Computer Assisted Instruction For Teaching / Learning Process And Its Effects On Students' Performance In Tertiary Institutions

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Abstract*— In determining the effect of computer assisted instructional method on students' performance, two groups of student for a period of two semesters in the introduction to computer science and electronic data processing courses offered at the department of computer science, Adeniran Ogunsanya College of Education were used as samples. One group was taught with conventional teaching method and the other with computer assisted instruction software package. As this was the first attempt in deploying CAI in teaching computer concepts in the department, it was primarily employed as educational means of teaching with CAI software. This paper reports a personal experience and a case study of implementing computer assisted instructional method and the effect it has on students' performance in the course. Through hypotheses testing, it is clearly possible that employing computer assisted instructional method in educational settings proves to have significant effect on students' performance

***Keywords*— CAI strategy, Measuring Performance**

I. INTRODUCTION

Adeniran Ogunsanya College of education offers computer science courses in education. Over the years, the same chalk and board method of teaching was observed, before the introduction of CAI software to teach the same concept.

The courses are basically for new students to embrace the teaching of computer science and to acknowledge all the rudiments of computer science. Students are required to produce coursework and sit for final examination. Assessment percentages are 40 and 60 respectively. Marks for coursework are calculated from individuals as well as groups

Measuring the performance of the students is done both individually and in groups. This allows individual team member to be independently active and creative, and able to work coherently with the other members [5]. The final examination questions are based on multiple-choice and fill-in the gap questions.

The paper reviewed background literature and then described the hypotheses and research method. This was followed by an analysis of data and report on the findings. Finally, the report discussed the conclusions identified in the findings.

II. LITERATURE REVIEW

The 21st century teacher is being harassed by a bugbear of inadequacies in his teaching profession because he lacks many things. This has made functionalism in education a mirage. His laboratory (classroom) is a wasteland; an "open field" devoid of comfortable learning environment to adequately cater for the needs of the burgeoning "hungry" learners. He lacks appropriate methodology to work with in such an unfriendly environment and his scope of teaching does not incorporate modern information and communication technology. The roles and responsibilities of lecturers in various institutions have undergone significant evolution since the beginning of the twenty-first century [1]. With the technology, world of too-much-to-know and too-many-sources-of-knowledge outside the classroom that can easily be brought to bear within school walls by students themselves, teaching has gone beyond simply dispensing knowledge. Professional development programme in the real sense is a programme through which skills and competencies needed in any field can be improved to promote outstanding results [3].

In some ways, the students can be carried along, on the computer screen, simulations of impossibly lengthy, expensive or otherwise impracticable experiments in social studies, integrated science, mathematics and others [12]. Such simulations, as well as drill-and –practice tutorials, are available to schools through Computer-Assisted Instruction (CAI). The computer in the school is not only a way of implementing the existing curriculum; it can become a new part of the curriculum. It can drill students on the facts and figures that are new or difficult to teach during the conventional method. It can also usefully simulate scientific or social-scientific experiments and in the process of being used by school children for these purposes, it teaches students about itself.

In a well-run school with creative educational aims, the computer functions as a teaching assistant, frees the teacher to do what teachers are supposed to do, shares materials with students in the learning process, discovers the world and stretches their minds. There has been a dramatic increase in the capabilities of computers along with reduced cost, that has

influenced an increase in the various forms of computer-delivered instruction [6]. This increase has been seen in education as well as in their disciplines [14]. Throughout the 1980's and 90's computers have been generally heralded as being an effective teaching methodology [7].

Computer Assisted Instruction in learning involves the use of the computer system to deliver instructions to pupils by allowing them to interact with lessons programmed into the system, Learner would start their learning from different points; take different routes, finishing at different times in this type of learning environment. To [2], Computer Assisted Instruction is seen as instruction or learning that involves the use of a computer system, including any of the hardware, software, network and telecommunication efforts, for the primary use of learning. Nonetheless, the computer is able to keep a record and analyses the outputs of all the learners, provide them with immediate knowledge of results, and enable teachers to maintain quality control. Computer aided instruction has a rich history and developed concurrently with the development of electronic computers (Daniel, 1999). Computer Assisted Instruction or CAI is an instructional medium to facilitate teaching and learning and the program may emanate or generate from the learner himself. In this case, if he wants to learn and he uses the computer to explore the ways, he can learn better whatever he wants to learn. Thus, we find the learner manipulating the computer to suit his convenience in learning. That is the use of the computer as a device for teaching and learning. On the other hand, the application may come from the teacher or as we say, from the instructors and or from the learners. In this wise, the subject or topic to be learnt will have to be analysed and broken down into programme(s) before being given to a learner. The teacher may do this, and when he does, we are looking at the Computer Assisted Instruction from the teacher's point of view. He has the knowledge, and the expertise to provide instruction for learners; hence, this authority in his packaging of materials he thinks suitable for the learner [13]. [8], in discussing the status of technology use in mathematics education, noted that there is ample justification for research into how computers are used in education. [9], in a study involving junior high students, found that CAI alone tended to be the most effective instructional delivery system compared to video alone and interactive video. [15], while examining the effects locus of control has on the acquisition of computer literacy, found that externally controlled pre-service teachers learned better in the CAI mode than in the comparison text mode, while internally controlled pre-service teachers learned equally in both modes of instruction. [11], reported significant learning increase when pre-service teachers worked in a paired condition using computer-based instruction that was designed for individual learning. [10], conducted a non-equivalent control group design study and found that the CAI treatment group did significantly better than the control group on concept understanding

In CAI situation, where every learner is at an individual workstation within a network, those needing help with an assignment can send a message to the instructor, or to other learners, without disturbing others in the group specifically, with the aid of electronically scanning the display screens of a particular class member, or of the entire class in turns. The teacher can monitors learner's progress, and respond immediately, quietly and privately without disturbing the class where help, encouragement, or even discipline is needed. The feedback may be given by sending a message to the learner or by interviewing directly in the learner's programme to make suggestions, use illustrative examples, and provide on-line counseling. The teacher can broadcast a learner's display screen to every other workstation in the network when he is working on a program or problem that may be of interest to the rest of the class. This development and that of interaction between learners elicit the objection of those who complain of "computer obstructed education". Their objection is that the individualized nature of CAI did not enable learners to work together as in social situation interacting, learning from, teaching and examining one another.

In a CAI, the sequence of learning and the amount of time spent on learning tasks are determined by the performance of the learners themselves. Also in CAI, the achievement of each learner is assessed against a given performance standard rather than against the performance of other learners. In all these, CAI is in line with our concept of continuous assessment as a given chance-oriented teaching-learning process.

III. METHODOLOGY

Following the literature review, the following hypotheses were established:

Ho_1: Using Computer Assisted Instructional Method has no significant effect on coursework marks.

Ho_2: Using Computer Assisted Instructional Method has no significant effect on final examination marks.

Ho_3: Using Computer Assisted Instructional Method has no significant effect on overall course marks.

The first group (Group A) of 60 students was exposed to printed textbooks, lecture notes and reference books with regular discussions; contact hours with the lecturer were regular with all members of the group meeting the lecturer at least one hour per week. The other group (Group B) of 60 students ware more independent and attended one hour per week with discussion sessions without any lecture, no paper textbooks or reference used. All books replaced with CAI software electronic book. The electronic book contained the same contents from the regular printed textbooks that were used in the previous group.

Students are from different combinations- ranging from Computer/Mathematics, Computer/ Physics, Computer/Integrated and Computer/Economics- over a period of two semesters. In order to eliminate different evaluation standards from different lecturers, the samples are all students of the same lecturer. Continuous assessment (Course Work) and final examination questions over the period were of the same standard and difficulty. Group A was taught with

conventional method, while group B with CAI electronic book.

TABLE I
SHOWS THE NUMBER OF SAMPLES INVOLVED IN THE EXPERIMENT

	CSC/Math	CSC/Phy	CSC/ISC	CSC/Eco	Total
A	17	20	10	13	60
B	15	15	20	10	60
Total	32	35	30	23	120

Key: CSC ==> Computer Science Course, Math ==> Mathematics, ISC==>Integrated Science, Eco ==> Economics, Phy==> Physics

Fig. 1(a) A table contains number of sample used for the experiment

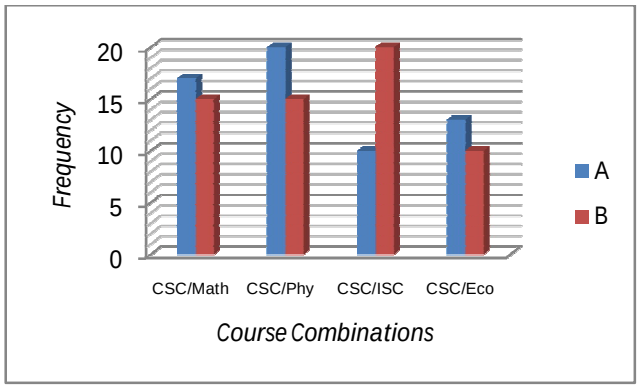

Fig. 1(b) A chart depicts number of sample used for experiment

IV. ANALYSIS and FINDINGS

All hypotheses were separately tested for statistical significance using SPSS 10.0. The hypothesis testing were first performed on the course work, then on examination and finally on overall course marks (total scores) of the groups.

TABLE II

It shows the total number of students with the mean and standard deviation. So also the Independent Sample Test for course work.

Group Statistics

	Groups	N	Mean	Std. Deviation	Std. Error Mean
Course Work	1.00	60	32.8500	7.0466	.9097
	2.00	60	24.1500	5.4860	.7082

Fig. 2 A table shows the descriptive number of group A and B for course work.

Independent Samples Test

		Levene's Test f ality of Variar		t-test for Equality of Means					
		F	Sig.	t	df	g. (2-taile	Mean ifferenc	td. Erro ifferenc	5% Confidenc nterval of the Difference Lower	Upper
Course	Equal var assumed	.000	.989	7.546	118	.000	8.7000	1.1529	6.4169	10.9831
	Equal var not assur			7.546	111.305	.000	8.7000	1.1529	6.4155	10.9845

Fig. 3 A table shows independent sample t-test between group A and B for course work.

An independent-samples t-test was conducted to compare Group A (Conventional Method) and Group B (Using Computer Assisted Instructional Method). There was significant difference in scores for group A (M=32.85, SD=7.05) and Group B [M=24.15, SD=5.49; t(118)=7.55, p=.00]. The magnitude of the differences in the means was very large (eta squared=.33).

TABLE III

It shows the total number of students with the mean and standard deviation. So also the Independent Sample Test for examination.

Group Statistics

	Groups	N	Mean	Std. Deviation	Std. Error Mean
Examination	1.00	60	52.0500	5.7914	.7477
	2.00	60	40.8667	5.6312	.7270

Fig. 4 A table shows the descriptive number of group A and B for examination

Independent Samples Test

		evene's Test fo ality of Varian		t-test for Equality of Means					
		F	Sig.	t	df	g. (2-taile	Mean ifferenc	td. Erro ifferenc	5% Confidenc Interval of the Difference Lower	Upper
Examina	Equal vari assumed	.316	.575	10.724	118	.000	11.1833	1.0428	9.1182	13.2484
	Equal vari not assum			10.724	117.907	.000	11.1833	1.0428	9.1182	13.2485

Fig. 5 A table shows independent sample t-test between group A and B for examination.

An independent-samples t-test was conducted to compare Group A (Conventional Method) and Group B (Using Computer Assisted Instructional Method). There was significant difference in scores for group A (M=52.05, SD=5.79) and Group B [M=40.87, SD=5.63; t(118)=10.72, p=.00]. The magnitude of the differences in the means was very large (eta squared=.49).

TABLE IV

It shows the total number of students with the mean and standard deviation. So also the Independent Sample Test for total scores.

Group Statistics

	Groups	N	Mean	Std. Deviation	Std. Error Mean
TSCORE	1.00	60	84.9000	10.1409	1.3092
	2.00	60	65.0167	7.9372	1.0247

Fig. 6 A table shows the descriptive number of group A and B for total scores.

Independent Samples Test

		Levene's Test for uality of Varianc		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	ig. (2-tailed	Mean ifference	Std. Error ifference	Lower	Upper
TSCOF	Equal variar assumed	1.304	.256	11.960	118	.000	19.8833	1.6625	6.5911	3.1756
	Equal variar not assume			11.960	11.562	.000	19.8833	1.6625	6.5891	3.1775

Fig. 7 A table shows independent sample t-test between group A and B for total scores.

An independent-samples t-test was conducted to compare Group A (Conventional Method) and Group B (Using Computer Assisted Instructional Method). There was significant difference in scores for group A (M=84.90, SD=10.14) and Group B [M=65.02, SD=7.94; t(118)=11.96, p=.00]. The magnitude of the differences in the means was very large (eta squared=.55).

In tables 2, 3 and 4 above, it could be observed that two different tables were presented to a particular hypothesized analysis. The first presented tables were mainly descriptive group statistics that showed mean and standard deviations of the two groups: 1 (Group A) and 2 (Group B).

Critical observation into these tables (2,3 and 4) revealed a wide difference in the means: Table1- (A-32.9) compared with (B-24.2), Table2- (A-52.1) compared with (B-40.9) and Table3- (A-84.9) compared with (B-65.0) as well as standard deviations: Table1- (A-7.05 compared with B-5.49), Table2- (A-5.79 compared with B-5.63) and Table3- (A-10.14 compared with B-7.94). From these findings, the standard deviations gave a more accurate value to interpret the difference in their means. Collectively, the standard deviations in the tables 2,3 and 4 above showed that 2 (Group B) means were far better than 1 (Group A).

In order to show clearly, the differences between the groups, t.test (Independent Samples Test) was conducted. Tables 2, 3 and 4 also showed the results obtained from the t.test tables.

Since the significant Levene's test for equality of variance in the t.test tables was greater than .05, equal variance assumed values were used, which showed significant results on the formulated hypotheses: Table1- t(118)=7.55, P<.05, Table2- t(118)=10.72,P<.05 and Table3- t(118)=11.96, P<.05 respectively.

The results from t.test tables showed that all the three hypotheses were significant, in another words they were all rejected but the results did not show the magnitude of the differences in the means of the two groups. To ascertain this, eta squared was conducted for the three hypotheses using mean scores and standard deviations of each group. At the end, the results showed that there was a large magnitude of the differences in their means, showing that the extent at which 2 (Group B) performed better than 1 (Group A) was very large. Conclusively, it is possible to say that the difference between these means can be attributed to Computer Assisted Instructional Method usage as shown clearly on the tables. Also it is due to the fact that group B students were exposed to treatment (CAI) which gave them opportunity to interact with the computer on their own at other time after the normal classroom lecture. They also saw the method as a chance to be exposed to a new technology and also appreciated the design of CAI packages to teach some concepts in computer science.

The likely intervening variable of one group using material prepared for the other group was controlled. No student from one group had access to another group's material. Still, the results of this research did not take age and maturity of the students into consideration during randomization of the samples.

IV. Conclusions

Since all three hypotheses were significant, it is possible to state that using computer Assisted Instructional Method does have significant effect on student s' performance. By saying this, it is believed that incorporating Computer Assisted Instructional Method (CAIM) into conventional teaching method and enforcing teachers to embrace it are ways of increasing the educational value, promoting learning and providing students with good experiences. CAI has the knowledge, and the expertise to provide instruction for learners [13].

This experiment was done to tell teachers of various schools to embrace the use of computer to prepare CAI package that can be used to teach a new concepts in their fields of study. In the cause of preparing the CAI packages it must be borne in their minds that age, environment, maturity, level and other factors are very important to be considered.

References

[1] A. Adedina, L. Bolaji, and T. Oyetoro, " Computer Assisted Instruction" Retrieved on the 16th October, 2010 from www.info.com.

[2] I. A. Adeleke,M. A. Rahman, and I.O. Muraina, " Fundamentals of Computing", Lagos, Paranormal Communications, 82-88, 2011.

[3] A.B .Adewumi," The Computer Age", Retrieved on the 16th October, 2010 from www.wikipedia/encyclopedia/ computerage, 2008.

[4] Association for Educational Communications and Technology, Educational technology: Definition and glossary of terms (Vol. 1). Washington, D.C.: Association for Educational Communications and Technology, 1977.

[5] S. A. Bakar,"Teaching Multimedia Through Computer Supported Collaborative Work (CSCW)", Paper presented at the International conference on IT & Multimedia (ICIMU, 98), 28-29,1998.

[6] K. G. Brown, " Using computers to deliver training: Which employees learn and why?", Personnel Psychology, 54, 271-296,2001.

[7] E. P. Christmann, and J.L. Badgett, " The comparative effectiveness of CAI on collegiate academic performance", *Journal of Computing in Higher Education, 11(2), 91-103*, 2000.
[8] D. A Coffland, " Factors related to technology use by secondary geometry teachers", Unpublished Dissertation, Idaho State University, Pocatello, ID, 1999.
[9] D. W. Dalton and M. J. Hannafin , " The effects of video-only, CAI only, and interactive video instructional systems on learner performance and attitude: An exploratory study". *Paper presented at the Annual Convention of the Association for Educational Communications and Technology*, Las Vegas, NV, 1986.
[10] C. L. Glickman, " The effects of computerized instruction in intermediate algebra. Dissertation Abstracts International", 61 (5), 1773A. (UMI No. 9973965), 2000.
[11] K. S. Ivers and A. E. Barron," Using paired learning conditions with computer-based instruction to teach preservice teachers about telecommunications. Journal of Technology and Teacher Education, 6(2-3), 183-191, 1998.
[12] O.James," Software Design Process". Retrieved on the 17th November, 2009 from www.answer.com, 2000.
[13] J. Okediran, " Interactive Multimedia Technology. Retrieved on the 3rd October, 2009 from www.alltheweb.com, 1998.
[14] K. Passerini," A comparative analysis of performance and behavioral outcomes in different modes of technology-based learning. Unpublished Dissertation, George Washington University, Washington D.C., 2000.
[15] B.E. Wesley, G. H. Krockover, and C. R. Hicks, C. R.," Locus of control and acquisition of computer literacy". *Journal of Computer-Based Instruction, 12(1), 12-16*, 1985.