Impact of Computer Assisted Instruction on Students' Academic Achievement in Biology in Ilorin West, Kwara, Nigeria

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ABSTRACT

This study was carried out to examine the impact of Computer Assisted Instruction (CAI) on students' achievement in Biology in Ilorin West Local Government Area of Kwara State. Three schools were selected using stratified random sampling; a total of 80 students were also involved in the study. Achievement tests (pre and post) were used as instruments for data collection, while a registration form was used to obtain data as regard information about students. The data obtained from the registration form and the achievement tests were analyzed using descriptive statistics (frequency counts tables, simple percentages and cross tabulation), t-test as well as a computer excel program. The findings showed that students were already exposed to the used of computer, although they did not utilize it for educational purposes. The findings also revealed that Computer Assisted Instruction (CAI) has a positive impact on the achievement of students. It use significantly improved the performance of students. Also, female students performed better than male students when exposed to computer assisted teaching. Based on the findings of this study, it was recommended among others that; computer access should be made available in all secondary schools, and that science teachers should always refer students to relevant educational softwares for more information on topics taught by them. It was also recommended, that teachers should undergo in-service trainings to update themselves on the usage of computer and its essential skills in their operation.
Introduction

Nigeria’s philosophy of education believes that education is an instrument for national development and as such, there is need for functional education, for the promotion of a progressive and united Nigeria (Adaralegbe 1985). To this end, school programmes need to be relevant in practicals and be comprehensive, while interest and ability should determine individuals’ direction in education. According to the National Policy on Education (FRN, 2004), education and training facilities should continue to be expanded in response to the societal needs and made progressively accessible to afford the individual more diversified and flexible choice. Education activities shall be centered on the learner for maximum self-development and self-fulfilment. The educational system shall be structured to develop the practice of self-learning. While modern educational techniques shall be increasingly used and improved upon in all levels of the educational system National Policy of Education (FRN, 2007).

One of the goals of secondary education is to provide trained manpower in the applied science and technology, at sub-professional grades. The sciences at the S.S.S level comprises of Physics, Chemistry and Biology. The biology curriculum which was originally prepared by the Comparative Education Study and Adaptation Center (CESAC), is aimed at satisfying the Biology requirements of the Senior Secondary School (S.S.S) programmes in the New National Policy on Education. The curriculum content is
organised around the major concepts of Living and Non-living, Ecology, Genetics, Nutrition and the Nervous System. These topics are organised into instructional units, and are sequenced in a spiral form with each unit treated in detail as the course progresses. It was recommended that the guided discovery approach, resting on the activity of the pupils be used in teaching. This instructional approach is recommended to ensure that learners are provided with continuous experiences in the skills of solving problems, recognizing assumptions, critical thinking, hypothesizing, observing, collecting and recording data, testing and evaluating evidence, manipulating variables, generalizing and applying generalization.

There are basically two methods of teaching science in general and Biology in particular: teacher-centered and student-centered methods. These can be categorized as delivery mode and access mode of instructions. Delivery mode of instruction is expository and didactic. It refers to a traditional method of teaching in which knowledge is passed from the teacher to the students. This presupposes that the teacher is all knowing while the students come to the class to be filled with knowledge. Access mode of instruction involves students being given free hand to learn on their own, by giving them access to information. For the teacher of Biology, teacher-centered method is discouraged while the use of student-centered method is encouraged. In the student-centered, the students are provided with access to information through the teacher working with the students. This means that, the
collaboration with the students’ experiences are designed to help students build their existing knowledge and obtain new data skills. Within this approach are instructional strategies such as; inquiry method, discovery/problem solving, student-centered discussion, student-centered project method and field trips.

Computers are increasingly being used in education, both for direct instruction and for administrative functions. For instance, teachers use computer for record keeping, administrators use computers to support managerial and administrative functions such as scheduling and financial accounting. In science education, computer can perform several functions and add new dimensions to learning. The most obvious application involves solving numerical problems and analyzing data generated in laboratory exercises.

The role and function of computer in schools can be classified into two.

- Computer for literacy and
- Computer as learning/teaching tools

**Computer for Literacy:** - Beginning in the 1990’s, it was assumed that all children should become computer literate. While the meaning of the term computer literacy has changed over time, all children are expected to graduate with knowledge about the role of computers in society and the essential skills in their operation.

**Computer as Learning/Teaching Tools:** - With the continuing increase in computer power and the decline in its costs, schools have steadily increased the numbers of computers in their domains and the use by their students. Rather than place computers in
specialized laboratories where students have access to them for only a limited period each week, computers have now increasingly been placed in libraries and in classrooms. Thus, computers have become something more than a curriculum topic, they had become a tool that students needed in order to perform their works. Computer Assisted Instruction (CAI) is a term used to describe the use of computers to provide instruction to students by stimulating teaching and learning situation (Olorundare, 1983). Teacher support has been of one of the justifications for the introduction of computers in schools, but it has not been the only or most important justification. Computers are also promoted as an important part of the school curriculum. Learning about computers and acquiring computer skills have been accepted by educators and the lay-public as a necessary curricular requirement because they give students tools needed to function effectively in a modern society (Encyclopedia of Education, 1998). Abimbade (1996) described Computer Assisted Instruction as the technique of using the computer to carry out teaching and learning activities with or without the presence of a physical teacher in the teaching learning situation. He stated that computer is used to deliver instruction directly to learners by allowing them to interact with lesson programmed into the computer. As a teaching aid, Computer Assisted Instruction provides simulation of activities which the student would have not ordinarily experienced in traditional situation.
In Computer Assisted Instruction (CAI), the teacher can use computers at different times and in different places according to the characteristics of the subject matter, the students and available software and hardware. Computer programs can be used for practice, revision, one-to-one instruction, problem solving or simulations during their applications (Darnirel, 1996). Kahle and Meece (1994) found gender differences in science achievement when computers are used. Rowe (1993) pointed out systematic gender difference in the use of computers in the classroom, where girls are often not given appropriate support and contexts for learning about and with computers.

The gender differences in computer use have been found to be more evident at the secondary level than in the elementary years (Hatie & Fitzgerald 1988). According to Rowe (1993), computers are tools which can be used for a variety of purposes. However, in the absence of a broader perspective, many schools subsume them under mathematics/science curricular and consequently take on an existing stigma of sex stereotypes. In a study in which the influence of gender on student’s attitude towards internet usage was examined, Tsai, Lin and Tsai (2001), found that students who participated in the study did not show any statistical difference in their ideas about the usefulness despite their different gender. On the other hand, male students were found to have more positive feelings, less anxiety and more self-confidence than female students did. Students are expected to use the internet to gather information and use word processing and multimedia software to produce their
reports, while other instructional media were seen as tools for both teaches and students.

**Statement of the problem**

Over the years, science educators have identified difficult topics in the sciences and especially in biology. Difficulties encountered in the teaching of these topics have posed major concern to educators. This is because the teaching and learning of science concepts in secondary schools in Nigeria have played significant role toward technological development of Nigeria. In spite of these roles, the attitude of students toward science and the study of science has not been encouraging. The deficiency of Biology teachers has its own share of the problems. Most Biology teachers are not properly professionally trained and do not make use of appropriate methodology needed for effective Biology teaching and learning. For instance, holders of the National Certificate in Education (NCE) who are made to teach senior science classes is a mismatch as they were trained only to function at the J.S.S level of education (NPE 1981). Such teachers are not able to motivate sufficiently students at the S.S.S level toward effective Biology learning. This practice often leads to students’ poor performance in Biology. Students’ poor performance in the sciences and especially biology has been taken to a large extent to methodology of teaching. Much of the teachers’ instructional strategies have been generally restricted to centre method and to a lower degree inquiry. The role of the computer in teaching and learning is becoming overwhelming in our school system. There is the urgent need for empirical data on to how
information and communication out the impact of CAI on the student’s academic achievement in Biology in Nigeria secondary schools.

**Research methodology**

The research work is an experimental study. The study made use of two groups of secondary school students. The first group (Experimental) was exposed to Computer Assisted Instruction while the other group (Control) was not exposed to Computer Assisted Instruction. The dependent variable in this research is the student achievement in Biology while the independent variable is the impact of Computer Assisted Instruction (CAI). The target population was all the senior secondary schools in Ilorin West Local Government Area of Kwara State. However, three (3) schools were selected out of the eighty (80) available secondary schools in Ilorin West Local Government Area of Kwara State using the stratified random sampling technique. This was so, since the research was an experimental one, eighty (80) students of the sample were selected from the population of students both male and female using the random sampling technique.

This study made use of the student’s WAEC as well as the registration forms, pre and post achievement tests. The registration form was designed to obtain personal information from the student on their use of the computer. The achievement tests were used to assess the students’ academic achievement before and after the study. The achievement tests contained multiple-choice questions
from past WASSCE questions. The t-test statistics was used to test the research hypotheses.

**Data Analysis and Result**

The data analysis and results are as presented in this chapter with special reference to the research questions and hypothesis raised in the study. Based on the purpose of the study, the analysis was done by establishing if there was any significant impact of Computer Assisted Instruction on the students’ achievement in Biology.

Table 1 shows that 35 (43.75%) of the respondents were females, while 45 (56.25%) were males. This indicates that there are more female students.
### DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

**Table 1**

*Distribution of respondents by sex*

<table>
<thead>
<tr>
<th>SEX</th>
<th>FREQUENCY</th>
<th>PERCENTAGE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MALE</td>
<td>45</td>
<td>56.25%</td>
</tr>
<tr>
<td>FEMALE</td>
<td>35</td>
<td>43.75%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>80</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 1 shows that 35 (43.75%) of the respondents were females while 45 (56.25%) were males. This indicates that there are more male students in the science-based classes.

**Table 2**

*Students’ Computer Usage*

<table>
<thead>
<tr>
<th>RESPONSE</th>
<th>FREQUENCY</th>
<th>PERCENTAGE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>72</td>
<td>90%</td>
</tr>
<tr>
<td>NO</td>
<td>8</td>
<td>10%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>80</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 2 shows that more than half of the study sample actively used the computer. This indicates that majority of these students are not new to computer usage.
Table 3
Frequency of Use of the Computers

<table>
<thead>
<tr>
<th>RESPONSE</th>
<th>FREQUENCY</th>
<th>PERCENTAGE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once a Week</td>
<td>12</td>
<td>16.7%</td>
</tr>
<tr>
<td>Once in 2 Weeks</td>
<td>11</td>
<td>15.3%</td>
</tr>
<tr>
<td>Twice a Week</td>
<td>32</td>
<td>44.4%</td>
</tr>
<tr>
<td>Once a Month</td>
<td>17</td>
<td>23.6%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>72</td>
<td>100%</td>
</tr>
</tbody>
</table>

Respondents were asked how often they made use of computers. The responses given indicate that a good majority of the study population spend twice a week on the computer. This shows that students generally require computer access at least twice a week.

Table 4
Frequency of experience with biology program using the computer

<table>
<thead>
<tr>
<th>RESPONSE</th>
<th>FREQUENCY</th>
<th>PERCENTAGE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>17</td>
<td>23.6%</td>
</tr>
<tr>
<td>NO</td>
<td>55</td>
<td>76.4%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>72</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 4 shows that only 23.6% (17) of the participants who had used the computer and come across Biology application programs. This implies that students rarely used the computer for studying biology.
Three hypotheses guided this study. They are as follow:-

**HO$_1$:** There is no significant difference in the pre-test score and post-test scores of biology students exposed to the use of the CAI.

Table 5

**t-test comparison between the pre-test mean score and the post-test mean score.**

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>SD</th>
<th>No</th>
<th>DF</th>
<th>L.O.S</th>
<th>t-cal</th>
<th>t-table</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>7.288</td>
<td>3.23820</td>
<td>80</td>
<td>158</td>
<td>0.05</td>
<td>11.929</td>
<td>1.972</td>
<td></td>
</tr>
<tr>
<td>Pre-test</td>
<td>13.9</td>
<td>3.71313</td>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From table 5, t-calculated has a value of 11.929, while t-table has a value of 1.972. Since t-calculated is greater than t-table at 0.05 significant level, the difference is significant. Therefore, HO$_1$ is rejected.

Hence there is a significant difference in the pre-test score and the post-test score of biology students exposed to the use of CAI. The first hypothesis was rejected; as there was a significant increase in the mean score of the post-test conducted on the students. The increase in the scores of the students in the post-test shows that CAI had a positive impact on the achievement of the students.

**HO$_2$:** There is no significant difference in the post-test scores of students exposed to Computer assisted Instruction and those that were not.
Table 6

**t-test comparison between performance of control group and experimental group.**

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>SD</th>
<th>No</th>
<th>DF</th>
<th>L.O.S</th>
<th>t-cal</th>
<th>t-table</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group</td>
<td>6.575</td>
<td>1.67772</td>
<td>40</td>
<td>78</td>
<td>0.05</td>
<td>18.762</td>
<td>1.990</td>
<td></td>
</tr>
<tr>
<td>Experimental Group</td>
<td>13.08</td>
<td>1.36603</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From table 6 above, t-calculated is 18.762 while t-table is 1.990. Since t-calculated is greater than t-table at 0.05 level of significance, the difference is significant. Therefore, HO₂ is **rejected**. Hence there is a significance difference in the post-test mean score of students exposed to CAI and those that were not exposed to CAI. This second hypothesis stated in the null form was also rejected, as the t-calculated is greater than the t-table. This implies that there is a significant difference in the performance of the experimental group and the control group. This is evident in their mean scores; since clearly, the experimental group has a higher mean score than the control group in the post-test conducted.

**Ho₃:** There is no significant difference in the post-test mean score performance of female students and male students in the experimental group.
Table 7

<table>
<thead>
<tr>
<th></th>
<th>X Mean</th>
<th>SD</th>
<th>No</th>
<th>DF</th>
<th>L.O.S</th>
<th>t-cal</th>
<th>t-table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>12.05</td>
<td>1.2344</td>
<td>20</td>
<td>38</td>
<td>0.05</td>
<td>5.4997</td>
<td>2.024</td>
</tr>
<tr>
<td>Girls</td>
<td>14.05</td>
<td>0.9945</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7 indicates that t-calculated has a value of 5.4997 while the value of the t-table is 2.024. Since t-calculated is greater than t-table at 0.05 level of significance, the difference is significant. Therefore, \( H_0 \) is rejected. Hence, there is a significant difference in the post-test score performance of female and male students in the experimental group.

Hypothesis 3 attempted to determine whether there would, be a significant difference in the performance of female students compared to that of male students. It was observed that the average mean score of male student’s (12.05) is lower than the average mean score obtained for female students (14.05). This infers that female students performed better than male students when exposed to CAI. Findings from table 9 indicate that gender had an impact on the number of times students spent working with the computer. This indicates that female students exposed themselves to the use of computer assisted teaching more than their male counterparts. This may be the reason for the disparity in the test scores of participants.
Summary of the major findings

1. The results of the findings show that the use of Computer Assisted Instruction in the senior secondary schools of Kwara State has significant relationship in each other; Thus,

2. The First Hypothesis was rejected because the t-calculated is greater than the t-table and there is a significant increase in the means of the post-test scores hence, there is a significant difference in the pre-test score and post-test score of students exposed to the use of the CAI.

3. The second Hypothesis, it was also rejected because the t-calculated is greater than the t-test and there is an increase in the mean score of the experimental group than the control group. Hence, there is a significant difference in the experimental group and the control group.

4. The third Hypothesis, it was also rejected because the t-calculated is greater than the t-test and there is an increase in the mean score of the female than the male. Hence, there is significant difference in the post-test score performance of the female students and male students in the experimental group.

Conclusion

From the result of the study, the following conclusions could be made;
There is a significant difference in the performance of students after being exposed to the use of Computer Assisted Instruction. In other words, a teacher with high level of expertise and interactive skills in computer use would be able to present the subject matter in a more comprehensive format to the learner than his counterparts who lack such skills. This will no doubt enhance the learners' performance.

Also, there is a significant relationship between students' with exposure to Computer Assisted Instruction and their academic achievement in Biology. Adequate knowledge of the computer was found to enhance academic performance. Consequently, computer literacy by each learner will help them to adopt appropriate modes of study or study techniques that suit them to perform effectively in a Biology classroom.

Finally, the findings shows that, the impact of Computer Assisted Instruction on students' academic achievement in Biology is not influenced by genders. Equal opportunity is available for every student to succeed in class irrespective of their gender.

**Recommendation**

Based on the findings of this study, the following recommendations are considered relevant;

1. Access to computer should be made a priority for student in all secondary schools. Science teachers should refer students to educational software’s for more information on topics taught by them. Teachers may need to undergo in-service trainings to
update themselves on the usage of computer and the essential skills in their operation.

2. The role and function of computer in schools must be classified into two, which are computer literacy and computers as learning tools. ICT centers should be well equipped to meet student population, while computer facilities should be made available sat all times and should be dedicated for students and teachers use only.

3. Students should be supervised when browsing in the internet to ensure that they only browse on educational websites and time should be allocated for Computer Assisted Learning in the school timetable. Such a time should be a double period of (80 minutes) once a week.

REFERENCES


Encyclopedia of Education 1998