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ENHANCING STUDENTS' ACHIEVEMENT IN ECOLOGY THROUGH CO-OPERATIVE COMPUTER INSTRUCTION IN OGUN STATE, NIGERIA

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ABSTRACT
The understanding of concepts of ecology appears to be difficult for most secondary school students compared to other topics in biology as evident from the poor performance of students in ecology as reported by WAEC. Therefore, this study investigated how Co-operative computer instruction (CCI) could enhance students' achievement in ecology. Quasi-experimental design was adopted for the study. The sample consisted of sixty two students studying biology. Two schools were purposively selected in Odogbolu Local Government Area in Ogun State, Nigeria based on following criteria: presence of functional computer laboratories; availability of qualified biology teachers teaching SS 2 and public co-educational school. Students in the experimental group were taught using Co-operative computer instruction while those in the control group were taught using conventional method of teaching. The hypotheses were tested using Analysis of Covariance and t-test at 0.05 level of significance. Ecology Achievement Test (EAT) with 0.68 was used for data collection. Students in experimental group recorded better and significant achievement in ecology than their counterparts in the control group and also CCI was gender friendly. It was recommended that there should be continuous capacity building of biology teachers on the effective use of CCI.

Keywords: *Computer Instruction, Co-operative Learning, Students' Achievement, Gender, Ecology*
Paper type*: Research paper*
Type of Review: *Peer Review*

1. INTRODUCTION

Biology occupies an important position in the curriculum because of its importance as the science of life (Federal Republic of Nigeria, 2014) and it is important to students pursuing science-related disciplines. In Nigeria, the secondary school biology curriculum is designed to improve students' investigation into natural phenomena, to deepen students' understanding and interest in biological sciences and also to encourage students' ability to apply scientific knowledge to everyday life (Federal Ministry of Education, 2014). Despite the relevance of biology to the nation, there is still poor performance of students in Senior Secondary School Certificate Examination (SSSCE) in Nigeria. This can be attested from the results of students in biology in SSSCE in Nigeria between 2010 and 2018 (WAEC, 2018) which is found in table 1.

Table 1: Students' achievement in the May/June biology between 2010 and 2018 in Nigeria

Year	Total Entry	No of Passes	% of Passes	No of Failure	% of Failure
2010	1,051,557	375,850	35.74	675,707	64.26
2011	1,238,163	413,211	33.37	824,952	66.63
2012	1,137,181	559,854	49.23	577,327	50.79
2013	1,646,150	587,044	35.66	1,059,106	64.34
2014	1,259,965	427,644	33.94	832,321	66.06
2015	1,505,199	579,432	38.49	925,767	61.50
2016	1,340,206	383,112	28.59	957,094	71.41
2017	1,675,440	541,956	32.34	1,133,484	67.65
2018	1,433,440	371,624	26.11	1051,812	73.89

Source: WAEC Chief Examiner's Reports retrieved from https://waeconline.org.ng/e-learning/Biology/Biomain.html.

Table 1 shows students' dwindling performance and underachievement for the period of 9 (nine) years between 2010-2018. The board (WAEC) revealed that less than 50% passed at credit level from 2010 – 2018. The implication of the trend of performance is that only a few students would eventually be able to pursue biology related courses in the higher institutions. The WAEC pointed out that poor students' achievement in biology examinations could be attributed to poor grasp of the concepts in genetics and ecology (WAEC, 2018). The poor achievement of students offering biology - especially in ecology – in external examinations is linked to the usage of the lecture method in teaching secondary school biology (Adebanjo, 2019; Awobodu, 2016).

It is with this reference that the present study seeks to examine an instructional method for enhancing students' academic achievement in ecology. Ecology concepts of the biology subject provide a conceptual framework for understanding and researching human social interactions (human ecology) (Raji, 2017). The board report stated that one of the reasons for students' underachievement in ecology questions are their inability to apply abstract reasoning to understand concepts in ecology. The prevailing practices during ecology instructions emphasis is on transmission of information from the teacher and textbooks to the students do not promote meaningful learning of ecological concepts in Nigerian secondary schools (Adebanjo, 2019). Most biology teachers taught ecological concepts using conventional method and teacher-centred approach which make students passive rather than active learners which resulted in poor performance (Adebanjo, 2019; Adebanjo & Omoniyi, 2018).

To improve the understanding of ecological concepts in the era of information and communication technology, Gambari and Yusuf (2017) recommended co-operative learning strategy which is student-centred method to the teaching of ecological concepts which allows students to work in group, interact effectively in the classroom so as to promote active learning. Therefore, co-operative learning is the process in which individuals learn in a small group with the help of each other and also a student-centred, instructor - facilitated instructional strategy. Udu (2018) affirmed that students performed better when taught chemistry using Co-operative learning than conventional method of teaching. There are many Co-operative learning strategies in existence but Team Accelerated Instruction (TAI) was adopted

for this study because it is one of the simplest methods of Co-operative strategy and also it allows active participation of the learners (Gambari & Yusuf, 2017).

Empirical studies revealed that Co-operative learning strategy improved learning outcomes in physics (Gambari, 2010), in biology (Moreno, 2012), and in chemistry (Mattingly & VanSickle, 2013). For instance, Alshammari (2015) reported that Co-operative learning improved students' achievement in biology. Shimazoe and Al-Drich (2010) found that co-operative learning enhances deeper understanding of materials and improves students' academic achievement. In this study, the use of computer as a medium of instructional delivery in Co-operative learning if referred to as Co-operative computer instruction (CCI). Students using computers for learning in groups enhanced students' learning outcomes (Yusuf &Afolabi, 2010). Numerous studies have found a Co-operative computer instruction (CCI) was effective for improving students' academic achievement. For example, Gambari and Yusuf (2016); Gambari, Ezenwa and Anyanwu (2014); Gambari (2010); Yusuf, Gambari and Olumorin (2012) found from their various researches that students taught using Co-operative computer instruction significantly improved students' learning outcomes.

Meanwhile, gender influence on students' academic achievement has for a long time been of concern to researchers, but no consistent result has been established. Alshammari (2015) observed that girls achieved higher grades than boys when taught biology using Co-operative computer instruction. Zakaria, Solfitri, Daud and Abidin (2013) found that boys performed better than girls in Co-operative computer instruction students' academic achievement in mathematics. Moreover, the study of Gambari (2010) reported that the computer-assisted Co-operative learning strategy was gender-friendly. These contradictory results showed that the issue of gender in students' academic achievement has not yet been resolved. The interactions among the independent variables, moderating variable and dependent variable that were used for the study are diagrammatically represented as shown in Figure 1.

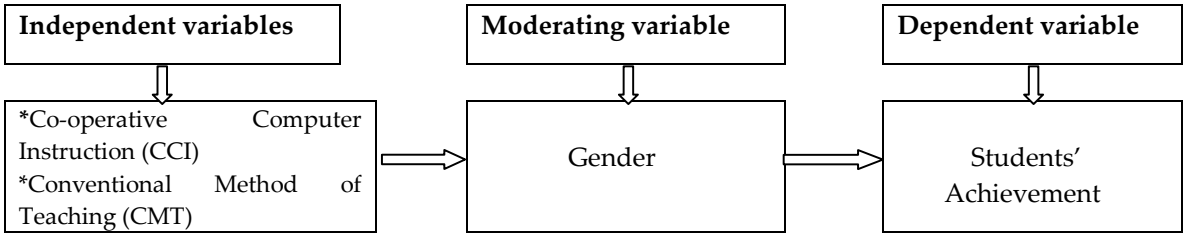

Figure 1: Conceptual Framework for CCI and CMT in students' achievement

Evidences from studies in Nigeria indicated that a few research efforts had been directed towards improving students' academic achievement using Co-operative computer instruction and this learning strategy has been found to be effective in teaching and also being embraced in developed nations (Alshammari, 2015; Moreno, 2012; Shimazoe & Al-Drich, 2010). Based on these, the researcher poised to investigate whether the use of Co-operative computer instruction would improve the teaching and learning of ecology in Nigerian senior secondary schools or not.

This research hinges on constructivism theory, which was originally developed by Vygotsky (1978) which described the active nature of learning. For the constructivist, the learner must actively construct new knowledge into his or her existing mental framework for meaningful learning to take place. The theory is of learner-centered while teacher facilitates guides and mentors the learners. This theory is relevant to the present study as it supports active participation of learner. The use of Co-operative computer instruction also falls within the domain of active learning of constructivist where meaningful learning takes place.
From the foregoing, it is evident that ecology is a branch of biology which deals with the relationship is not well taught in schools. Poor achievement in senior secondary school ecology which is an important aspect of biology calls for greater concern. Literature has shown that among other factors such as poor instructional approach can affect students' achievement in ecology and in biology general. Similarly, WAEC chief examiner's report also stated that one of the reasons for students' underachievement in ecology questions is their inability to apply abstract reasoning to understand concepts in ecology. Literature supports that students' achievement in ecology and biology in general could be enhanced if teacher adopts student-centered instructional approaches of technology-driven such as Co-operative computer instruction (CCI). This study investigated the effect of Co-operative computer instruction and gender influence on students' achievement in ecology. Two hypotheses were outlined as indicated in H_{o1} and H_{O2}:

H_{O1}: There is no significant main effect of instructional method (Co-operative computer instruction (CCI) and conventional method of teaching (CMT)) on students' achievement in ecology.

H_{O2}: Gender will not significantly influence the effect of Co-operative computer instruction (CCI) on students' achievement in ecology.

2. METHODOLOGY

The research design adopted for this study is the quasi-experimental research design involving two groups (one experimental and the other control groups). Purposive sampling technique was used to obtain two public secondary schools in Odogbolu Local Government Area, Ogun State, Nigeria. The criteria for selecting the schools were: presence of functional computer laboratories; availability of qualified biology teachers teaching SS 2 and the mixed school. Again, randomisation was used to assign the schools into experimental group (CCI) and control group (CMT) respectively. Both groups were pre-tested to ensure equivalence before the treatment (CCI) was administered. The treatment was administered to students in the experimental group only while students in the control group were taught using the conventional method of teaching. Thereafter, a post-test was administered to the two groups to determine their academic achievement.

Two main instruments were used for the study: Ecology Achievement Test (EAT) and Computer-Assisted Instructional Package (CAIP). EAT was meant to measure students' achievement in ecology. EAT covered the following ecological concepts as contained in the NERDC curriculum for the SS 2 students in biology - pollution, conservation, ecosystem, population growth and quality of environment. The EAT consisted of 20 multiple-choice test items drawn from ecological concepts, which were developed by the researcher. Each test item had four response options, A - D. The items were developed using a test blue-print indicating the topics and number of test items along three process categories of objective - that is knowledge, comprehension and application. To validate the EAT, it was content and face validated by two experts in biology, one expert in Measurement and Evaluation from the Faculty of Education, Olabisi Onabanjo University, Ogun State. The reliability of EAT was determined by

administering it twice on a sample of twenty SS 2 students studying biology at a school different from the main study. The reliability index of EAT was found to be 0.68 using test retest reliability method. The Computer Assisted Instructional Package (CAIP) was downloaded from the internet that corresponds to the ecological concepts (pollution, conservation, ecosystem, population growth and quality of environment). The package was face and content validated by two experts in computer programmers and two experts in educational technology; two experts in biology; and finally pilot tested.

In the experimental group, the students were divided into a group of three and the research assistant divided the content of the lesson into three and assigned it to each member in the group. The CALP package on ecology was installed on standalone computer systems of all the participants in the experimental group. The ecological contents were presented through the computer and the learners interacted and responded to the computer prompts. The computer presents information and display animation to the learner on each of the unit and the participants were studied at their own pace. Then, the participants now discussed and shared their particular materials with other members of the group and discussed any difficulty and misconception encountered during the study from more clarifications for meaningful learning to take place after which the students attempted ten multiple-choice questions for the computer at the end of each lesson.

The control group was taught the same ecological concepts through conventional method of teaching. Before treatment commenced, each teacher administered EAT was administered to the students as pre-test and recorded their scores. The process lasted for five weeks after which a post-test was conducted on both groups, the post-test instrument was a re-arranged version of the pre-test. The data collected were analysed based on formulated null hypotheses using the Univariate Analysis of Covariance (ANCOVA) and independent t-test at 0.05 level of significance.

3. RESULTS AND DISCUSSION

Hypothesis 1: There is no significant main effect of instructional method (Co-operative Computer instruction (CCI) and conventional method of teaching (CMT)) on students' achievement in ecology.

Table 2: ANCOVA of Students' Achievement in Ecology According to Treatment

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Covariates (pre-test)	403.212	1	403.212	10.285	0.000
Main Effect (treatment)	178.847	1	178.847	8.311	0.024*
Model	2307.092	1	192.669	13.689	0.000
Residual	564.338	59	17.508		
Total	2878.012	62			

** Indicate significant F at 0.05 level of significance*

Table 2 shows significant main effect of instructional method ($F_{1, 59} = 8.311$, $P < 0.05$). This implies that there is significant difference in the academic achievement of students taught ecology with CCI and those taught with CMT. Therefore, the null hypothesis, (H_{01}) of no significant main effect of instructional method (Co-operative Computer instruction (CCI) and conventional method of teaching (CMT)) on students' achievement in ecology is rejected. Based on these results, students' performance in two groups were further analysed using mean gain scores between the pre-test and post-test for each group and the results are shown in Table 3.

Table 3: Main Gain Scores of Students Taught Ecology with CCI & CMT

Group	Pre-test	Post-test	Mean Gain Score
CCI	28.09	72.80	44.71
CMT	22.20	58.75	36.55

From Table 3, CCI had the highest mean gain of 44.71 while the CMT had the least mean gain of 36.55. Therefore, the results showed that Co-operative computer instruction was more effective in promoting performance than the conventional method of teaching. As a result, null hypothesis one (H_{01}) is rejected

The results of the analysis in table 2 indicate that a significant difference in favour of students taught with CCI. The reason for this outcome might be due to the fact that Co-operative computer instruction improves active learning in classroom. The finding corroborated earlier findings of Gambari and Yusuf (2017); Yusuf and Afolabi (2010) who found from their various researches - physics, visual art and mathematics that Co-operative computer instruction improve students' performance. Furthermore, this finding also agrees with Gambari, Ezenwa and Anyanwu (2014) who reported that Co-operative-assisted with CAI fostered higher achievement in solid geometry than the conventional approach.

Hypothesis 2: Gender will not significantly influence the effect of Co-operative computer Instruction (CCI) on students' achievement in ecology.

Table 4: T-test Comparison of Mean Achievement Scores of Students in Experimental Group (CCI) based on Gender

Groups	N	Mean	SD	Df	t	Sig.	Remark
Male	14	78.435	17.104				
				30	3.253	0.254	Not Significant
Female	18	80.071	16.991				

In table 4, the gender difference was not significant t (30) = 3.253, P > 0.05. Hence, the hypothesis which says that gender will not significantly influence the effect of Co-operative computer instruction (CCI) on students' achievement in ecology was retained.

This finding indicated that the CCI could be found that students learn well when they were interested in the lesson taught because when learners are delighted in what they are doing, then the performance will improve irrespective of gender (Awobodu, 2016). The finding is in support with the work of Gambari (2010) who reported that computer-assisted instructional strategy was gender-friendly. The result however contradicts the findings of Alshammari (2015) who found that girls performed better than boys taught biology with Co-operative computer instruction.

4. CONCLUSION

The findings revealed a significant difference in the academic achievement students taught ecology with Co-operative computer instruction (CCI) and those taught with the conventional method of teaching. The Co-operative computer instruction (CCI) was reported to be more effective in enhancing better academic achievement of the learners than the conventional method of teaching. The findings also reported that there was no significant difference in the academic achievement of students taught ecology based on gender using CCI because the CCI was a gender friendly.

5. RECOMMENDATIONS

In view of the findings of the study and the conclusion thereof, the following recommendations were made: that there should be continuous capacity building for biology teachers on the effective use of Co-operative computer instruction (CCI); curriculum planners/policy makers should encourage the adoption of Co-operative computer instruction (CCI) as a means of designing instruction in Nigerian secondary schools; the government should equip the computer laboratories in Nigerian secondary schools with functional and workable computer systems to promote quality education in the era of information and communication technology.

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