
Effects of Computer Assisted Instruction Package on Achievement of Pre-Service Integrated Science Teachers at Different Levels of Scientific Literacy

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Abstract

This study investigated the effects of Computer Assisted Instruction Package (CAIP) on achievement of pre-service Integrated Science teachers at different levels of scientific literacy. A quasi- experimental design was used. The sample consisted of 79 pre-service Integrated Science teachers from two intact classes in two Colleges of Education in Delta North Senatorial District of Delta State. Two research questions and two hypotheses tested at 0.05 level of significance guided the study. Two instruments namely, Scientific Literacy Test (SLT) and Integrated Science Achievement Test (ISAT) were used for

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data collection. Before the commencement of treatment, ISAT were administered as pre-test to the experimental and control groups. While SLT was used for categorizing the subjects into High, Medium and Low levels of Scientific Literacy. At the end of the treatment, ISAT was administered on the pre-service teachers as post test. Data collected were analyzed using Mean and Standard deviation to answer the research questions and Analysis of Covariance (ANCOVA) to test the hypothesis. Results show that CAIP enhanced achievement of Pre-service Integrated Science teachers better than the expository method. Pre-service Integrated Science teachers at high, medium and low levels of scientific literacy exposed to CAIP recorded higher mean achievement scores than those at the same levels of scientific literacy exposed to expository method of teaching. Based on the findings of this study, CAIP is recommended to Lecturers as an effective method for enhancing pre-service Integrated Science teachers' achievement in Integrated Science in Nigeria Colleges of Education.

The performance of pre-service teachers in science subjects in general and Integrated Science in particular in semester examination and in final examinations have remained persistently poor over the years. However, many factors have been attributed to be responsible for the poor performance of students; prominent among these is the predominant use of lecture method by lecturers for teaching Integrated Science. The lecture method is a teacher centered method of teaching that subjects learners to be passive listeners to lesson instead of active participants in the lesson. There is need to seek ways of improving the pre-service Integrated Science teachers' performance through the use of innovative activity based teaching methods. The technological development that took place in the last quarter of the 20th century has ushered in a lot of changes in the way knowledge is acquired (London, 2005). A lot of scientific information for instance can be acquired through visual enriched resources like computers, internet and television. The use of computer technology in science teaching and learning in some countries of the world is one of the far-reaching and fast growing developments that have occurred.

Computer programmes can be used both as teaching strategy and as instructional material for fostering interest and enhancing achievement in various school subjects. Basturk (2008) stated that the use of computer as instructional tool in science lesson makes the lesson not only interesting and more meaningful to the learner, but also enables the learner to acquire a wide range of skills in Information and Communication Technology (ICT). A number of computer programmes such as Computer Assisted Instruction (CAI), Computer Based Learning (CBL), Web-Based Learning (WBL), on-line Learning among others have been developed for use in classroom instruction.

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Computer Assisted Instruction (CAI) has been found to be effective in the teaching and learning of various subjects like handwriting, social studies and language development (Egunjobi, 2002). There is need to investigate its efficacy in the teaching and learning of Integrated Science in Colleges of Education in Delta State. Also, research findings have shown that computer programmes enhance achievement in social studies (Ajelabi, 1998); Geography (Egunobi, 2002); Chemistry (Okoro & Etukudo, 2001); and Mathematics (Udousoro, 2008). However, the effective uses of computer assisted instruction in learning Integrated Science depends to a great extent on the scientific literacy level of the pre-service integrated science teacher. Scientific literacy is the knowledge and understanding of scientific concepts and processes that will enable an individual to make personal decision, participate in civil and cultural affairs, and become economically productive. Scientific literacy according to Hurd (1998) is seen as a civic competency required for rational thinking about science in relation to personal, social, political, economical problems and issues that one is likely to meet throughout life. It is simply a combination of concepts, history and philosophy that helped in understanding the scientific issues. It is the capacity to use scientific knowledge to identify questions and draw evidence based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity.

A person with good scientific literacy will not only have the understanding, but develop a perspective of science and technology that includes the nature of science, the role of science and technology in personal life which involves the use of computers. There is need to investigate the efficacy of computer assisted instruction in enhancing achievement among Pre-Service Integrated Science teachers in Colleges of Education in Delta State.

Statement of the Problem

The performance of pre-service science teachers in science subjects in general and Integrated Science in particular in both semester examinations and in final examination for the award of Nigeria Certificate in Education have remained persistently poor over the years. This has been attributed to the method employed in the teaching/learning process. The introduction of Computer as an instructional tool and as a method of teaching to compliment the traditional method of teaching is gaining prominence all over the world and it has been found to enhance achievement in science subjects in some developed and developing countries of the world, Imhanlahimi (2008). The use of computer in the classroom has given rise to computer assisted instruction software packages for classroom instructional purposes. Therefore, the position of integrated science makes it necessary for the use of innovative pedagogical strategy that will enable lectures meet the challenges of teaching and learning of the subject especially in the era of information age. The use of CAI provides the learner with

different backgrounds and characteristics. Using teaching software such as CAI, concepts are presented to the learners in such a well organized manner that makes for greater clarity and easier understanding. One wonders if computer assisted instruction, if applied in the teaching of Integrated Science in Colleges of Education would enhance achievement of pre-service Integrated Science teachers. This study therefore, investigated the effect of computer assisted instruction package on achievement of the pre-service Integrated Science teachers at different levels of scientific literacy.

Purpose of the Study

The purpose of the study was to ascertain the effect of computer assisted instruction package on achievement of Integrated Science teachers at different levels of scientific literacy.

Specifically, the study aimed at finding out;

1. the effects of computer assisted instruction package on academic achievement of pre-service Integrated Science teachers.
2. the effects of computer assisted instruction package on academic achievement of pre-service Integrated Science teachers at different levels of scientific literacy.

Research Questions

The following research questions guided the study:

1. What are the differences in the mean achievement scores of pre-service Integrated Science teachers exposed to Computer Assisted Instruction Package and those exposed to Expository teaching method?
2. How does the mean achievement score of pre-service integrated science teachers at different levels of scientific literacy taught with Computer Assisted Instruction Package differ from those taught with expository teaching method?

Hypotheses

Four null hypotheses were tested in the course of the study.

1. There is no significant difference ($p < 0.05$) in the mean achievement scores of pre-service Integrated Science teachers taught Integrated Science using the Computer Assisted Instruction Package and those taught using the expository method of teaching.
2. There is no significant difference in the mean achievement score of pre-service Integrated Science teachers at different levels of Scientific Literacy taught Integrated Science using CAIP and those taught using expository teaching method.

Research Design

The design is a quasi-experimental design; specifically the pre-test post-test non-equivalent control group design. This design is a suitable alternative to an experimental design when randomization is not possible (Gall, Borg & Gall, 1996). This design is appropriate as it controls threats to internal validity. The subjects in this type of design were not randomly assigned; intact classes of students were assigned to either the experimental groups or the control.

Methodology

The sample comprised all the 79 year one Pre-service Integrated Science teachers from Federal Colleges of Education (Tech), Asaba and Colleges of Education, Agbor in Delta North Senatorial district. Intact classes were used so there was no randomization of subjects into experimental and control groups, instead intact classes were randomly assigned to experimental and control groups. The experimental group comprised a sample of 27 pre-service Integrated Science Teachers and the teaching method that was used is the Computer Assisted Instruction, while the control group comprised a sample of 52 pre-service Integrated Science Teachers with expository teaching method as the method of instruction.

Instrument for Data Collection

Two instruments were used for data collection in this study; namely;

1. Scientific Literacy Test (SLT)
2. Integrated Science Achievement Test (ISAT)

These instruments were developed by the researcher and validated by panel of science educators. The reliability of SLT and ISAT was determined using Kuder Richardson formula 21 ($K - R_{21}$) and reliability co-efficient of 0.82 and 0.85 were obtained respectively.

Procedure for Data Collection

Two instruments were used for data collection in this study namely; Scientific Literacy Test (SLT), and Integrated Science Achievement Test (ISAT). These were administered on the pre-service Integrated Science teachers before the experiment. The SLT was administered and scores obtained were used to categorize the pre-service Integrated Science teachers into different levels (Low, Medium and High) scientific literacy, while Integrated Science Achievement Test (ISAT) was administered as pre test. After the treatment which lasted for four week, ISAT was re-administered to the pre-service Integrated Science teachers and the results obtained were used as the post test scores in the study.

Results

All research questions were answered using mean and standard deviation while the hypotheses were tested using ANCOVA at 0.05 level of significance. The results of the analysis are presented according to the research questions and hypotheses to which they pertain.

Research Question 1

What are the differences in the mean achievement scores of pre-service Integrated Science teachers exposed to Computer Assisted Instruction Package and those exposed to Expository Teaching Method?

Table 1: Mean Pre-test and Mean Post-Test Achievements Scores

Group	N	Pre-Test		Post-Test		Mean Gain
		Mean	SD	Mean	SD	
Control	52	47.500	1.139	53.943	10.679	06.433
Experimental	27	48.518	1.247	70.741	9.168	22.223
Total	79	47.849	1.171	59.684	12.919	

The post-test means achievement scores of pre-service teachers taught with ETM and those taught with CAIP are 53.943 and 70.741 with standard deviation (SD) of 10.679 and 9.167 with a mean gain of 06.433 for those taught with ETM and 22.223 for those taught with CAIP respectively. This means that pre-service teachers taught with CAIP have higher academic achievement than those taught with ETM. In order to make a decision on academic achievement based on the use of CAI and ETM in Integrated Science. Hypothesis one was tested.

Hypothesis One

There is no significant difference ($p < 0.05$) in the mean achievement scores of pre-service Integrated Science teachers taught Integrated Science using the computer assisted instruction and those taught using the expository method of teaching.

Table 2: ANCOVA Table on Pre-service Integrated Science Teachers Post-Test Achievement Scores

Score	Type II Sum of Squares	Df	Mean Square	f	Sig.
Corrected Model	5283.001	3	1761.000	17.077	.000
Intercept	28126.468	1	28126.468	277.752	.000
		6			

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Teaching Methods	1363.130	1	1363.130	13.219	.001
Literacy	3.130	1	3.130	.030	.082
Tm x Literacy	259.124	1	259.124	2.513	.117
Error	7734.088	75	103.121		
Total	294425.000	79			
Corrected Total	13077.089	78			

For hypothesis one, an examination of Table 2 reveals that the teaching method has F-value of 13.219 at 1 and 75 degrees of freedom. This is significant at the 0.05 level of significance. This is because the significance of $f = 0.001$ is less than 0.05 alpha level. This shows that CAIP and ETM produced significant difference on the post-test performance of pre-service integrated science teachers. Hence, hypothesis one was therefore rejected.

Research Questions 2

How do the mean achievement scores of pre-service integrated science teachers at different levels of scientific literacy taught with Computer Assisted Instruction Package differ from those taught with Expository teaching Method?

Table 3: Mean Pre-test and Mean Post-Test Achievement Scores at Different Levels of Scientific Literacy

Group	Scientific Literacy Levels	N	Pre-Test		Post-Test	
			Mean	SD	Mean	SD
Control	High	23	46.739	1.249	53.260	11.140
	Medium	24	46.459	1.027	52.917	10.313
	Low	5	56.000	9.618	62.000	8.367
	Total	52	47.500	1.139	53.943	10.67
Experimental	High	4	53.750	1.109	77.500	6.455
	Medium	14	51.429	1.232	69.643	10.825
	Low	9	41.667	1.146	69.445	6.347
	Total	27	48.519	1.247	70.740	9.168

On the pattern of achievement by Control (ETM) and experimental (CAIP) groups, it can be seen from Table 3 that the experimental group performed better than the control group at different levels of scientific literacy. The post test achievement mean score for the control group was 53.26 with SD of 11.14 for high scientific literacy level, 52.91 with SD of 10.31 for the medium scientific literacy level and 62.00 with SD of 8.36 for the low scientific literacy level. While the experimental group post test

achievements mean scores were 77.50 with SD of 6.45 for high scientific literacy level, 69.64 with SD of 10.82 for the medium scientific literacy level and 69.44 with SD of 6.34 for the low scientific level. To find out if the difference on the academic achievement of Pre-Service Integrated Science is based on the use of CAI at different levels of scientific literacy, hypothesis 2 was tested.

Hypothesis 2

There is no significant difference in the mean achievement scores of pre-service Integrated Science teachers at difference levels of scientific literacy taught Integrated Science using CAIP and those taught using expository teaching methods. Data in table 2 reveals that scientific literacy level was not a significant factor in pre-service teacher's performance in Integrated Science. An examination of data in table 2 shows that an $F(1,75) = 0.030$, $\alpha = 0.082$ for the literacy level was not significant at 0.05 alpha level. This result shows that the control group (ETM) performance did not differ significantly from that of the CAI group when both were taught at different levels of scientific literacy. This is due to the fact that both groups showed high performance in the post-test. Therefore, the hypothesis was not rejected.

Discussion

The study has revealed that pre-service teachers using CAIP performed significantly better than pre-service teachers taught using ETM. The trend of higher performance by the Experimental group could be as a result of interactive activity provided by the CAIP which helped the pre-service teachers to easily understand difficult concepts in integrated science. Also, it could be as a result of the outright elimination of lecturer's bias as well as strained relationship of the lecturers and pre-service teachers, the excitement over the new approach and the handling of personal computer must have contributed to this higher performance. The above findings appear to corroborate the findings of Egunjobi (2002), Kareen (2003), Onasanya & Asuquo (2006) Udousoro (2000). However, the findings of this study with respect to achievement in science contradict those of Jegede, Okebukola and Ajewole (1992) and Olikeze (1995) in which they reported that CAI had no effect on science achievement. The advantage of the use of CAIP could be explained based on the presentation of difficult scientific concepts with simulation and pictorial illustration. The simulation and pictorial illustrations were however observed to enhance achievement in science (Tabassun, 2004).

The finding of this study as presented in Table 3 indicated that the computer assisted instruction strategy produced the highest mean achievement score in integrated science for the high level scientific literacy group followed by the medium and low scientific literacy level groups respectively. The expository teaching method produced the highest mean achievement score in integrated science for the low level group

followed by the high and medium scientific literacy level groups respectively. However, the results on Table 2 show that the difference in the mean achievement scores at different scientific literacy levels in integrated science was not significant. Meanwhile, in the experimental group, the finding revealed that the higher the scientific literacy level of the students, the better their achievement in Integrated Science. This finding agreed with Nwagbo (1997) who investigated the effect of teachers' methods on achievement and attitude to biology among students of different levels of scientific literacy.

Also, the finding corroborates the observation of Ellington (1988) regarding the research into students of high and low achievers. However, the present study found that CAI strategy tended to enhance pre-service teachers achievement in Integrated Science at different levels of scientific literacy, although, it was not necessarily significant compared to expository teaching method.

Conclusion

The study had shown that CAIP had significant effect on the pre-service integrated science teachers' achievement. The Computer Assisted Instructional Package (CAIP) appeared to be outstandingly more efficacious to the expository teaching method (ETM) in engendering the stated criterion measures.

However, the study shows a non-significant CAIP effect on achievement in integrated science at different levels of scientific literacy, although the experimental group demonstrated a higher level of achievement towards integrated science as indicated in the mean achievement.

Recommendations

The following recommendations were made in view of the findings of this study:

1. Since the use of CAIP in teaching has been found to enhance the quality of achievement and interest in Integrated Science at the Colleges of Education, Integrated Science lecturers should be encouraged to use it more in the teaching of the subject. By so doing, the achievement of pre-service Integrated teachers could be enhanced.
2. The fact that high mean achievement and interest scores were recorded in the use of CAIP, it is therefore required for lecturers to acquaint themselves with the distinctive characteristics of these teaching techniques with a view to enhancing student's cognitive and affective outcomes of learning

3. Necessary attention should be accorded computer literacy and operation in the colleges of education and relevant computer assisted instructional packages should be developed with a view to make abstract scientific concepts concrete.
4. Adequate provision should be made for infrastructure in the Colleges to enhance effective use of CAIP for teaching.

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