

## **An Evaluation of the Effectiveness of Computer Assisted Learning Strategy and Expository Method of Teaching Biology: A Case Study of Lumen Christi International High School, Uromi, Nigeria**

**E. O. Imhanlahimi and R.E Imhanlahimi**

*Department of Curriculum and Instruction, Faculty of Education,  
Ambrose Alli University, P.M.B 14 Ekpoma Nigeria*

**KEYWORDS** Evaluation; effectiveness; computer; learning strategy; expository method and biology

**ABSTRACT** The study assessed the effectiveness of computer assisted learning strategy and expository or traditional method of teaching biology using lumen Christi International high school, Uromi, Edo State Nigeria as a case study. The study which was a true experimental design: randomized, two groups, pre-test, post-test control group, involved sixty (60) senior secondary class one (SSC 1) students of the high school. The instrument for the study consisted of six essay questions based on three selected topics from SSC 1 curriculum. Data were analyzed using t-test statistics and analysis of variance (ANOVA). Results showed that expository method of instruction was superior to computer assisted learning strategy in teaching biology. Besides students taught through co-operative or interactive computer assisted learning strategy achieved significantly higher than those taught through individual computer assisted learning strategy. Recommendations were offered based on the result of the study.

### **INTRODUCTION**

We are in a world of computer age, Internet, e-mails and world-wide – web (www). The computer is causing a revolution in the society similar to the industrial revolution (Johnson and Rising, 1971). In this age of computer revolution, computer literacy forms the basis for modern development and no nation can meaningfully talk about development without her citizens being computer literate.

Knowledge of computer has been found to be very useful in all aspects of human endeavours: space exploration, engineering, banking, medicine, communication, business transaction, etc. (Yusuf, 1997). In the field of education, computer has been used in a variety of ways-instructional process which consist of computer assisted instruction (CAI) and computer management instruction (CMI), and in administration. In the instructional process, Computer Assisted Instruction (CAI), is used to instruct students in various subjects. Information and messages are presented to the learner using the computer, through interactive process involving drill, practice, tutorial and dialogue. The CAI ensures that students are presented materials or problems situations, guiding students' thinking, responding to students' questions, assessing students' performances and managing students' path

through a course (Milner and Anderson, 1984). Computer managed instruction involves assisting the teachers in administering and guiding the instructional process, scheduling classes, budgeting etc. It involves a learning support system that includes information organization and retrieval by students as well as teachers, and generation of materials through computer assistance (Milner and Anderson, 1984). In administration, computer is very useful in keeping records of students and schools because of its capacity to receive, store and recall information. These records are used in decision-making, administration and in guiding the learners.

With information communication and technology, computer and internet, the world is now a global village. Today's education is no longer adequate preparation for tomorrow's computerized society. The teaching of science which form the basis for scientific and technological growth of any nation requires a high quality teaching force or method to be able to cope with the dynamics of changing world (Rogersun, 1992).

A lot of studies in science, technology and mathematics education in other countries of the world revealed the importance of computer in science instruction. According to Okwo (1998) the use of new media (Computer) made the learning of science, technology and mathematics faster and

easier and consequently made learning effective, efficient and fun. DAVIS (1997) found that the introduction of computer to her mathematics lessons saved her time, which was used more effectively in helping her students and collaborating with colleagues. Above all, her class became more professional as she stored her lessons plans, unit plans and grades in the computer. Consequently, the class became more students centred and the students developed better self-esteem. Besides, both the teacher and the students developed greater versatility in connecting mathematical concepts to other subjects.

The use of computer in science instruction according to Doris and Barnea (1997) has a lot of advantages: provides for individual learning and advance opinion for stimulation and graphics; the interactive stimulation provided by computers in science classes are particularly important because they enable the users explore and visualize the consequences of their reasoning (Hennessy, 1995). Additionally, the use of computer in science classrooms, gives students instant feedback in the form of dynamic graphic or numerical representation of how variables are inter-related, and thus enable students to design and carry out a series of their own experiments requiring more sophisticated quantitative appreciation of the problem.

The role of computer in science instruction cannot therefore be over emphasized. Consequently, the Federal Government of Nigeria introduced the study of computer science into her secondary school curriculum in 1988 and implementation of the curriculum started in 1989. This study therefore assesses the effectiveness of the use of computer-assisted learning strategy in science (biology) instruction.

### Statement of the Problem

Computer is causing a revolution in societies similar to that of industrial revolution (Johnson and Rising 1971). Consequently, today's education is no longer adequate preparation for tomorrow's computerized society. Any nation genuinely interested in scientific and technological growth therefore must embrace the computer age by employing a teaching strategy that will enhance the teaching and learning of science through the development of positive attitude towards science concepts by students.

The Federal Government of Nigeria realizing the importance of computer education has introduced the study of computer science into the secondary school curriculum in 1988. A pilot study of the programme started in 1989 in all the Federal Government Colleges and Armed Forces Secondary Schools in the Federation (Yusuf 1997). Observation by the researchers has shown that most secondary school principals/ heads of schools in Edo State are not implementing computer education, despite the importance of computer and its effectiveness in science instruction in other countries of the world, probably for the following reasons:

- i) computers are expensive to purchase and maintain;
- ii) lack of qualified computer science teachers to teach the subject;
- iii) low priority attention given to computer education by governments and
- iv) non inclusion of computer science as a subject in both the junior and senior schools certificate examinations.

This study therefore assessed the effectiveness of computer assisted learning strategy in biology instruction by comparing it with expository method of instruction. Specifically, the study answers if there are significant differences between:

- i the effectiveness of computer assisted learning strategy and expository method of teaching biology and
- ii the achievement of students in biology using individual and co-operative computer assisted learning strategies.

### METHOD OF STUDY

The study is a true experimental design: randomized, two groups, pre-test, post-test, control group. This design is appropriate as it controls for all threats to internal validity.

**Population of the Study:** The population of the study consisted of all the senior secondary school class one (SSS1) students of Lumen Christi International High School, Uromi, Edo State Nigeria. This number which is estimated to be one hundred and sixty (160) students is made up of four arms. The school is boys school and has conducive environment for the teaching and learning of computer as there is a well equipped computer laboratory and trained computer science teachers. Consequently the students of the school are computer literate.

**Samples / Subjects:** The subjects for the study comprised sixty (60) SSS1 science students (those offering biology, chemistry and physics) in the college. The choice of SSS1 for the study is very appropriate as it ensured that the students have not been exposed to any of the selected topics employed in the study in the senior secondary school.

**Instrument:** The instrument for the study consisted of six essay questions drawn from three selected topics in SSS 1 curriculum. The topics included: :

- i) Photosynthesis:
- ii) micro-organisms in air and water and
- iii) digestive system.

Three highly structured lesson notes, one per topic, were prepared by the researchers and copied into diskette. The lesson notes were highly structured as they contained all the relevant information and questions necessary to understand the topics of study. Such information included questions testing students' understanding of basic concepts and experiments in the selected topics. Besides diagrams were used to explain where necessary. .

The content validity of the essay questions was established by showing the specified curricular objectives and the test-items to two senior biology teachers who agreed that the items covered the objectives of the curriculum. Based on the believe by Gay (1987), that once an instrument is valid, it is certainly reliable, no attempt was made to determine the reliability of the instrument.

**Research Procedure:** The sixty (60) SSS1 biology students employed in the study were randomly grouped into three: A, B, and C, twenty per group using a table of random number. This method ensured that every subject had equal and independent chance of being selected. Group A was taught through computer-assisted learning strategy. For this group, the diskettes containing the highly structured lesson notes were placed in the computer and the students studied the three topics packaged in the diskettes on their own from the computer. This group of students did not enjoy the presence of a visible biology teacher. Group B was exposed to expository method of instruction. This group was taught by their regular biology teachers the three topics involved in the study using the structured lesson notes prepared by the researchers. Group B students had the opportunity to interact with their

teachers and asked questions where they were probably in doubt. Group C, which was the control group, was neither taught through computer assisted learning strategy nor through expository method. This group was asked to read up on their own the three topics involved in the study. Groups A and B were exposed to the same topics simultaneously, using different methods, to prevent interaction effect of treatment.

**Administration of the Instrument:** The three groups of subjects were assembled in the school biology laboratory and the six essay test items were administered on them by their regular biology teachers as pre-test. The teacher told the students, on the advice of the researchers that the essence of the test was to determine those who read their books in advance of teacher. On completion of the test, the scripts were collected, mixed together to prevent bias during marking, and handed over to the researchers who marked and sorted out according to groups (Imhanlahimi and Aluede, 1997). The performance of the students in the pre-test is shown in table 1.

After the pretest, each group was taught for three weeks. Groups A was taught using computer assisted learning strategy while group B was taught using expository method. Both groups were taught simultaneously. The six essay questions were then administered on the three groups of students. The scripts were collected after the test, mixed together by the teacher and handed over to the researcher who marked and sorted out the scripts according to groups. The mean performance of the groups in the post-test is shown in table 2.

The three mean scores of the groups were compared to determine if there were any significant difference among them using analysis of variance (ANOVA) as shown in table 3. The direction of superiority of teaching methods was determined by carrying out post-hoc analysis using Turkey's Honestly Significant Difference (HSD) test as shown in table 4.

To determine if there was any significant difference in the achievement of students in biology using individual and co-operative computer assisted learning strategies, hypothesis two, the students in group C (control group) who were neither exposed to computer assisted learning strategy nor expository method of instruction were used to prevent the interaction effect of treatment. The group was further divided into two: D and E, ten students per-group. Group

D was exposed to computer assisted learning individually while group E was exposed to computer assisted learning co-operatively using the highly structured lesson notes packaged into diskette and based on the three selected topics. The six items essay questions were then administered as post test and mean scores determined and compared using t-test statistics as shown in table 5.

## RESULTS

Table 1 showed that there was no significant difference among the means of the three groups in the pre-test. Any observed difference after the post –test among the groups could reasonably be attributed to the effect of treatment.

**Table 1: Mean performance of the students in the pre-test.**

Teaching methods	Mean score	No of students
Computer Assisted Learning Strategy (Group A)	21.31	20
Expository method (Group B)	20.70	20
Control (Group C)	21.52	20

Table 2 showed that there was a difference in the mean achievement of students in the post test, with students (group B) exposed to expository method of teaching performing better

**Table 2: Mean performance of students in the post -test**

Teaching methods	Mean score	No of students
Computer assisted learning strategy (Group A)	58.40	20
Expository method (Group B)	63.00	20
Control (Group C)	38.20	20

**Table 3: Summary of ANOVA: Post-test comparison of means**

Sources of variation	Sum of squares (SS)	Degree of freedom (df)	Mean square (estimate of variance)	Observed F-value	Critical F-value at 0.05
Between (treatment )	1748.4	2	874.2	17.21	3.15
Within (error)	762	57	50.8		

**Table 4: Multiple comparison of means of the methods: Turkey's Honestly Significant Difference (HSD) test**

	Computer assisted learning strategy (x1=58.40)	Expository method (x2= 63.00)	Control group (x3 = 38.20)
Computer assisted learning strategy (x1=58.40)	-	4.60*	20.20*
Expository method (x=63.00)	-	-	24.80*
Control group (x =38.20)	-	-	-

\*= P < 0. 05

than those exposed to computer assisted instruction (group A). Group C being the control group did not perform well in the post -test. To determine if there was any significant difference among the mean achievements of students, an analysis of variance was carried out as shown in table 111. In table 3, the observed F- value of 17.21 is greater than the critical or table F- value of 3.15 at 0.05 level of probability. This means that there is a significant difference among the three means of the teaching methods –computer assisted learning strategy, expository method and control. The Null hypothesis is therefore rejected.

To determine the superiority of means of the teaching methods, post hoc analysis using Turkey's Honestly Significant Difference test was carried out as shown in table 4. As indicated in this table, the group taught with expository method (x=63) performed significantly better than the group taught through computer assisted learning strategy (x=58.00). Additionally, the table revealed that both expository method and computer assisted learning strategy were very effective in enhancing students' achievement in biology. The control group with mean score of 38.2 was not effective as the group was not exposed to treatment.

Regarding hypothesis two which compared students' achievement in biology using individual and co-operative computer assisted learning strategies, the result showed that students taught through co-operative computer assisted learning strategy achieved greater (mean score 67.32) than those taught through individual computer assisted learning strategy (mean score 56.1), and the difference between the means was statistically significant at 0.05 level of probability as shown in table 5

**Table 5: Comparison of students' achievements in biology using individual and co-operative computer assisted learning strategies: t – test statistics**

Groups	Number (N)	Mean (X)	Standard Deviation (SD)	Calculated t-value	Table t-value	Significant / not significant
<i>Individual Computer</i> Learning strategy (Group D)	10	56.11	1.26	19.23	2.10	Significant
<i>Co-operative Computer</i> Learning strategy (Group E)	10	67.32	1.34			

## DISCUSSION

The result of this study has shown that both computer assisted learning strategy and expository or traditional method of instruction are effective in enhancing students' achievement in biology. Expository method of instruction however proved to be more effective. This is probably due to the presence of a biology teacher who besides structuring the lessons, delivered them to the students sequentially and explained concepts and principles using relevant examples. Students had the opportunity to interact with their teachers and asked questions in areas where they had difficulties, thus learning became meaningful (Ausubel, 1980). Those exposed to computer assisted learning strategy achieved lower as they lacked the presence of a biology teacher to explain despite the fact that the lessons were highly structured and experiences arranged sequentially from the simplest to the most complex. Besides, computer assisted learning strategy, being an innovation or new method of instruction in our environment dominated by traditional method of instruction, has probably not been fully embraced by our students. The result of this study in essence suggests that though computer is important in enhancing students' achievement in biology, it cannot take the place of a biology teacher, rather it complements the efforts of a biology teacher. The result of this study is not in agreement with the finding by Choi and Bennaro (1987) and Wain Wright (1989) who found that students taught through computer assisted learning strategy performed better than those taught through the traditional expository method.

The result of this study also showed that students taught through co-operative or interactive computer assisted learning strategy achieved significantly higher than those taught through individual computer assisted learning strategy. This is probably due to the opportunity

the former group had to interact with themselves and asked questions in areas where they had learning difficulties, an opportunity the latter group never had, in agreement with Shigia, Zhiwen and Jietian (1986) who found that students who interactively used the computer had a more favourable attitude towards learning physics concept than those who never had such opportunity. The favourable attitude was due to the novelty of using the computer and the captivating nature of the question and answer sessions provided by the computer software.

## RECOMMENDATIONS/CONCLUSION

Based on the results of the study, the following recommendations are made:

- (i) both expository and computer assisted learning strategy should be used in biology instruction as both are effective in enhancing students' achievement;
- ii) the Federal Government should urgently pursue the implementation of computer education in Nigeria by providing the necessary facilities, human and material, in order to achieve the goals of computer education in a world of computer technology or revolution;
- iii) computer science as a subject should be included in the senior secondary school curriculum as a compulsory certificate subject and as co-operative computer learning strategy offers opportunity for students' interaction, it should be encouraged in biology class-rooms.

## REFERENCES

- Ausubel, D.P 1980. *Educational Psychology*. New York: Holt Rinchart and Winston.
- Choi, B. and E. Gennaro. 1987. "The Effectiveness of Using Computer Simulated Experiments on Junior High Students' Understanding of the Volume Displacement Concept." *Journal of Research in Science Teaching*, 24(6): 539-552.

- Davis, S. J. 1997. "How Mastering Technology can Transform Mathematics Class." *Journal of Educational Leadership*, 55: 49-51
- Doris, Y.J and Barnea, M 1997. "In service Chemistry Teachers' Training: The Impact of Introducing Computer Technology on Teachers' Attitude and Classroom Implementation." *International Journal of Science Education*, 19(5): 577-592.
- Gay, R. 1987. *Educational Research: Competencies for Analysis and Application*. 3<sup>rd</sup> Edition. Columbus, Ohio: Charles E. Meril Publishing Company.
- Hennessy, S. 1995. "Design of a Computer Augmented Curriculum for Mechanics." *International Journal of Science Education*, 17: 75-92.
- Imhanlahimi, E O. and O. O. Aluede. 1997. "The Effectiveness of Discovery and Expository Methods of Teaching Biology: A Case Study of Adolo College, Benin City." *Journal of Science Teaching and Learning*, 3(1 and 2): 1-7.
- Johnson, D.A and G. R. Rising. 1971. *Guideline for Teaching Mathematics*. New York: Wadsworth Publishing Com. Inc
- Milner, J.A and S. A. Anderson. 1984. "The Micro-electronic Education Programme Dissemination and Diffusion of Microelectronic Technology in Education." *Programme Learning and Technology*, 21(2): 82-87
- Okwo, F.A. 1998. "Communication STM with New Media Status: Implications in Communicating Science, Technology and Mathematics." *39<sup>th</sup> Annual Conference Proceeding of Science Teachers Association of Nigeria*, 80-82
- Rogersun, A 1992. "The Current state of Computing in Schools Mathematics." *Education: Moving into the Twenty First Century*, 8: 207-227.
- Shigia Z, L. Zhiwen and Z. Jietan. 1986. "Application of Microcomputer in Electrical Experiments." *Proceedings of the International conference on Physics Education. Nanjing Institute of Technology, Nanjing Jiangsu, People's Republic of China. August 31<sup>st</sup> - September 5<sup>th</sup>*, pp 71-78
- Wainwright, T.S 1989. "The Effectiveness of Computer-Aided Instructional Package in High School Chemistry." *Journal of Research in Science Teaching*, 26 (4): 275-290.
- Yusuf, M.O. 1997. "An Investigation into Teachers Competence in Implementing Computer Education in Nigeria Secondary School." *Journal of Science Teaching and Learning*, 3 (1 and 2): 54-63.