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THE JOURNAL

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TEACHERS' AWARENESS OF THE USE OF COMPUTER ASSISTED INSTRUCTION (CAI) IN TEACHING SECONDARY SCHOOL MATHEMATICS

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Abstract

Colleges and universities are trying alternative instructional approaches to improve the teaching of mathematics with the goal of increasing the number of students who have the skills and knowledge required for the twenty-first century workforce. Computers and the internet make possible new methods of delivering instruction so that students will have choices of when, where, and how they learn mathematics. The purpose of the study was to investigate the extent of availability and use of computer assisted instruction (CAI) in teaching and learning of school mathematics. In addition, gender differences in the awareness and use of CAI were also investigated. The research design was survey. It was conducted in Enugu East LGA of Enugu State. The 106 mathematics teachers comprising of 70 females and 36 males in 14 secondary schools in Enugu East LGA were used for the study. A 32-item questionnaire was used in collecting the data. Mean and standard deviation were used in answering the two research questions. Mathematics teachers are aware of how to use drill and practice package. They are aware of how to use about 50% of tutorial package. They are not aware of how to use problem solving, discovery and simulation CAI packages at all. Based on the results of this study, it was recommended that the ministry of education and/or its agent should organize intensive workshops for mathematics teachers on how to use the five CAI packages in teaching and learning mathematics effectively in secondary schools. It is recommended that the ministry should organize similar workshops for teachers on other areas with regards to these five CAI packages in various subject areas.

Introduction

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 (Wiki-Educator). CAI utilizes a combination of text, graphics, sound and video in enhancing the learning process. There are various terminologies for computer assisted instruction (CAI). They are computer aided information (CAI), computer assisted learning (CAL), computer based education (CBE), computer based instruction (CBI), computer enriched instruction (CEI) and computer managed instruction (CMI) (Ewe, 2013). Some new terminologies have been coined for CAI. They are web based training, web based learning and web based instruction. According to Wiki-educator, computer based education (CBE), and computer based instruction (CBI) are the broadest terms and can refer to virtually every type of computer used in teaching and learning. It is important to note that computer assisted instruction (CAI) or computer aided instruction (CAI) is a narrower terminology. This narrower term refers most to drill-and-practice, tutorial or simulation activities. However, computer managed instruction (CMI) refers to an instructional strategy whereby the computer is used to provide learning objectives, learning resources, record keeping, programs tracking and assessment of learner performance (Okechukwu and Udebunu, 2013). Again, computer based tools and application are employed to help the classroom teacher or school administrator in the management of the learner and instructional process.

Note that CAI is a self-learning technique that may be usually offline or online, and involves interaction of the student with programmed instructional materials. CAI uses a combination of text, graphics, sound and video in increasing the learning process. The computer has various purposes in the classroom (Ewe, 2013). It can be used to assist the student in every area of teaching and learning. In other words, CAI refers to the utilization of computer as a tool that can facilitate and enhance instruction in the classroom. The programmes of CAI utilize tutorials, drill and practice, simulation and problem solving approaches to present topics. They test students' understanding of concepts learnt. There are different kinds of computer assisted instruction. They are as follows (Okechukwu and Udebunu, 2013): The first is the tutorial. Tutorial activity includes both the presentation of information and its extension into different forms of work, including drill and practice, games and simulations. The second is drill and practice which provides students opportunities to repeatedly practice the skills that have previously been presented and that further practice is necessary for mastery. The third is the problem solving. This approach helps children to develop specifics to a course or content area and challenges the learner to analyze, compare, infer and evaluate based on their explorations of the data. Another type is games. The games software usually creates a contest to achieve the highest score and either beat others or beat the computer. The last is simulation. The simulation software provides a close approximation of reality that does not require the expense of real life or its risks. CAI has several advantages. It is a one-to-one interaction. It is a great motivator. It provides freedom to experiment with different options. CAI provides instantaneous response/immediate feedback to the answers elicited. It gives room for self pacing by allowing students to proceed at their own pace. CAI assists the teacher to devote more time to individual students. It provides opportunity for privacy which helps the shy and slow learners to learn. CAI gives room for individual attention. It assists students to learn more and more rapidly. The multimedia in CAI helps students to understand difficult concepts through multi-sensory approach. Lastly, it gives room for self directed learning. This means that students can decide when, where and what to learn (Iloanusi 2013).

However, there are some limitations of CAI. Students may feel overwhelmed by the information and resources that are available. Again, over use of multimedia may divert the attention from the content. Learning becomes too mechanical with CAI. There is non-availability of good CAI packages. There also exists lack of infrastructure. With the above information, CAI can be used effectively to enhance mathematics instruction in the classroom despite its limitations. Students' mathematics performances have been deteriorating over the years in senior school certificate examinations (WAEC, 2014, NECO, 2014; Ngugah, 2013; Iloanusi, 2013). All efforts to use all available techniques in mathematics teaching and learning to enhance teaching and learning proved abortive. Hence, the need arose to ascertain the extent of the availability and use of CAI in effective teaching and learning of mathematics in secondary schools. Students are very much interested in computer and its manipulations with respect to use of cell phones, laptops, notebooks, desktops, internet, etc (Okechukwu and Udebunu, 2013). Perhaps, their interest in information and communication technology facilities when used in teaching and learning mathematics may arouse their interest in mathematics.

Purpose of the Study

The purpose of the study was to investigate the extent of availability and use of computer assisted instruction (CAI) in teaching and learning of school mathematics. Specifically, the study sought to ascertain the extent of;

1. Male and female teachers' awareness of different aspects of CAI?
2. Awareness of use of software packages in teaching and learning of mathematics.

Research Questions

The following research questions guided the study:

1. To what extent are male and female mathematics teachers aware of different packages of CAI in teaching mathematics effectively?
2. To what extent are male and female mathematics teachers aware of the use of six different CAI packages to teach mathematics in secondary schools effectively?

Method

The research design was survey. This study was conducted in Enugu East LGA of Enugu State. There were 106 mathematics teachers comprising of 70 females and 36 males. Due to the smallness of the population size, the entire population of 106 mathematics teachers in 14 secondary schools in Enugu East LGA was used for the study.

Results

Table 1 shows the results for research question 1

Table 1: Mean Scores and Standard Deviations on Extent of Availability of CAI in Secondary Schools.

S/N	To what extent are each of the following CAI packages available in your school?	Male			Female			Overall		
		$\bar{X}$	SD	DEC	X	SD	DEC	X	SD	D
1	Tutorial package	3.16	0.81	GE	2.96	0..72	GE	3.06	0.76	GE
2	Drill and practice package	3.22	0.58	GE	3.41	0.66	GE	3.32	0.62	GE
3	Discovery package	1.82	0.92	LE	1.52	0.92	LE	1.67	0.92	LE
4	Games package	2.84	0.61	GE	2.99	0.90	GE	2.90	0.76	GE
5	Simulation package	1.41	0.82	LE	1.31	0.71	LE	2.72	0.77	GE

	GRAND MEAN	2.49	0.75		2.44			2.73		GE

Table 1 shows that both male and female teachers are aware of tutorial, drill and practice and games packages to a great extent. Both sexes are aware of the discovery and simulation packages to a low extent.
Table 2 shows the results for research question 2.

Table 2: Mean Scores and Standard Deviations on Awareness of the Use of CAI in Secondary Schools.
Section A: Tutorial Package CAI

S/N	To what extent are you aware that tutorial package can be used as follows?	Male			Female			Overall		
		$\bar{X}$	SD	DEC	X	SD	DEC	X	SD	Dec
6	a set of instruction to complete a maths task	3.10	0.22	GE	3.26	0.48	GE	3.18	.33	GE
7	an intera ctive problem solving in maths	2.96	.66	GE	2.52	.77	GE	2.74	.71	GE
8	a method of transferring knowledge to maths students	3.51	.72	GE	3.41	0.61	GE	3.46	.66	GE
9	for presentation of the view usually explained and showing the user the interface	2.00	.76	LE	2.18	.91	LE	2.09	.86	LE
10	for demonstration of a maths process using examples to show how a workflow or process is completed, often broken up into discrete modules or sections	2.76	.58	GE	2.67	.21	GE	2.72	.63	GE
11	a method of review that reinforces or tests understanding of the maths content in the related module or section	3.66	.52	GE	3.48	.46	GE	3.57	.48	GE

12	a transition to additional maths modules or sections that builds on the instructions already provided	2.51	.94	GE	2.36	.66	LE	2.44	.80	LE

Dec= decision

SECITON B: Drill and Practice CAI

To what extent are you aware that drill practice software can be used as follows?

13	to teach repetition of specific skills e.g. addition, subtraction, multiplication, division	3.26	.58	GE	3.11	.76	GE	3.19	.68	GE
14	to ensure students acquisition of knowledge through repetitive practices	3.48	.91	GE	3.52	.86	GE	3.50	.88	GE
15	To break facts into small tasks	2.98	.49	GE	2.89	.63	GE	2.94	.55	GE
16	to help learners master materials at their pace	3.72	.41	GE	3.62	.55	GE	3.67	.46	GE
17	Drill and practice can be used as a reinforcement tool	3.52	.70	GE	3.48	.58	GE	3.50	.63	GE

SECITON C: Problem Solving Package CAI

To what extent are you aware that problem solving software can be used as follows?

18	Problem solving CAI can be used	1.	0.	LE	1.	.0	LE	1.	.0	LE

	as a generic method in an orderly manner for finding solutions to problems	0 0 0	0 0		0 0	0		0 0	0	
19	an adhoc method in an orderly manner for finding solutions to problems	1 . 2 2	. 0 9	L E	1 . 2 5	. 1 0	L E	1 . 2 4	. 1 0	L E
20	Problem solving can be used to help maths students understand the problem	2 . 9 6	. 9 2	G E	3 . 0 2	. 7 7	G E	2 . 9 9	. 8 4	G E
21	It can be used to help maths students know what rules could be applied in solving a problem	1 . 5 6	. 4 8	L E	1 . 4 5	. 6 1	L E	1 . 5 1	. 5 4	
22	to enhance students abstract thinking in maths	2 . 0 0	. 7 9	L E	1 . 9 5	. 8 0	L E	1 . 9 8	. 8 0	L E
23	to enhance students creative solutions to maths problems	2 . 2 2	. 6 0	L E	2 . 3 1	. 5 1	L E	2 . 2 7	. 5 5	L E

SECITON D: Discovery Package. CAI

To what extent are you aware that discovery CAI can be used as follows?

24	The discovery CAI software can be used to help students find how to solve given problems	1 . 2 0	. 4 9	L E	1 . 3 1	. 6 2	L E	1 . 2 6	. 5 2	L E
25	The maths discovery software can be used regularly in	1 . 0 0	. 0 0	L E	1 . 0 1	. 0 0	L E	1 . 0 0	. 0 0	L E

SECITON E: Games Software CAI

To what extent are you aware that games CAI software can be used as follows?

26	in teaching students how to play the maths game	2.11	.72	LE	2.02	.55	LE	2.07	.63	LE
27	to supplement teaching in maths	2.31	.42	LE	2.22	.52	LE	2.27	.47	LE
28	to illustrate related topics in maths	1.98	.62	LE	2.01	.43	LE	2.00	.53	LE
29	to motivate students interest in maths	2.11	.23	LE	2.06	.22	LE	2.09	.23	LE

SECTION F: Simulation CAI

To what extent are you aware that simulation CAI software can be used as follows?

30	Computer simulation CAI can be used to reproduce behavior of a mathematical system in the classroom	1.11	.06	LE	1.21	.11	LE	1.16	.09	LE
31	Simulation can be used to demonstrate a mathematical modeling of many natural systems in physics, chemistry, biology, etc.	1.19	.10	LE	1.21	.16	LE	1.20	.12	LE
32	Simulation can be used to demonstrate an abstract model such as computer model or computer tutorial model to stimulate the system.	1.00	.00	LE	1.00	.00	LE	1.00	.00	LE

Table 2 shows sections A to G of the questionnaire. The results for section A on tutorial package show that male and female teachers are aware that six and five items can be used to enhance

teaching and learning of mathematics respectively. The results for section B (drill and practice CAI) show that both male and female teachers agreed to a great extent that all the five items can be used to enhance the teaching and learning of mathematics. The results for section C (problem solving CAI) show that male and female teachers agreed to a low extent with only one item and disagreed to a great extent with five items. The findings for section D (discovery CAI) shows that male and female mathematics teachers disagreed with each of the three items to a great extent. For section E (games software), the findings show that both male and female teachers agreed to a low extent with each of the four items. For section F (simulation CAI), the results in Table 2 show that both male and female teachers agreed with each of three items to a low extent.

Discussion

The results for research question one in Table 1 shows that male and female teachers are aware to a great extent of tutorial, drill and practice and games package/software CAI in teaching and learning mathematics effectively. They are aware to a low extent with regards to discovery and simulation CAI. This finding portrays that both sexes know that these packages (tutorial, drill and practice and games) can be used to enhance the teaching and learning of mathematics. They equally do not know much about discovery and simulation CAI. If they are not aware of discovery and simulation aspects of CAI, they cannot go for it for classroom use. A teacher can only use what he/she is aware of or knows in teaching mathematics. This finding is in agreement with the finding of Okechukwu and Udebunu 2014).

The results in Table 2 show that male and female teachers are aware that about 50% (half) of the items under tutorial package can be used in teaching mathematics in secondary schools effectively. In other words, they are not aware that the remaining 50% can be used effectively in teaching mathematics. This means that these male and female teachers are not fully knowledgeable on how to use CAI tutorial package in teaching mathematics. This finding agrees with the findings of five (Ewe 2013) that most teachers are not ICT compliant.For drill and practice, both male and female teachers are aware to a great extent that every item in Section B can be used to enhance effective teaching and learning of mathematics. This is the only aspect of CAI that both male and female teachers are very conversant with. The results for section C (problem solving package) shows that both male and female teachers are not aware of how to use the CAI problem solving package at all. They are ignorant of its use. The only item where they responded great extent is on using problem solving to help mathematics students understand the problem. This response may have arisen from them because of their familiarity and use of Polya's problem solving technique in teaching mathematics. Understanding the problem is the first step in Polya's problem solving technique.

For discovery, games and simulation CAI packages, both male and female teachers are not aware that any of them can be used to enhance effective teaching and learning of mathematics. This means that teachers do not actually know and/or comprehend that each of these three can be used to improve teaching and learning of mathematics in secondary schools. This is a bad omen because teachers are denying our students means of improving their poor knowledge of mathematics. This finding agrees with the finding of Okechukwu and Udebunu (2014), that lack of knowledge for using ICT is one constraint that hinders effectively teaching in schools.

Conclusion

From the findings of the study, male and female teachers agree that CAI tutorial package, drill and practice package and games package are available in their schools while discovery and simulation packages are not available. Secondly, male and female mathematics teachers are aware

of how to use drill and practice package. They are aware of how to use about 50% of tutorial package. They are not aware of how to use problem solving, discovery and simulation CAI packages at all.

Recommendations

From the above results, the ministry of education and/or its agent should make available to all schools all the CAI packages and ensure that there is standby generator to provide electricity. They should also organize intensive workshops for mathematics teachers on how to use the five CAI packages in teaching and learning mathematics effectively in secondary schools. It is recommended that the ministry should organize similar workshops for teachers on other areas with regards to these five CAI packages in various subject areas.

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