

Instructional Methods and Students' End of Term Achievement in Biology in Selected Secondary Schools in Sokoto Metropolis, Sokoto State Nigeria

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Abstract

This study investigated the Correlation between instructional methods and students end of term achievement in Biology in selected secondary schools in Sokoto Metropolis, Sokoto State Nigeria. The study addressed three Specific objectives. To examine the relationship between; Cooperative learning methods, guided discovery, Simulation Method and students end of term achievement in Biology. Cross-sectional survey design was used in the study and questionnaires were used to collect responses. A sample of 381 respondents from both students and Biology teachers in Nagarta College Sokoto and Sultan Bello Secondary School was used. The findings of the study established statistically significant relationship between instructional methods and students' academic achievement with Co-operative learning method ($r = .86$, and $p < .05$) very strong positive Correlation, Guided Discovery method ($r = .57$, and $p < .05$) moderate positive Correlation and Simulation method ($r = .89$, and $p < .05$) very strong positive Correlation. This implies that the use of different instructional methods by Biology teachers was not put to waste. Based on conclusions, more emphasis is needed in active engagement of students in hands-on experience and use of hypermedia tools in order to reduce students' imagination in understanding Biological concepts were recommended.

Keywords: cooperative learning, simulation, guided discovery, instructional methods, academic achievement

1. Introduction

Teaching is an "art" but the success of a teacher lies in making his subject so simple as to make it intelligible for his students (Yadar, 1994). In order to make students learn effectively, the teacher has to adopt the right method of teaching. According to Archibong (2009), the interest which students show in science subjects and Biology in particular and the mastery they demonstrate on completion of a course of study depend on the teaching methods and materials. In spite of much focus on teaching strategies in Biology, students' performance in the subject has continued to record a persistent variation trend in Nagarta College Sokoto (NCS) and Sultan Bello Secondary schools (SBSS). For example, in the year 2011 report by WAEC reveals that about 58% of the students in SBSS failed to score credits in Biology. The end of third term 2014 result of student doing biology revealed that 51 students failed, 72 students passed, 37 students got credit, 12 students very good and only 3 students were excellent. Results in school X revealed that 54 students failed, 57 students pass, 20 students were very good and only 9 students were excellent.

Several factors have been advanced as affecting students' achievement in Biology, these include the students' factors, teachers' factors, societal factors, governmental infrastructural problem, language of instructions, instructional strategies employed by the teachers (Ali, and Chacko, 2013); and recently students' learning differences (Felder, 2013).

To overcome these problems, there is need to strive for a balance of effective teaching strategies such as co-operative learning, Discovery and simulation method of instruction. In Nigeria for example, Teachers are familiar with the use of a number of teaching methods but more especially the conventional methods like lecture, discussion and demonstration methods. Currently, Co-operative learning and Guided Discovery methods of instructional strategies among others were employed by teachers in Nigeria. The question now is, does Co-operative learning, Simulation and Guided Discovery methods of instruction help students' understanding and learning of, and enhance achievement in biology if employed by biology teachers in the classrooms? This provides the impetus for this study. It is against this background that the researcher investigated the correlation between instructional methods and students' end of third term achievement in biology in selected secondary schools in Sokoto state Nigeria; Nagarta College Sokoto (NCS) and Sultan Bello Secondary School (SBSS).

Nagarta College Sokoto was established in 1905 as a school for the children of the chiefs during colonial era, from then to middle school and then Provincial Secondary in 1956. The College took its first West African Examination Council (WAEC) in 1959.

The name Nagarta College, replaced its former name of Government College in 1986. In 1989 the College was among the pioneer schools of the then established Science and Technical Education Board. The College has always been a science school that trained students in all fields of the sciences.

Sultan Bello Secondary School was established in 1970 as a school for the students. It's mainly a day school for males, and the school got the name from the Muslim spiritual leader in Nigeria. The school was among

the pioneer schools in the State, it offers both Science and Art subjects, and it's established under Teachers Service Board. The School has always been an excellence that trained students in all the fields.

The study is guided by the following objectives.

- 1- To examine the correlation between co-operative learning method and students' end of term achievement in Biology in selected secondary schools in Sokoto State, Nigeria.
- 2- To examine the correlation between guided discovery method and students' end of term achievement in Biology in selected secondary schools in Sokoto State, Nigeria.
- 3- To explore the correlation between Simulations method and students' end of term achievement in Biology in selected secondary schools in Sokoto State, Nigeria.

Null Hypothesis

Ho₁ There is no statistically significant correlation between Co-operative learning method and students' end of term achievement in Biology in selected secondary schools in Sokoto State, Nigeria.

Ho₂ There is no statistically significant correlation between Guided Discovery method and students' end of term achievement in Biology in selected secondary schools in Sokoto State, Nigeria.

Ho₃ -There is no statistically significant correlation between simulation method and students' end of term achievement in Biology in selected secondary schools in Sokoto State, Nigeria.

2. Scope of the Study

This study examined the correlation between instructional methods i.e. co-operative, guided discovery and simulation methods of instruction and students' end of third term 2014 achievement in Biology in selected secondary schools in Sokoto State, Nigeria. The researcher is aware that there are other instructional methods related to the study, but the study is limited to Co-operative, Guided Discovery and simulation methods of instructions and students Biology end of third term 2014 grades in the said schools. This period was considered because the schools employed, used all the instructional methods that the researcher wanted to investigate to teach students Biology at ordinary level in secondary schools. The population of the study included both students and Biology teachers in senior secondary schools levels in Nagarta College Sokoto (NCS) and Sultan Bello Secondary School (SBSS) in Sokoto State Nigeria.

3. Literature review

The literature review comprised of two parts; the concepts and empirical studies related to the methods of teaching under investigation.

3.1 Cooperative learning method and students' academic achievements

The term cooperative learning (CL) refers to students working in teams on an assignment or project under conditions in which certain criteria are satisfied, including that the team members be held individually accountable for the complete content of the assignment or project (Smith, 2005).

The UNESCO-EFA Global Monitoring Report (2005) notes that; "practitioners broadly agree that teacher-dominated pedagogy where students are placed in a passive role is undesirable, yet such is the norm in the vast majority of classrooms in Sub-Saharan Africa". The report further notes that there is consensus on the desirability of a participatory, interactive, learner-centred, active pedagogy that is characterized by cooperative learning.

Agashe (2004) notes that there has been great interest on the effects of social interaction on students' achievement in Biology, and cooperative learning has been found effective across various academic levels and subjects.

Aronson, (2002) has noted that cooperative learning approach encourages listening, engagement and empathy by giving each member of the group an essential part to play in the academic activity. Group members must work together as a team to accomplish a common goal and each person depends on all the others. No student can achieve his or her individual goal of learning the material or getting a good grade unless everyone works together as a team. Group goals and individual goals complement and bolster each other. This cooperation by design facilitates interaction among all students in the class, leading them to come to value each other as contributors to their common task. Cooperative learning has many positive effects on a range of student outcomes including academic achievement and social skills development (Ferrer, 2004).

3.2 Guided Discovery method and students' academic achievement

Guided discovery is one of those teaching methods that employ exploration, manipulation and experimentation to find out new ideas; it is a problem solving oriented method (Akuma, 2008). Guided discovery instructional strategy is characterized by convergent thinking. The instructor devises a series of statements or questions that guide the learner, making a series of discoveries that leads to a single predetermined goal. In other words, the teacher initiates a stimulus and the learner reacts by engaging in active inquiry thereby discovering the appropriate response.

Extensive review of the literature by DE Jong and Joolingen showed that generally speaking guided discovery leads to better results than non-guided ones. It aided better understanding of Biological concepts and of course better train for the discovery process itself (DeJong, & Joolingen, 2003).

According to Okoye, (2004) and Nwagbo (2004), during the early 70's the rationale for science teaching shifted as discovery strategy was adopted worldwide. This was because students tended to memorize facts and concepts, most of which they did not understand. This resulted in a lack of retention and application of concepts. They maintained that there was a great burst of interest as the guided discovery strategy was adopted in the Nigerian curriculum. The guided discovery strategy is activity oriented and involves practical demonstration, discussion and experimentation.

During such instruction the students employ the processes of science like observation, classification, investigation and critical interpretation of findings. In Biology, it is possible for guided discovery strategy of teaching to be enhancing students' performance. This is because of the activity oriented nature of the guided discovery strategy (Okoye, Momoh, Aigbomain, and Okecha, 2008).

3.3 Simulation method and students' academic achievement

The rapid increase in educational computer use has led to changes in the teaching/learning process, curricula and teachers' and administrators' approaches to instruction (Loveless & Ellis, 2002). These changes in instructional techniques are shaped by the fact that computer-assisted learning increases student motivation and creates better learning environments in which rote learning is minimized and meaningful learning can occur (Renshaw and Taylor, 2000).

The term simulation has been used interchangeably with "games with simulated environments," "teaching games," "learning games," "instructional games," and "educational games" (Duke & Greenblatt 1979). Simulation game is a game based strategy that can be used for teaching and learning at any level of education.

Simulation games in the classroom are used to copy what are found in real life situations. According to Enciso (2001) simulation game is defined as an activity that works, fully or partially, on basis of players' decision. Academic games can be divided into two: simulation or non-simulation games.

Simulation games are argued to be an excellent supplement to the standard lecture. Lean, Moizer, TowlSer, and Abbey (2006); Dobbins, Boehlje, Erickson and Taylor (1995) identify some of the key benefits of simulation games in teaching and learning:

1. Adapt to the level of the individual while providing support; games are learner-centered.
2. Provide multiple levels; ensuring user's skills are challenged.
3. Engage users for hours in pursuit of a goal.
4. Learners to play with others; online communities provide engagement.
5. Provide immediate and contextualized feedback.
6. Encourage creative expression, problem solving in complex situations, and experiential/active learning.

One way of enhancing learning is to help students create models of dynamic systems by combining words with pictures (Schnotz and Bannert, 2003).

3.4 Empirical studies

Several studies have been conducted on methods of teaching and students' achievement in several Nigerian states. Some have been highlighted below:

Ajaja and Eravwoke (2010) studied the effect of cooperative learning strategy on junior secondary school students' achievement in integrated science in Nigeria. The findings revealed a significant higher achievement scores in cooperative learning group than those in traditional classroom. Whereas this study tested the effect of cooperative learning on student achievement in integrated science, the current study tested the relationship between cooperative learning and student achievement in Biology subject in Sokoto state Nigeria.

Olalere and Afolabi (2010) investigated the effects of computer assisted instruction (CAI) on secondary school students' performance in biology in Oyo state Nigeria. The findings revealed that the performance of students exposed to CAI either individually or cooperatively are better than their counterparts exposed to conational classroom instruction. Whereas this study was concerned about performance in Biology, it tested the effect of CAI on Biology performance. The current study tested the relationship between cooperative learning and biology achievement of students in Sokoto state.

Adeyemi (2008) investigated the effect of cooperative learning on problem- solving strategies on junior secondary school students' achievement in social studies in Ife central local government area of Osun state, Nigeria. The study revealed that students exposed to cooperative learning strategy performed better than their counterparts in the other groups.

Ekeke (2007) tested the relative effectiveness of expository and field trip methods of teaching on students' achievement in ecology in Niger Delter reion of Nigeria. Findings revealed that students exposed to field trips were able to perform highest because of their opportunity of having first-hand experience of organisms in their

natural habitat.

Afolabi & Akinobola (2009) tested the effects of constructivist problem based learning technique on the academic achievement of physics students with low ability levels in Taraba state Nigeria secondary schools. The results showed that the physics students with low ability level taught with problem based learning technique performed significantly better than those taught with conventional learning method.

Adedeji (2007) investigated the impact of motivation on students' school academic achievement in mathematics in secondary schools in Osun state Nigeria. Results showed that gender difference were significant when impact of motivation on academic achievement was compared in male and female students. This study is different from the current study in that it tested impact of motivation on academic achievement while the current study tested the relationship between teaching methods and academic achievement.

Analysis of the empirical studies revealed that several studies have been carried in different Nigerian states on effect of various teaching methods like cooperative learning, computer assisted instruction (CAI), expository and field trips, problem-solving and discovery method of learning on academic achievement of students. The most tested method was cooperative learning. However these methods were tested on different subjects like physics, mathematics, integrated science, ecology, and social studies. It is therefore justifiable for the current study which examined the correlation between instructional methods i.e. co-operative, guided discovery and simulation methods of instruction and students' end of third term 2014 achievement in Biology in selected secondary schools in Sokoto State, Nigeria to estimate, to run the ten machines on the production floor.

4. Methodology

The study used cross sectional survey design. The cross sectional survey design involved collecting data from a wide range of respondents from a sampled population in various classes at the same time. The population of the study involved two schools, teachers and students of Nagarta College Sokoto and Sultan Bello Secondary School. This population was chosen due to the nature of the research and the problems that agitated the mind of the researcher to carry out this study. Also, the schools employed, used all the instructional methods that the researcher wanted to investigate to teach students Biology at ordinary level in secondary schools. The population of senior secondary students in the schools was 4715, (schools records, 2014). Population of Biology teachers in the schools was 25.

Two (2) Government Secondary Schools, Nagarta College Sokoto (NCS) and Sultan Bello secondary School (SBSS) were employed for the study. From these schools, a sample size of 357 students and 25 teachers were used. This size is obtained following Krejcie and Morgan (1970)'s table of sample size determination.

A stratified random sampling was used to select the number of students from their respective schools. Additionally, census survey was used for Biology teachers. The stratified sampling above was used because of the nature of the students, these enable students from each school to have representative sample.

Questionnaire and document reviews were used to collect data. Two sets of closed ended Questionnaires for Biology teachers and students of NCS and SBSS were designed. Students Biology end of term grades (3rd term grades) was also employed for the study. Questionnaire for Biology teachers consist of 4 sections, section A comprises Teachers Bio-data, section B consist of 10 items on co-operative learning method, section C consist of 10 items on Guided Discovery method and section D comprises 8 items on simulation method. Also students questionnaire consist of four sections, section A comprises students Bio-data and section B consist of 10 items on co-operative learning method, section C consist of 10 items on Guided Discovery method and section D comprises 8 items on simulation method.

To ensure validity of the research instruments, the instruments were subjected to scrutiny by 3 experts who include senior lecturers in the Faculty of education UIIU, and 6 knowledgeable postgraduate students in the faculty of Education to undertake content validity. Their comments and recommendations were used to improve the validity of the instruments which was used for data collection. A pilot study was carried out and Content Validity Index (CVI) was calculated.

After undertaking the content validity of the instrument, CVI of the questionnaire was 0.933 and 0.875 for both students and Biology teachers respectively. Kathuri and Palls (1993) argued that instruments with validity index 0.7 are accepted as valid in research.

Cronbach's Alpha statistic method was used to determine the reliability of the research instruments. A pilot test was conducted using some copies of the questionnaire to the respondents that were not involved in the main study but part of the target population. The value of Cronbach alpha obtained was .887.

Data collected from the participants of the study was scored, coded and analyzed using SPSS software. Pearson Product Moment correlation Coefficient was used to determine the relationship between the independent and dependent variable. According to Pallant (2005), the purpose of using Pearson Product Moment correlation Coefficient is to find the relationship between two variables in order to determine the strength and magnitude of the relationship. In this study, each of the elements of the independent variable was correlated with the academic achievement of the students in Biology in order to determine the strength and magnitude of the relationship.

5. Findings and discussions

There Is No Statistically Significant Relationship Between Cooperative Learning Method And Students' End Of Term Achievement In Biology In the Selected Secondary Schools.

Table 1: Relationship between Cooperative learning and Students academic achievement

		Cooperative_ Learning	Academic_ Achievement
Cooperative_Learning	Pearson Correlation	1	.863*
	Sig. (2-tailed)		.033
	N	347	347
Academic_Achievement	Pearson Correlation	.863*	1
	Sig. (2-tailed)	.033	
	N	347	347

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Field data

From table 1 above, Pearson Correlation was conducted to determine the relationship between cooperative learning method and students' academic achievements. The results revealed a statistically very strong positive correlation between cooperative learning and students' academic achievement at ($r=.863$ and $\text{sig} < 0.05$). Therefore the null hypothesis was rejected and it was maintained that there is statistically significant relationship between cooperative learning and students' achievement in Biology. According to Taylor (2009) the higher the correlation the stronger the relationship. In view of this finding, I therefore deduce that the use of cooperative learning as a teaching method in Biology had contributed high to students' academic achievement in Biology.

The above findings concur with the findings of Ajaja (2013) who found that students taught with cooperative learning tend to score higher than those taught with traditional teaching method. Similarly, study by Rose and Smith (2011) revealed a significant relationship between cooperative learning and students' academic achievement. This therefore implies that students' performance may be increased by the utilization of cooperative learning in teaching Biology.

There Is No Statistically Significant Relationship Between Guided Discovery Method And Students' End Of Term Achievement In Biology In Selected Secondary Schools.

Table 2: Relationship between guided Discovery method and Students academic achievement

		Discovery_ Method	Academic_ Achievement
Guided_Discovery_Metho d	Pearson Correlation	1	.571*
	Sig. (2-tailed)		.000
	N	347	347
Academic_Achievement	Pearson Correlation	.571*	1
	Sig. (2-tailed)	.000	
	N	347	347

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Field data

From the results presented in table 2 above, Pearson product moment Correlation coefficient was conducted to determine the relationship between guided discovery method and students' academic achievement. The result of the correlation revealed a statistically significant moderate positive correlation between guided discovery method and students' academic achievement in Biology at ($r = .571$ and $P < 0.05$). Based on this, the null hypothesis above was therefore rejected. In view of this finding, I therefore deduce that the use of guided discovery as a teaching method in Biology had fair contributions to students' academic achievement in Biology.

The above findings concur with Kui (2010) who found a positive significant relationship between guided discovery learning and students' academic achievement. Brunner (1966) opined that discovery learning enables learners to discover new experience on their own through the guide of the instructor.

There Is No Statistically Significant Relationship Between Simulation Method And Students' End Of Term Achievement In Biology In Selected Secondary Schools.

Table 3: Relationship between Simulation method and Students academic achievement

		Simulation_ Method	Academic_ Achievement
Simulation_ Method	Pearson Correlation	1	.891*
	Sig. (2-tailed)		.000
	N	347	347
Academic_ Achievement	Pearson Correlation	.891*	1
	Sig. (2-tailed)	.000	
	N	347	347

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Field data

Pearson Correlation was conducted to determine the relationship between simulation method and students' academic achievements in Biology. The result of the correlation revealed a statistically significant strong positive correlation between simulation method and students' academic achievement in Biology at ($r = .891$ and $P < 0.05$). Based on this, the null hypothesis was rejected. In view of this finding, I therefore deduce that the use of simulation as a teaching method in Biology contributed highly to students' academic achievement in Biology.

The above findings are consistent with Naidu (2006) who stressed that simulation-based learning engages learners in real life experience; making learners to conceptualize abstract concepts through real life situations and virtual learning experience.

6. Conclusions

The findings of the study revealed that cooperative learning and simulation had strong correlation to academic achievement in Biology end of term examination followed by guided discovery method which had moderate correlation. The findings of the study are highly significant and relevant. These results have implication for teacher training and classroom practice. More emphasis is needed in active engagement of students in hands-on experience and use of hypermedia tools in order to reduce students' imagination in understanding Biological concepts.

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