.

2.3 Drill and Practice Programmes

CAI provides the learner with different types of drill and practice programmes covering specific topics related to a particular subject. Through these, the service of computers can be properly availed for providing practice in something already learned in some other way. It helps in the development of a variety of skills. For providing practice in multiplication skill, the computer may display on the screen a simple problem like $7 \times 8 =$

The child is required to respond to typing the numeric keys of the keyboard. If the answer is wrong, the computer immediately displays WRONG and if the answer is correct, another problem for carrying out the practice is presented. These responses come within a fraction of a second; therefore, the child has not to wait for the answer for feedback. On the other hand, the computer has the required patience to wait and allow the child to go ahead on with his own speed and intention of responding and move forward. The advanced programmes student's performance during the problems of varying difficulty levels on the basis of the memory for the errors of the learners and, therefore, proves a very effective teacher in providing the students proper material for their drill and practice.

2.4 Educational Game Type

In it, the learners are provided with a variety of well-designed computer games. These games should not be confused with academic type games. Their purpose is only to provide intellectual challenge, stimulation of curiosity and serve as a source of motivation to the individual learner. In a course of learning, these games can be used as a source of view or as a reward for some accomplishment for the learner.

2.5 Simulation Type of Instruction

Stimulation is used as a technique for providing training to the students. Such type of instructional activities

provides powerful learning tools to them. With the carefully prepared programmes, the students are made to face real or idealized situations. They have to play an active role and are required to take decisions that have consequences. For example, a simulation computer programme may put the participants in the shooting range of the enemies in the battlefront or in the role of a hunter in a jungle full of horror or beasts or in the role of an explorer who is looking for a buried treasure. The stimulation in all these proves much less expensive and dangerous to have a trainee blow up something on the screen than to face a real danger to make a real mistake while trained in real situations.

2.6 Problems-solving Type

This type of computer-assisted instruction focuses on the process of finding an answer to a problem rather than the answer itself. Here, the students are provided with programmes that make them think about the ways and means of solving the problem systematically, with the concrete ways suggested in the programmes, the students can divide or analyze the problem into its small constituents and able to devise systematic procedure for its solution. One of the best known problem solving instructional material packages is LOGO, a procedure-oriented language based on the learning theories of Jean Piaget. Besides, There are other programmes available for different types of students for increasing the sophistication of their thought process helping them learn good thinking strategies and problem solving abilities.

2.7 Practical Work-oriented Instruction

CAI programmes can provide valuable help in supplementing laboratory and other practical work. A student can learn so many things about the science experience before actually performing them in his practical class by watching and following a computer programme made for this purpose. Similarly, he can avail the necessary skills and experience about practical tasks in other fields before actually engaging in such practical activities. Thus, the children will have a necessary preparation and background from computers for their better performance at the school hours.

2.8 Learning Affairs-managing Type

In this type of instructional activities, the computer-assisted programmes provide valuable help in managing and supervising the learning affairs of the students. They can have a proper check over the learning activities of individual students by identifying their academic weaknesses through extensive diagnostic testing and to prescribe educational programmes to meet their individual needs. They can give assignments, help in self-study, library reading, group work, take a test over assignment, keep progress chart and guide the teacher as well as parents to plan their children's education. In the subjects and area needing extensive computation and manipulation of data, such as mathematics, engineering, statistics and advanced researches, the computers can do wonders. A mini computer can do and replace the work of a giant calculating machine. In the education of the handicapped children, e.g., deaf and dumb, the computer can provide the needed learning experiences with quite negligible the affairs of the teaching-learning process but also in the whole range and area connected with the world of education.

2.9 Power Point Presentations (PPPs)

PowerPoint is a software tool that has become a presentation staple in lecture halls, conference rooms, and through the application of computer-based training. It is used in over 30 million presentations a day, and its software is on 250 million computers world-wide (Alley & Neeley, 2005; Erdimir, 2011). Initially, PowerPoint

was developed to improve learning by providing the means to develop presentations that are more structured and interesting to audiences (Amare, 2006). Researchers have examined the benefit that these types of presentations bring to various audiences. Overall, research indicates that students prefer PowerPoint-type presentations to traditional lectures (Cassady, 1998; Gok & Sılay, 2008; Susskind, 2005).

PPPs can be as simple as consisting only of text on a coloured screen. Presentations can also be complex and include tables, pictures, graphs, sound effects, visual effects, clips, etc. The effectiveness of PowerPoint and other multimedia presentations may depend on the complexity of the material that is being presented. In fact, several researchers have demonstrated that material, such as interesting but extraneous text (Schraw, 1998), irrelevant sounds (Moreno & Mayer, 2000) and irrelevant pictures (Mayer, 2001), can reduce comprehension.

Some lecturers state that PowerPoint inhibits the presenter-audience interaction (Driessnack, 2005), limits the amount of detail that can be presented (Tufte, 2003), and reduces a presentation's analytical quality (Stein, 2006). On the other hand, supporters claim that PowerPoint improves learning (Lowry, 1999), invokes audience interest (Szaba & Hastings, 2000), and aids explanations of complex illustrations (Apperson, Laws, & Scepansky, 2006). In short, all software has advantages and disadvantages, and this debate highlights the fact that PowerPoint is no exception.

Numerous studies have been conducted to determine whether or not PPPs affect the students' success in science instruction. Studies have revealed that the reason for success in science education have been associated with students' motivation, interest, and the use of PPPs in the classroom setting (e.g. Craker, 2006; Normah & Salleh, 2006). Furthermore, studies have consistently indicated that students generally believed that the use of PowerPoint facilitated their learning and retention (Apperson, Laws, & Scepansky, 2008; Mantei, 2000; Rankin & Hoaas, 2001; Szaba & Hastings, 2000). Therefore, the use of the PPPs to increase student teachers' achievements should be considered as an important step in science education.

Students who were exposed to teaching methods with PPPs emphasized that their interest and achievements were improved. They said that PPPs enhanced their learning and success (Frey & Birnbaum, 2002; Rickman & Grudzinzki, 2000) because they were able to see the notes (e.g., slides and texts) on the screen and easily follow the subject. Moreover, research has indicated that the sole use of traditional teaching methods has negative effects on students learning or comprehension of science concepts (Araujo, Veit, & Moreira, 2004; Susskind, 2005). So, we can conclude that we need to implement contemporary teaching methods, tools, and technology (e.g., PPPs and computerized teaching) into science education in order to increase the level of students' academic success.

Educators hypothesize that the use of PPPs in science courses aims to encourage students' active involvement in science teaching and learning (Blas & Fernández, 2009; Gay, 2009). It enables students to learn, interpret the information, and retain the knowledge for a long time. Further, it attracts the students' attention to the subject, makes the lesson easy to learn, and helps them to memorize abstract and concrete information (Erdemir, 2009; Savoy, Proctor & Salvendy, 2009; Wofford, 2009). Students appreciate the details, distinctive features, and critical points in the figures on the slides when graphic presentations are used. Hand-drawn figures cannot be copied onto the board. The impact on the success of this type of drawing is not as great as PPPs within the classroom setting (Bartsch & Cobern, 2003; Yucel, 2007).

In fact, students perceive lectures accompanied by computer-mediated PowerPoint presentations as more organized (Pippert & Moore, 1999; Susskind, 2005) and better at emphasizing key points (Frey & Birnbaum, 2002; Susskind, 2005; Szabo & Hastings, 2000) than traditional lectures. When college instructors accompany lectures with computer-mediated PowerPoint presentations, there are positive effects on students' attitudes toward the

course and their self-efficacy beliefs (Frey & Birnbaum, 2002; Kask, 2000; Susskind, 2005; Szabo & Hastings, 2000).

Students claimed that PowerPoint presentations made it easier to attend to (Apperson, Laws, & Scepansky, 2006; Frey & Birnbaum, 2002) and understand (e.g., Apperson et al., 2006; Susskind, 2005; Szabo & Hastings, 2000) the lectures. Students felt they took better notes (Frey & Birnbaum, 2002; Kask, 2000; Pippert & Moore, 1999; Susskind, 2005) and believed their notes were more organized, easier to understand, and useful for studying for exams (Susskind, 2005) when PowerPoint was employed.

Nigeria as a developing nation needs her youths — the future generation to be prepared and equipped for the 21st century challenges. This calls for the need to integrate ICT into her educational system since education is concerned with the acquisition of knowledge, skills and attitudes (Ojo, 2008). The purpose of education is to produce wholesome, pleasant and understanding individual who will interact wisely and purposefully within and outside the environment.

3. Empirical Studies on Computer Assisted Instruction in Teacher Education

Bartsch and Cobern (2003) investigated effectiveness of power point presentations in lectures over overhead transparencies. Quazi-experimental design was adopted for the study with thirty nine students in social psychology class at the University of Texas and Analysis of variance as a method of data analysis, the result showed that students preferred power point presentations to over head transparencies and traditional method of lecture.

Afolabi (2006) investigated the effects of Computer Assisted Instructional package on secondary school students' performance in Biology, in Oyo, Nigeria. The researcher made use of quasi experimental design. 120 senior secondary school One students were randomly assigned to experimental group I (20 males and 20 females), experimental group II (19 males and 21 females) and control group (19 males and 21 females). Biology performance Test (BIOPET) was the research instrument. The students' pretest and posttest scores were subjected to Analysis of Covariance (ANCOVA) and post hoc analysis using Scheffe test. The findings showed that the performance of students exposed to CAI either individually or cooperatively were better than their counterparts exposed to the conventional classroom instruction.

Susskind (2007) determined the limits and effects of power point's power: Enhancing students' self-efficacy and attitude but not their behaviour. Quazi-experimental design was adopted with two groups composed of 42 students in experimental group and 38 students in the control group. Descriptive statistical of mean and standard deviation were used to describe the results as well as a non-parametric statistics of ANOVA to determine any significant difference in the two groups. The results showed that power point presentations have significant influence on students self-efficacy, attitude and academic achievement in University than the traditional method.

Harshad (2007) studied development and effectiveness of Computer Assisted Instruction Programme for Teaching of Adjective in English Language. Two equal groups only posttest experiment design was adopted for the study. 46 students of grade IX were selected as sample for the replication of the experiment. A teacher made unit test was administered as posttest. The scores obtained on the test were analyzed by t-test. Students' reactions (attitude) were obtained on opinionnaire developed by Ambasana (2002) and analyzed employing chi-square technique. The findings revealed that the CAI package developed to teach Adjective in English grammar to the students of grade IX was effective with respect to the students' academic achievement and that students responded favourably towards learning through CAI package.

Oduwaiye (2009) had a study on the impact of Computer Assisted and Textual Programmed Instructions on pre-service teachers' learning outcomes in some environmental education concepts in Biology. The study adopted a pre-test, post test, control group quasi-experimental design with a $3\times3\times2$ factorial matrix. 281 pre-service Biology teachers from six colleges of education in southwestern Nigeria were selected using stratified random sampling technique, seen instruments were developed and used for the study, among are Biology Achievement Test (BAT), Environmental Attitude Scale (EAS), Programmed and Conventional Lecture Method Instructional Guide; Assessment Sheet for Evaluating Teachers' Performance; Pre-service Teachers' Academic Ability and Personal Data Sheet; Evaluation Sheet for Programmed Instructional Package and Worksheet for Textual Programmed Instruction. Seven null hypotheses were tested at 0.05 level of significance. Data were analyzed using analysis of covariance and scheffes post-hoc test. The findings revealed a significant main effect of treatment on pre-service teachers' environmental knowledge with the Computer Assisted Instructional Group obtaining the highest adjusted post mean score followed by the textual programmed instructional group and lastly control group. There was also a significant main effect of treatment on environmental attitude with CAI having more favourable reactions from the sample students.

Erhan and Okan (2011) researched on the relationship between students' exposure to PPPs and their achievement in Science and Maths. The data for the study came from the 2009 administration of the Programme for International Student Assessment (PISA) using 9th grade students in schools. The sample of 4996 students in Turkey were used for the study Hierarchical linear modeling was used for analyzing the effects of ICT in students. The results indicated that students' familiarity with ICT and their exposure to technology helped to explain Maths and Science achievement gap among students.

Erdemir (2011) determined the effect of power point on students' achievement in Physics over the traditional lectures, using pretest-posttest control group quazi-experimental research design and 90 science student-teachers (Pre-service teachers) in physics education in a University in Turkey. T-test was used to analyze the data collected. The results indicated that PPPs group had higher grades than the control group and that intelligent use of power point presentations in Physics instruction is capable of increasing the students' success.

4. Limitations, Conclusion and Recommendations

4.1 Limitations

The computer assisted instruction as we have seen is available in its various types for helping the students in their auto-instructional activities. Though perhaps, this is the most workable instructional device run by the individual learner with little or no teacher assistance. Yet, when coming to the practical use, it is found to suffer from a number of limitations and drawbacks:

(1) The instruction of CAI in classrooms prove quite expensive and uneconomical in terms of educational returns;

(2) Computer, as an electronic device, may invite significant hazards to children. There is a potential danger for the children either to damage the machine or be damaged by it.

(3) Much of the difficulty is felt on account of the unavailability or usability of the educational software. Either were don't get any programme for a particular type of instruction and teaching of a topic or we are cheated by the computer firms by selling us the software found virtually useless and unusable.

(4) Serving of the hardware (computer machine) also poses a serious problems. If for one or the other reason

the machine is failed, the expertise to operate it again or do repair work is not easily available. Consequently, the regular instructional work on self-study of the students may receive a major setback.

(5) The auto-instruction or self-study carried out in the form of CAI is basically a learners-controlled instruction. Here, the learner is the master of the whole instructional process and thus, there is little scope for keeping restraint and checks on the learner. It may lead to indiscipline, truancy, carelessness and unnecessary wasting of time on the part of the students.

(6) The learners are supposed to type from the keyboard or use light pens against the screen for putting up their responses. During long study hours, this exercise may prove quite boring, mechanical and tiresome. However, they have to live up with it as a way to interact with the communicate and respond to the speech and writing of the students like their teachers.

(7) CAI, how good and effective it may prove as an instructional device, cannot be accommodated properly in the set-up of our schools or colleges comprising set time-table schedules, uniform curricula and groups-oriented instruction, and examination system. Neither we can replace or build up altogether a new structure nor can we dare to invite chaos by introducing CAI.

(8) The other major limitations of the CAI lie in the fact that computers are machines and no machine can ever match the human beings for effective interaction with the human beings. The emotional touch, warmth and sympathy as well as the heart link establish in teacher-pupils interaction are not possible in CAI.

There is a truism that everything in the world persistently changes whereas change itself is constant in all human endeavour. This basic fact do not exempt the field of teacher education, the clarion call for this 21st century teaching-learning environment to go digitalized is a must obey. Therefore, let all hands on deck, trajecting teacher education from the archaic and obsolete era of talking and chalking into an epoch making and heuristic computer assisted instruction where hands and minds of learners are always on.

4.2 Recommendations

The following are recommended for effective trajection of teacher education for successive national development:

(1) Schools and tertiary instructions should be refurbished by the federal, state and local government to avail computer and other ICT tools in institutions;

(2) Teachers professional development should be paramount to update their didactic to heuristic teaching strategies which enhances use of CAI;

(3) Curriculum planners should incorporate CAI into methods of instruction right from primary to tertiary levels of education.

Curriculum implementers, the teachers should take the ample opportunity to lift their instructional level to 21st century compatibility by using CAI.

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