EFFECTS OF MULTIMEDIA ASSISTED INSTRUCTIONAL STRATEGY ON THE ACADEMIC PERFORMANCE OF BIOLOGY STUDENTS IN SOME SELECTED SECONDARY SCHOOLS IN KATSINA STATE

N. USMAN
DEPARTMENT OF BIOLOGY
FEDERAL COLLEGE OF EDUCATION, KATSINA
J. RABE
DEPARTMENT OF BIOLOGY
FEDERAL UNIVERSITY, DUTSINMA, KATSINA
AND
M. MARWANA
DEPARTMENT OF BIOLOGY
ALQALAM UNIVERSITY, KATSINA
nuhuu@yahoo.com

Ab*stract*
This study investigated the effects of two instructional strategies i.e. computer assisted instruction and traditional method of instruction on gender learning and retention of biology concepts in secondary schools in Batsari Local Government under Dutsinma Educational Zone of Katsina State. Two groups were treated. The both experimental group was taught concepts in digestion of food using computer and their achievements were compared with that of control group who was taught some concepts using the traditional method of instruction. Pre-test and post-test results were analyzed to determine the effectiveness of the two instructional strategies. Three hypotheses were tested using the t-test statistics and the following major results were obtained. Students exposed to computer-assisted instruction achieved significantly higher than their counterparts, and those exposed to computer assisted instruction retained the learnt concepts significantly better than their counterparts exposed to traditional method of teaching. On the basis of the findings of this study, it is recommended that teachers in secondary schools of Batsari Local Government under Dutsinma Educational Zone of Katsina State should be encouraged to use computer in the teaching of biology to their students.

Keywords: Computer, Instructional strategy, Multimedia, Performance, Katsina

Introduction

Great emphasis is placed on the computer-based science and technology laboratories as well as ordinary science laboratories in the educational curricula of the developed countries. One of the aims of the science and technology course is to train individuals capable of keeping up with the fast developing and changing science world and capable of utilizing the recent technological discoveries in every field. Researchers have been interested in revealing the effects of the computer-based instruction, which began to be used with the invention of the computer, which is one of the most important technological devices of the time (Lin,2009).

As a result of the rapid development of the information and communication technology, the use of computers in education has become inevitable. The use of technology in education provides the students with a more suitable environment to learn, serves to create interest and a learning centred-atmosphere and helps increase the students motivation. The use of technology in this way plays an important role in the

teaching and learning process (Isman, Baytekin, Balkan, Horzum, *et.al* kiyici 2002). In parallel with the technological advances; technological devices, particularly computers began to be used in educational environments to develop audio-visual materials such as animation and simulation, which resulted in the development of computer- based instructional techniques.

The best example of the integration of science and technology is the computer-based instruction or computer-based/multimedia techniques. The use of computers in the teaching and learning activities is defined as Computer-Based Instruction (CBI). Computer-based instruction is the use of computers in the teaching and learning activities (Brophy, 1999). Computer-based instruction enables the students to learn by self-evaluating and reflecting on their learning process. Computer-based instruction motivates children to learn better by providing them with immediate feedback and reinforcement and, by creating an exciting and interesting game-like atmosphere. Studies in the field reveal that, the students' achievements increase when the computer-based instruction technique is provided as a supplement to the classroom education. Computer-based instruction is more effective on less successful children. The reason for this is that, the computer-based instruction enables children to progress at their own pace and provides them with appropriate alternative ways of learning by individualizing the learning process (Senemoglo, 2003). The most familiar function of the science education is to teach the children the science concepts in a meaningful way and enable them to learn how they can make use of these concepts in their daily lives (Cepni, Tas & Kose, 2006).

The computer-based teaching has had an impact on the development of the educational technology to a great extent in the 21st century. This had resulted in the production of software for the computer-based instruction. The primary purpose of the educational software is to solve the learning problems in science courses encountered by the senior secondary schools' students, to increase their motivation and achievements and to protect them against the negative effects of the rote-memory based educational system.

There are software –supported educational products designed to be used in the computer-based and computer-supported teaching practices. These are the products that teachers use as complementary materials for taking notes about their students' observations; making tables, developing materials, doing calculation, and preparing simple educational software. The educational software is used as a teaching material in the teaching of a part of a subject or the whole subject (Alkan, Deryakulu and Simsek, 1995; Isman, 2005).

According to Alessi and Trollip (2005), it is possible to divide educational software into five different types such as tutorial, drill and practice, simulation, educational games and hypermedia type. For effective and productive teaching, these techniques should be used with some classroom activities. These are: presentation, demonstration, practice and evaluation of learning (Ozmen, 2004). The use of computer technology enables learners to be active in the learning process to construct knowledge, to develop problem solving skills and to discover alternative solutions (Ozmen, 2008).

Among the senior secondary schools' students, girls use computer five (5) hours a week for the play purpose whereas boys spend thirteen (13) hours a week for the same purpose (Christakis, Ebel, Rivara and Zimmermen, 2004). The use of computer in teaching and learning environments is very important as the

children like it very much and can continue playing with it without ever getting bored. In our time, it is evident that, visual materials such as television and computer are utilized in every field. It is also evident that, computer attracts students very much. The use of the audio-visual devices and animations with instructional materials results in the enjoyable and productive learning process. In this way, the learning process can become enjoyable and interesting for students as a result of abolishing traditional classroom learning activities.

Technological developments give rise to new teaching and learning facilities. In our time, human beings keep on searching to find out how to use computer in educational activities in a more productive way rather than searching to reveal whether the use of computer in teaching and learning activities is effective (Kara and Yakar, 2008). Educational technologies, especially computers play an important role in concretizing abstracts concepts, which are difficult for students to learn, by means of animations (Akpinar, 2005).

The computer-based instruction makes teaching techniques more effective than those of the traditional teaching methods as it is used for presenting information, testing and evaluating and producing feedback. It makes a contribution to the individualization of learning. It motivates students and gets them to take an active part in the learning process. It helps to develop creativity and problem-solving skills, identity and self-reliance in learners. Computer-based/multimedia provides drawings, graphics, animations, music and plenty materials for the students to proceed at their own pace and in line with their individual differences. It serves to control lots of variables having an impact on learning, which cannot be controlled by

means of traditional educational techniques (Kasli, 2000; Chang, 2002).

Statement of the Problem

The traditional method of instruction may be too fast for some and too slow for others. This method of teaching forces the students to remain as passive element in learning processes and that results in poor performance of students in biology. Nigeria is now going in to 21st century of modern technological advancement with other nations. Even though, Nigeria does not have the same economic resources and development with those nations, currently computer is being used in teaching and learning different subjects in our schools. However, this research work aimed at showing the effect of computer-based education in senior secondary schools of Batsari Local Government and how the application of computer in teaching biology will promote active learning instead of passive learning.

Objectives of the Study

The study is geared towards achieving the following objectives: -
1. To investigate the possible ways of improving the performance of biology students through the application of computer-based in teaching and learning processes.
2. To find out the effect of computer-based/multimedia on the academic achievement of male and female students.
3. To investigate the role of computer-based instruction on students learning retention.

Research Questions

The study has the following research questions: -

1. What is the effect of computer-based/multimedia on the students' performances in biology?
2. Are there any effects of computer-based/multimedia on academic achievement of male and female students?
3. What is the effect of computer-based instruction on student learning retention?

Null Hypotheses

The study has the following hypotheses: -
1. There is no significant difference in performance of students taught using computer-based/multimedia and their colleagues taught using traditional lecture/method.
2. There is no significant difference between effects of computer-based instructions on student's academic achievement or performance.
3. There is no significant difference between the learning retention ability of students taught using computer-based/multimedia and their colleagues taught using traditional teaching method/lecture method.

Materials and Methods
Research Design

This study investigates the effects of computer-based/multimedia in teaching and learning of biology in secondary schools of Batsari Local Government in Katsina State. It is a survey and experimental study which focuses on variables. Thoroughly to have an idea of what other variables to consider in the use of computer in teaching and learning of biology.

Population of the Study

The six schools had a total population of 724 SSII students for the year 2014/2015. These students constituted the target population from which the sample was drawn. The population, therefore, included all male and female SSII students offering biology.

Sample and Sampling Procedure

In schools sampling, the total of secondary schools in Batsari local Government was written down. The sampling was done by specifying the type of sample used for the study counting from the list and picking every 1st name in the list until three (3) names of schools were sampled plus the last female school in the list. The schools sampled were as follows:-
- ✓ Government Pilot Day Secondary School Batsari (GPDSS)
- ✓ Government Day Senior Secondary School Yandaka Ruma (GDSSS)
- ✓ Community Day Secondary School Wagini (CDSS)
- ✓ Community Girls Day Secondary School Batsari.

S/N0.	Name of School	Type	Biology Students Enrolment		TOTAL
			Male	Female	
01.	G.P.D.S.S Batsari	Mixed	344	23	367
02.	G.D.S.S.S. Y/Rumah	Mixed	34	09	43
03.	C.D.S.S Wagini	Mixed	46	13	59
04.	C.D.G.S.S. Batsari	Female	69	66	135

Krejai and Morgan (1970) was used to determine the sample size for this research work as shown on the table above.

In sampling the subject or students to be used for evaluating both computer assisted instruction and lecture method,

pieces of papers were cut according to the number of students in the class (CAI) was written on pieces of paper according to the number of students required to be on the experimental group. Lecture was written on pieces of papers according to the number of students required to be in the control group and (NO) was written on the rest of the paper and the pieces of papers were tightly folded and kept in a container. It was shaken to ensure a good mixture. Students were called one-by-one at a time to pick while being blind folded. As they picked they opened the paper and saw what they picked and the researcher collected the pieces of papers from the students and kept it inside and then recorded the name of students only who picked (CAI) or (lecture) that their names will be recorded on the separate sheet (CAI) record sheet and (lecture) record sheet. At the end, the names of the students who picked (CAI) and (lecture) were selected and assigned into experimental and control groups respectively.

Instrumentation

The instruments used in collecting the data are questionnaire and test which would be conducted for the selected students.

1. A questionnaire which was intended to collect relevant information from the students and teachers. The questionnaires were of two types; questionnaire (A) for the teacher and questionnaire (B) was for the students. **Questionnaire type (A)**, was given to all biology teachers in the four secondary schools sampled in the research area, while **Questionnaire type (b),** was given to one hundred and sixty (160) students from the sampled schools in Batsari Local Government under Dutsinma

Educational Zone of Katsina State.
2. Test which was intended to evaluate the effectiveness of computer-based or computer assisted instruction and traditional method of instruction.

Validity of the Instrument

In order to ensure the validity of the instrument for this research work, the questionnaires were tested and administered to some students of Government Day Secondary School Ruma and Government Day Secondary School Kandawa all in Batsari Local Government Area under Dutsinma Educational Zone of Katsina State. The information gathered showed and determined a good understanding of the item asked through its administration. The questions were devoid of ambiguities and the responses obtained were as valid.

Reliability of the Instrument

This is the consistency with which a test measures what is supposed to measure. The questionnaire and test carried out for this purpose are dependable. The questionnaire is aimed to find out the effects and extent to which computer can be used to enhance effective teaching and learning of biology.

The questionnaire designed for this research work is valid as well as reliable, because the result obtained using the questionnaire can be used any time to obtain the result using the same format.

Administration of the Instrument

The four (4) selected secondary schools at Batsari under Dutsinma Educational Zone were visited by the researcher where he sought permission from the principals of the schools to distribute questionnaires to the students of the schools. One hundred and sixty (160) students were

served with the questionnaires by the researcher. The researcher however collected the questionnaires himself.

Approach to Data Analysis

The statistical technique or tool used in analyzing the data was t- test, and simple approach of comparisons of responses on percentage based was adopted.

The analysis was base on the tests and questionnaire administered.

Pilot Testing

The pilot test of this research work has been designed among three students who were not within the selected schools. The questionnaire was administered on them as well as the test, and the result was recorded below:-

STUDENTS	MARKS (CAI)	MARKS OF LECTURE METHOD
BABANGIDA	18	10
ONOJA	16	12
KHADEEJAT	12	17

The table above indicates that the application of lecture method of teaching with that of computer assisted instruction showed a significance variability in students' performances.

First student that is Babangida scored 18 (90%) marks out of 20 in Computer Assisted Instruction(CAI) in comparison to 10 (50%) marks in lecture method. The second student, that is, Onoja scored 16 (80%) marks in computer assisted instruction in comparison to 12(60%) marks in lecture method and the last student who was khadeejat scored 12 (60%) marks in computer assisted instruction in comparison to lecture method which is 17(85%).

It shows that computer assisted instruction is the most effective method of teaching and learning biology among the three students in comparison to lecture method. Though, one of the female respondent outperformed better in lecture method than computer assisted instruction.

Data Presentation and Analysis

The results obtained from the data analysis are presented in tables below:-

The analysis of covariance on the pre-test mean scores of the experimental group (E.G.1) and the control group (C.G. 2).

Table 4.1 comparison of pre-test mean scores of experimental group and control group.

GROUPS	N	X
Experimental Group	15	7.6
Control Group	15	7.5

It can be seen in table 4.1 above that, before any treatment is given, experimental group (E.G.1) attained the mean (X) scores of 7.6 and the control group attained the means scores (X) of 7.5 at pre-test.

Testing of Hypotheses
Hypothesis One

There is no significant difference in the performance of students taught using computer based instruction and those taught using the conventional lecture method.To test the hypothesis, the post-test

achievement scores of the experimental groups that is **E.G.1** and the control group

C.G.2 were compared using the t-test statistics. The result is shown in table 4.2.

Table 4.2 comparison of the post-test mean (X) score of experimental groups (E.G.1) and control group (C.G.2).

GROUPS	N	X	SD	ES	Calculated T-Value	Critical T-Value	Decision
Experimental Group	15	14.1	5.5	0.62	7.86	2.06	rejected
Control Group	15	13.3	4.5	0.51			

From table 4.2 the calculated t-value N=7.86 is greater than the critical t-value which is 2.05 at 0.05 with difference 28. This means that, the significant difference between the post-test scores of the experimental group and control group is in favor of the experimental group. Thus, the hypothesis implies that the experimental group taught using computer-based instruction achieved higher scores than the control group taught the same concept using the traditional method of teaching /lecture.

Hypothesis Two (2)

There is no significant difference between the learning retention ability of students taught using computer-based instruction (CBI) and their colleagues taught by traditional lecture method.

The data used to test this hypothesis were the post post-test achievement scores of both the experimental group (E.G.1) and the control group (C.G.2). The mean scores were subjected to t-test statistical analysis. The results are shown in table 4.3.

Table 4.3 comparison of the post-test mean scores of the experimental group (E.G.1) and control group (C.G.2) in the retention variable

GROUPS	N	X	SD	ES	Calculated T-Value	Critical T-Value	Decision
Experimental Group	15	13.1	5.5	0.85	17.47	2.05	rejected
Control Group	15	13.3	4.5	-0.75			

The result in the table 4.3 shows that the obtained t-value (calculated) is 17.47. This value is higher than that t-value (critical) of 2.05 at 0.05 with difference 28. This means that, there is a significant difference between the post post-test compared with the experimental group (E.G.1) and the control group (C.G.2) in favour of the experimental group. Thus, the hypothesis is rejected. This means that, the experimental group taught using computer based instruction retained the taught concepts for a significantly longer period

than their counterparts in the control group taught some concepts using the traditional lecture method of teaching.

Hypothesis Three (3)

There is no significant difference between the achievement of male and female taught the similar concepts using computer-based instruction.

The data used to test this hypothesis were the post post-test achievement scores of male and female. The mean (X) scores were subjected to t-test statistical analysis. The results are shown in table 4.4.

Table 4.4. Comparison of post post-test mean scores of male and female taught some concepts using computer

GROUPS	N	X	SD	ES	Calculated T-Value	Critical T-Value	Decision
Experimental Group	15	14.1	5.5	0.85	30.30	2.05	rejected
Control Group	15	14.9	4.6	0.22			

The result in table 4.4 shows that, the obtained t-value calculated of 30.30 is greater than critical t-value of 2.05 at 0.05 with difference 28. This means that, there is significant difference between the post post-test scores of male and female. Thus, the hypothesis, therefore, is rejected. This means that, male achieved significantly than the female in the use of computer to teach biology.

Summary of the Major Findings

The research was on the effects of computer-based/multimedia and enriched lecture approach on senior secondary biology students' academic achievements and interests in the 21st century. A case study of Batsari local secondary schools under Dutsinma Educational Zone of Katsina State.

The study found that 100% of biology teachers and 85% of the biology students in Batsari local government secondary schools were interested in the use of computer in teaching and learning of biology. The study also found that, 50% of biology teachers in Batsari local government secondary schools were computer literate and out of the 50% computer literates 45% are certificate holders and 5% are diploma holders in computer studies. Finally, the study discovered that 80% of Batsari local government secondary schools had computers.

Discussion of the Result

This study on the effect of computer-based/multimedia and enriched lecture approach on senior secondary school biology students' academic achievements and interest, compared students learning in classes taught with or without computer-based instruction. The analysis of co-variant on the pre-test scores of experimental group (E.G 1) attained a mean scores of 7.6 marks while the control group (C.G.2) mean scores has 7.5 marks. Therefore, 0.1 differential in favor of the experimental group is merely the result of chance. Hence, there is no difference between the intelligent level of experimental and control groups at a start. In this study, the overall results were consistent with findings in earlier literature reviewed in this area. We can see that, computer-based/multimedia raised students' examinations scores by 1.0 level of significance. This figure is very close to t-observe 0.11 reported by Bruce (2007).

The study provides evidence on the use of a control for instructors with effects which influence the outcome of evaluation of computer-based/multimedia. The effective was larger when different instructors taught both experimental and control groups. A similar relationship between control for instructor effects and study outcomes has been reported in meta analysis on other areas (Kulik and Kulik, 2001). The study also found that computer based instruction raised the students' examination scores with 0.62. This figure was very close to the t-observe of 0.60 reported by Harry-Peterson (2002). Analysis of data revealed that, CBI raised the students' retention ability with an 0.85. This figure was very close to 0.88 t-observed reported by Handerson (2004) in California.

The study also found that male performed better than female in the use of computer-based/multimedia to teach biology. In the study, 15 males and 15 females were used. The 15 males attained the mean scores of 14.1 while the 15 females attained the mean scores of 4.9 marks.

The analysis of data revealed that, computer-based/multimedia stimulates the teachers' interests by 100% while computer stimulates students' interests by 85%. Also, the analysis of data revealed that, 50% out of 100% biology teachers in the study area are computer literates, 45% out of 50% computer literates in the study area are certificate holders while 5% out of 50% are diploma holders in computer studies. From the study, it has been discovered that 20% of Batsari local government secondary schools had computers.

The study also found that 80% of the respondents agreed that, time has an effect in the application of computer in teaching and learning of biology. It was also discovered that 75% of the responded believed that, students will have better understanding of biology when taught using computer in the morning hour. In strong support of this, Nwogu (2009) reported that students will observe better when teach from home in the morning than at mid day when they are likely to be tired. 15% believed that students will have better understanding of biology in the afternoon while 10% believed that, students will have better understanding of the subject both in the morning and afternoon. This study also found that 100% of the teachers agreed that, adequate computers and internet facilities in our schools will substantially lower instructional cost and raised the quality of education at the same time.

Conclusion

On the basis of empirical evidence emanating from this study, the following conclusions were drawn: -

i.   The application of computer to the teaching and learning of biology promotes academic performance, interest and learning retention.

ii. The computer-based-instruction accelerates pupils' development. Mainly intellectual, and provides fascinating learning environment, one that attracts pupils and young people.

iii. Computer-based-instruction may be used to make students conscious of their own thinking process and also provide for an individual way and face of learning.

iv. In terms of theory and practice for education, the result obtained suggests that, computer-based instruction stimulates interests in both students and teachers. Thereby, providing meaningful learning, promoting learning retention, improving academic performance as well as lowering instruction cost and raised the quality of education generally. Therefore, the use of technology, as an effective learning tool, becomes necessary in our educational system, otherwise, we would be left behind.

Recommendations

Based on the findings, the following recommendations emerged: -

1. From the aforementioned it is imperative that, schools in the study area should be supplied with computers and train teachers adequately so that they would be

competent not only in using the computers to manage students'

data but be at a literate level as to be able to teach computer to their students and equally assist them to interact with it appropriately.

2. Schools should not see computers as sophisticated equipment which characterized the modern age, but rather as an essential support in the educational set up.

3. Students should be adequately motivated to lay a solid foundation on which all other future learning would be laid.

4. To this end, computer should be made accessible to all pupils early enough, so that, the accompany difficulty adults experience when learning to be computer literate wiould be checked.

5. Teachers should be challenged not to lose trend in the bid to become computer literate and acquiring the necessary computer skills which will assist them in utilizing the computer maximally for their own use and even enhance their teaching to better learning of their students.

References

Alkan, D. and Simsek (1999). *Science teaching in Nigeria.* Ilorin Atato press Ltd.

Alessi and Trollip (2005). Principles of practices teaching. New York: John Wiley and Sons.

Akpinar, (2005). Traditional method versus computer aided instruction in teaching key boarding skills to elementary school age children Dissertation abstract international. 45388 AA (university micro film No. 84 12, 292).

Bayraktar (2005). *First Year Biology in senior secondary schools*. London Wing. King tong limited.

Berger, L.V and Belzer (2000). *Teaching Modern Science. Fifth Edition* California.

Bobleck (1999). Using Computer In Teaching Nursing Course, *Journal of science in education.* 27-35.

Brophy (2000), *Secondary School Teaching Method.* New york macmillan ch. 6.

Cepni, Tas and Kose (2006). How Effective CAI Review of the Research Educational Technology. *Journal of education.* 147-153.

Cristakis (2008). *Goals and Objectives; In New Movement in the Study and Teaching of Biology.* London Cyril Schemes.

Edwards, J. et al (2001). *Effect of Computer Based in Biology Teaching and Learning Process.* London Cyril schemes.

Kenech, R.A et al (2007). *Essential of Physical Science.* New York John Wiley and Sons

Kulik, J.A (2001). Effectiveness of computer based education in secondary schools. *Journal of computer based instruction* 12, 59.-68.

Krejeie, R.V. and Morgan, D.W. (2000). Determination of sample size for research activities, educational and psychological measurement, *Journal of education* 30-70.

Liao (2007), *A Research Guide for Secondary School Teaching for competence* New York Macmillan.

Lin (2009). Computer Assisted Instruction in College Composition. *Albert Journal of educational research*.

Muduabum, A.M. (2001). *Teaching Biology Effectively.* Anambara: university press Nigeria.

Ozmen (2004 & 2008). *New Biology for Senior Secondary Schools*. Lagos Nigeria: Longman.

Ramalingam, S.T. (2000). *Modern biology*. Onitsha Africana Pub-Nigeria.

Stone, R.H. (2000). New biology for senior secondary schools. Lagos, Nigeria: Longman.

Tatiana & Erochenko (2007). *Minewa web-works. I.I.C.*