Effects of Learning-Cycle and Learning-Together Instructional Strategies on Senior School Students' Academic Performance in Biology in Ilorin, Nigeria

[1]Basira Abdulrahim JIBRIL Ph. D.
Email: jibriljimada@gmail.com
Tel: 08173320659

[1]SAFIYA BELLO
Email: safiyyahbello36@gmail.com
Tel: 08035720459

[2]Abdulkadir Akeem AYINDE
Email: ayindeakim@yahoo.com
Tel: 08132101213

[1]School of Sciences, Kwara State College of Education, P.M.B.1527, Ilorin.
[2]Kwara state College of Education (Technical) Lafiagi P.M.B. 001, Lafiagi

Abstract
The effect of instructional strategy on the academic performance of students cannot be over-emphasized. Studies have shown that strategy employed by biology teachers in the classroom can affect students' performance positively or negatively in the subject. This study therefore examined the effects of learning-cycle and Learning-together Strategies on senior school students' performance in cell division. The study employed a quasi-experimental design of non-randomized, non-equivalent pre-test post-test group design. The sample for the study comprised 138 senior school two (SS2) students drawn from three purposively selected co-educational private secondary schools Ilorin Kwara state, Nigeria. The research instrument was a Biology Performance Test in Cell Division (BPTiCD) which contain 52 multiple choice question items adapted from WAEC questions and 2009, WAEC and NECO syllabi. The instruments went through content and face validated and reliability of 0.64 was obtained using Pearson Product Moment Correlation Statistic. A research question was raised with corresponding hypothesis were formulated and tested at 0.05 level of significance. Data were collected and analyzed using Analysis of Covariance (ANCOVA) statistical tools. The findings of the study revealed that: there was a significant difference in the performance of students taught with learning-cycle, learning-together and conventional strategy. Students exposed to 5E learning-cycle had the best performance in the test as compared to learning-together and conventional. It was recommended among others; that learning-cycle strategy should be employed to teach cell division for better performance and understanding and also biology in general.

Keywords: Learning-cycle, Learning-together, Instructional strategy, Performance, Biology

Introduction

Biology is one of the three natural science disciplines at the secondary school level in Nigeria; others are physics and chemistry. Biology is also regarded as the most popular of the three natural science disciplines amongst secondary school students in Nigeria (Jibril, Bello & Abimbola, 2015). Despite its popularity, students' performances are not encouraging as reflected at the senior school certificate examinations results over the years (Jibril, 2019). One of the problems reported to be associated with the poor performances of students in biology was instructional strategy (Abdulrahim, 2013; Jibril, et.al, 2019). Instructional strategy is a method used in teaching and learning processes which helps to activate students' curiosity about a topic, engage students in learning and probe critical thinking skills for the better understanding of course content (Teaching resources, 2015). Among the innovative instructional strategies are learning-cycle and learning- together instructional strategies which is the focus of this study.

Learning-cycle guides students to learn the content of the lesson meaningfully through sequence of instructions (Bybee, 2001). It is an activity- oriented strategy that promotes students' meaningful understanding of the scientific concept, explores and deepens that understanding in application to a new situation (Sadi & Cakiroglu, 2010). The 5E learning cycle is one of the types of learning cycle employed in teaching and learning in science.5E Learning-cycle was developed by the Biological Science Curriculum Study in 1992. The 5E Learning-cycle phases are: Engage, Explore, Explain, Extend and Evaluate. (Bybee, 1997; Ergin, Kanli & Unsal, 2008).

Learning-together Strategy is a type of cooperative strategy developed by Johnson and Johnson in 1987 at the University of Minnesota. It involves learner working in small heterogeneous groups on a given material or content of instruction. Learners are group into four or five in a group and each group is given a task to be done and summarize the knowledge gain through feed back to the teacher. This strategy emphasizes team building activities and group working; thus promoting meaningful learning of content of instruction. (Slavin, 2009b).

Cell division is one of the topics in biology taught at the senior secondary school level. It is a concept that deals with the study of chromosomes movement during mitosis and meiosis (Sijil, 2007). Zurida (2012) define mitosis cell division is a process where a cell splits into two identical daughter cells, while meiosis cell division include roughly half of its cytoplasm. Cell division is responsible for the transmission of traits from the parent to the offspring (Aziz & Ami, 2011). Despite of the importance of knowledge of cell division, teachers and students still find the concept difficult this was revealed by Chief Examiners' reports (WASSCE 2011, 2014, 2018). Also, the study conducted by Zurida (2012), revealed that cell division is one of the concept found difficult by teachers and students other being genetics, ecology and evolution.

Different research works have been conducted on Learning-cycle instructional strategy, most of these studies were conducted outside the country. But few have been found conducted in Nigeria, particularly in Biology. Among studies found on Learning-cycle in Biology are those conducted by Balci et.al, (2006), Dogru-Atay and Tekkaya (2008), Bulbul (2010), Sadi and Cakiroglu (2010) outside the country. While Ajaja (2013) and Abdulrahim (2018) studies were conducted in Biology in Nigeria. This present study examined the effect of 5E Learning-cycle and learning- together instructional strategies on senior school students' achievement in cell division.

Objective of the Study

The main objective of the study is to examine the difference in the academic performance of students taught using learning-cycle, learning- together and conventional strategy

Research Question

What is the difference in the academic performance of students taught with learning-cycle, learning- together and conventional strategies?

Research Hypothesis

There is no significant difference in the academic performance of students' taught with learning-cycle, Learning-together and conventional strategies.

Methodology

This was a quasi-experimental study which involves pre-test, post-test, non-randomized, control and non-equivalent intact groups. The study involved two Experimental Groups and One control group. Experimental Group One students were exposed to learning-cycle, Experimental Group Two students were exposed to learning-together instruction and Control Group students exposed to conventional method. All Senior Secondary II (SSII) students offering Biology constituted the population. The sample comprised 138 senior school students from intact-classes purposively sampled from three co-educational private schools in Ilorin city. The schools were selected based on the following criteria; school that have been established for more than six years, school that have a stable qualified biology teacher and school location.

Data were collected for a period of four weeks based on the school time table. The lessons were taught by the Research Assistants who were the regular teachers in the selected schools. The teachers were trained prior the commencement of the research work. Research instrument was Biology Performance Test in Cell Division (BPiCD) which contain 52 multiple choice items. The Research instrument was given to three experienced Biology teachers, two WAEC Examiners and two Biology educators from the Department of Science Education, University of Ilorin, Ilorin, Nigeria for face and content validity. The questions went through item analysis to ensure that the items were appropriate in terms of difficulty index and discrimination power. Item analysis was done by trial testing the drafted test item on students in a secondary school not participating in the study. The Item difficulty and discrimination decisions for the selection of the test questions were based on Abiri (2007). Reliability of the instrument was determined using test-retest method of three weeks' interval on the students of non-participating school. A reliability of 0.64 was obtained using Pearson's Product-Moment Correlation.

The researcher sought the permission to conduct the study in the sampled schools by presenting an introduction letter to the Principals of the selected schools for consideration. After permission was given, the researcher was introduced to Biology teachers of the schools for familiarity and arrangement was made for the study to take place. The researcher and Biology teachers who were the Research assistants distributed the consent forms to the students. A form was given to each student to be completed by their parents and returned to the Research assistants of each school. The completed consent forms were given to seek their consents to participate in the study. The copies of the collected consent forms were returned to the Researcher. Pretest was administered to the participating students in both experimental and control groups before the commencement of the treatment. Posttest was administered to all the

groups at the end of the treatment. The posttest and pretest were same in terms of questions, but the posttest items were re-shuffled before administration. All the activities for this field work lasted four weeks. Data collected were analyzed using Analysis of Covariance (ANCOVA). All the research questions were answered using mean and standard deviation, while the null hypotheses were analyzed with ANCOVA at 0.05 level of significance.

Results

Research Question

What is the difference in academic performance of students taught with learning-cycle - learning- together and conventional strategies?

Table 1: The Posttest Mean Scores of Experimental and the Control Groups

Ability Levels	Mean	Std. Deviation	N
Conventional	20.5833	9.01496	48
Learning-cycle	25.6935	10.33153	62
Learning-together	37.3571	9.98226	28
Total	26.2826	11.47386	138

The result from Table 1 reveals the mean scores for the experimental groups; 1, 2 and the control group. The result reveals that experimental group 1 has an approximate mean score of 25.69 and standard deviation of 10.33, experimental group 2 has approximate mean of 37.36 with standard deviation of 9.98 and control group has an approximate mean of 20.52 with standard deviation of 9.01.

Hypothesis Testing

There is no significant difference in academic performance of students' taught with learning-cycle, Learning-together and conventional strategies.

Table 2: Result of ANCOVA on the Posttest for the two Experimental Groups and the Control Group.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	5018.175[a]	3	1672.725	17.218	.000
Intercept	9977.315	1	9977.315	102.72	.000
Pretest	3.470	1	3.470	.036	.850
Groups	2667.867	2	1333.933	13.731	.000
Error	13017.803	134	97.148		
Total	113363.000	138			
Corrected Total	18035.978	137			

a. R Squared = .278 (Adjusted R Squared = .262)

From the result shown in Table 2, the calculated F-value is 13.731 at 2 degree of freedom computed at 0.05 level of significance. Since the calculated level of significance 0.000 is less than the level of significance 0.05, ($P<0.05$). Hypothesis one is hereby rejected, which means that there is a significant difference in the academic performance of students that were exposed to learning-cycle, learning-together and conventional instructional strategies. This in favour of students taught with learning-cycle strategy.

Discussion of Finding

This study revealed that Learning-cycle as instructional strategy has a positive effect on students' academic performance in cell division. This as reflected in the academic performance of senior school students taught with the strategy as compared to students' academic performance obtained from learning-together and conventional strategy. Hypothesis one was rejected because there was a significant difference in the academic performance of students exposed to learning-cycle, learning-together and conventional strategy. This in favour of 5E learning cycle strategy. This is in line with the studies conducted by Jibril, Babalola and Abimbola (2019) study on effects of 5E learning-cycle strategies on secondary school students' achievements in ecology and Ajaja (2013) which revealed that 5E Learning-cycle improved the academic performance of students as reflected in students' performance tests. The positive results obtained could be as result active involve of the students at each phases of 5E strategy. Students' activity oriented strategy as learning-cycle has the potential to improve students' attitudes towards the lesson thus increasing the understanding of the concept taught.

Conclusion

Learning-cycle strategy improves academic performance of senior school students on cell division than learning-together and conventional strategies. Therefore, adoption of 5E Learning-cycle strategy will be appropriate for the teaching and learning of cell-division and Biology in general.

Recommendation

Based on the finding, it is recommended that learning-cycle strategy should be employed to teach cell division for better performance and understanding. Biology teachers should be encouraged to adopt 5E learning-cycle to teach biology in order to improve students' performance at the Senior School Certificate Examinations.

References

Abdulrahim, B.J. (2013). *Views of teachers on problem associated with teaching of biology in Kwara state, Nigeria*. Unpublished M.Ed. dissertation from University of Ilorin, Ilorin, Nigeria

Ajaja, O. P. (2013). Which way do we go in the teaching of Biology? Concept-mapping, cooperative learning or Learning-cycle? *International Journal of Science and Technology Education Research, 4*(2), 18-29. http://www.academic

Aziz, N. & Ami, K. (2011). Poor understanding and poor mastery level of both mitosis and meiosis cell division concepts among students. *Journal of Science and Mathematics Education,2*(3),108-122

Balci, S., Cakiroglu, J. & Tekkaya, C. (2006). Engagement, exploration, explanation, extension, and evaluation (5E) Learning-cycle and conceptual change text as learning tools. *Biochemistry and Molecular Biology Education,34*(3), 199-203

Bulbul, Y. (2010). *Effect of 5E Learning-cycle model accompanied with computer animations on understanding of diffusion and Osmosis concepts*. Ph.D. thesis, Middle East Technical University. http://etd.lib.metu. edu.trlupload/12612299/index.pdf

Bybee, R. W. (2001). The Five E's from Roger Bybee. *Biological Curriculum Science Study* (BSCS). http://www.miamisci.org/ph/lpintro5e.html

Ergin, I., Kanli, U., & Unsal, Y. (2008). An example for the effect of 5E model on the academic success and attitude levels of students: "Inclined projectile" motion. *Journal of Turkish Science Education*,*5*(3), 47-59.http://www.tused.org.

Jibril, B. A., Bello, G., & Abimbola, I. O. (2015). Views of teachers on problems associated with the teaching of biology in secondary schools in Kwara State, Nigeria. *A proceedings of International Science, Technology, Engineering, Arts, Management and Social Sciences*, 7,923-930.

Jibril, B.A., Babalola, G.T. and Abimbola, I. O. (2019). Effects of 5E learning-cycle and concept-mapping strategies on secondary school students' achievements in ecology. *Science Teacher Association of Nigeria Proceedings*, 315-322.

Sadi, Q. O. & Cakiroglu, J. (2010). Effects of 5E Learning-cycle on students' human circulatory system achievement. *Journal of Biology science 4*(3) 63-67. www.Nobel.gen.tr.

Slavin, R. E. (2009) *Cooperative learning: What makes group work-work*? http://www.sucessful.org.

Sijil, P. (2007). Application of virtual reality technology in biology education. *Journal of Biology Education*,*37*(2)71-74

Zurida, I. (2012). *Effects of hands-on, minds-on in biology student's achievement.* A publication of School of Educational Studies, University Science, Malaysia.

Teaching resources (nd.). *Instructional strategies*. http://teahcingresources.Uregina wikispaces.net.