

Effects of Conventional and Cooperative Learning Methods on Academic Achievement of Students in Biology Based on School Location

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Abstract: *This study investigated the effect of Cooperative and Conventional learning strategies on academic achievement of senior secondary school students in the Federal Capital Territory (FCT), Abuja, Nigeria relative to Urban-Rural school location. The study adopted the pretest-posttest, quasi-experimental design and was guided by three research questions and their hypotheses. A sample size of 379 was drawn from a population of 27,160 senior secondary school students (SS 11) in four public co-educational schools. A Biology Achievement Test (BAT), was used as an instrument for data collection. Descriptive and inferential statistics were used for data analysis. The results of this study indicated a significant difference between urban and rural students' achievement in Biology when taught using cooperative learning strategy, and in favor of urban students; a significant difference between urban/rural students mean achievement in Biology when taught using conventional learning strategy, in favor of urban students; no significant difference in achievement between students taught using cooperative learning and those taught using conventional learning strategy relative to school location. It was therefore recommended amongst others, that Biology Teachers in FCT, Abuja be trained on the operating procedures of cooperative learning in addition to conventional learning strategy they are used to; and that Biology students be exposed to jigsaw II cooperative learning strategy to engender social interaction that fosters the attainment of higher academic achievement and greater retention of learned materials, as well as those of conventional learning strategies that enables repetition and drills, leading to mastery.*

Keywords: urban, rural, school location; learning, cooperative learning strategy, conventional learning strategy, academic achievement.

1. INTRODUCTION

It is widely acclaimed that Education is a powerful instrument for reducing poverty, inequality, and the basis for sustained economic growth. It raises the productivity and efficiency of individuals and produces skilled manpower, capable of leading economic development (Dorleku, 2013). However, educational inequality among rural, urban and suburban schools has been a problem in many countries. Scholars generally hold the assumption that a child's academic achievement may be greatly influenced either by the environment in which he lives or his school location (Amadi, 2018).

Rural-urban differences in achievement have been linked to uneven distribution of resources and poor school mapping. Amadi, Nnamani and Ukoha, (2018) stated that some of the factors for lower academic achievement in the rural areas include refusal of appointment or posting to isolated, remote villages by teachers; lack of social amenities, poor communication, nonchalant attitude of some communities and parents to schooling among others, while the urban environment offer much more social interaction and stimulating effect on learning.

However, Olawale (2016) opined that overcrowded classes, inadequate teaching, and learning facilities are conditions prevailing in both rural and urban schools in Nigeria today and Teachers

seem grossly unable to adapt to changes in curriculum.

Efforts of various administrations on curriculum towards addressing Nigeria's needs are yet to achieve the desired results (Morinho, 2009). Specifically, the objectives of the Biology Curriculum areas follow: to prepare students to acquire adequate laboratory and field skills; meaningful and relevant knowledge in Biology; develop the ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture; reasonable, and functional scientific attitudes (Oludipe, 2011). Studies indicate however, those science teachers are poorly trained in content and pedagogy (Samba, Achor, Josiah, and Ogbeba, 2010). Essential material resources are inadequately provided in both rural and urban secondary schools in Nigeria. (Ahmadi and Lukman, 2015).

In science classrooms, teachers still transmit knowledge and cover the curriculum rather than guide students to think and construct their ways of learning (Omorogbe and Ewansiha, 2013). Cimer (2012) further observed that students find it difficult to learn concepts due to the teaching methods and techniques, as most teachers predominately adopt the conventional method (teacher-centered approach). The implementation of Biology programs at the senior secondary level has been a matter of serious concern, as Biology occupies a central position in the scientific and technological development of any nation.

Conventional Teaching Methods

Conventional teaching methods refer to teaching methods where instructors initiate discussions in the classroom and focus is exclusively on knowing content in textbooks and notes. The students receive the information passively and reiterate the information memorized in examinations (Chopper, 2010). Though it offers the advantage of delivering a substantial amount of information to a large number of students at the same time, it makes the grasping of some scientific concepts, skills, and principles difficult for students (Lindsay, 2011). They do not involve students in active learning; do not promote insightful learning and long-term retention of some abstract concepts in Biology (Ahmed and Abimbola, 2011; Umar, 2011). This strategy contradicts the Cooperative Learning class (Uwameiye, 2016).

Cooperative Learning Strategy

This is a learner-centered approach, where students are grouped to work together to learn from one another. The teachers' role in the process is that of a guide and facilitator of learning (Ferguson-Patrick, 2018). It is grounded in the belief that learning is most effective when students are actively involved and work cooperatively to complete academic tasks (Lewis, 2019). Positive interdependence, Face-to-face Interaction, Individual accountability, Interpersonal and social skills development, and group processing are its basic elements (Johnson and Johnson, 2012).

Some of its benefits include higher academic achievement and retention of learned materials, critical and social skills development, greater social support, appreciation of individual differences; increased learners' participation, improved psychosocial adjustment of students; increased self-awareness, self-esteem, and confidence in one's own ability as well as reduced anxiety. It fosters the development of better attitudes toward teachers, and school (Ismail & Allaq, 2013). Its limitations on the other hand include group dynamics dilemmas (as it relies on positive group dynamics to function at its highest efficiency); classroom management challenges, and the time involved in planning and preparing the cooperative learning lesson.

1.1. Theoretical Framework

Two theories lend support to this study. Cooperative learning strategy is supported by *Social Interdependence Theory* (Johnson & Johnson, 2009). The theory holds that learners help each other learn because they care about group members; derive self-identity benefits from group membership (Tran, 2013). It is associated with 'the degree to which actions of one person substitutes for the actions of another person; the openness to being influenced and to influencing

others and the investment of psychological energy in objects outside of oneself (Johnson and Johnson, 2009). In essence, how goals are structured determines how individuals interact, and interaction patterns create outcomes, establishing a strong relationship between this theory and cooperative learning strategy (Johnson & Johnson, 2012).

Conventional Learning Strategy on the other hand is supported by *Behavioral learning theory*. It postulates that behavior can be predicted and controlled; that an individual's behavior is the result of environmental factors (Weegar, 2012; Filipatali, 2013). Furthermore, humans are born as a blank slate (*tabula rasa*); learning everything from the environment. It also holds that learning is achieved through conditioning by association (*classical*) and reinforcement (*operant*) and which could be positive or negative (Britwum, 2014). It assumes that given the right stimulus, learners will give the desired response. This theory is equated with teacher-centered instructional approaches (Filipatali, 2013). It behooves a behaviorist teacher to enforce a lot of practices; encourage rote learning through drills; assess the mental or emotional state of the student and respond to them; make clear the objectives of every lesson and frame these objectives around behaviors, as a change in behavior is evidence that learning has taken place (Britwum, 2014).

A lot of literature compares the effects of cooperative and conventional learning strategies on academic achievement relative to school location. Higher academic achievement of urban students was reported by Chianson (2012) in Circular Geometry; (Haliru, 2015) in Geography; Mathew (2014) in Chemistry; Amadi, Nnamani, and Ukoha (2018) in Reading; Umar and Samuel (2018) in Basic science (at JSS 11 level); Opoku-Asare and Siaw (2015) on Visual Arts Education. However, higher academic achievement in favor of rural students was reported by Yaduvanshi and Singh (2018). *Studies that indicate no significant difference in achievement due to location include those of Alokan & Arijesuyo (2013)*. They concluded that rural students do not suffer disadvantages in their academic performance simply as the result of their residence or their attendance at rural schools. Ramos, Duque, and Nieto (2016) stated that the differential is attributable to family characteristics; inadequacy of physical facilities such as playing fields, toilets, and libraries. These have consequences for co-curricular development especially for games such as football, netball, volleyball among others, as well as insufficient instructional materials (Mege, 2014); large classes, reduced number of trained teachers in rural schools do not enable attendants to individual pupil's needs and are least preferred by majority of teachers respectively).

Given the relationship between academic achievement and teaching-learning strategy; and that between achievement and school location, Biology teachers should adopt teaching and learning approaches that can improve students' achievement as the focal point of reversing the current trend of low achievement in Biology especially in the Federal Capital Territory (FCT).

The study involved Jigsaw 11 model of cooperative learning strategy and 'Modified Lecture Method', which is characterized by the teacher being the sole resource person; and he intermittently introduces some elements of demonstration and questioning in the course of the lecture.

1.2. Statement of the Problem

The academic achievement of students in Biology has been on the decline (Boyi, 2013). Reports on achievement in Biology WAEC examination from the periods 2009- 2013 indicate a percentage decline of 51.9% - 59.7% (Chief Examiners' Report, 2013). What could be responsible for this? Could it be as a result of the poor method of teaching or urban /rural school location? For Science learning at the secondary level to engender scientific interest and participation in the economic and social development of nations, effort should be on adopting appropriate instructional strategies. The problem before this study, therefore, was to determine comparatively, the effect of cooperative and conventional learning strategies on senior secondary school student's academic achievement in Biology in FCT, Abuja relative to school location

1.3. Purpose of the study

The purpose of the study was to compare the effects of learning strategies on academic performance in Biology in FCT Abuja relative to school location.

The specific objective was:

1. To determine the effect of cooperative learning strategy on academic achievement of senior secondary school students in a post-test in Biology based on urban/rural school location.
2. To determine the effect of conventional learning strategy on academic achievement of senior secondary school students in a post-test in Biology based on urban/rural school location.
3. To determine the effects of cooperative learning strategies on academic achievement of senior secondary school students in a post-test in Biology when compared with conventional learning strategy based on location in the Federal Capital Territory, Abuja

1.4. Research Questions

1. What is the effect of cooperative learning strategy on students' academic achievement in posttest in Biology based on urban-rural school location in the Federal Capital Territory, Abuja?.
2. What is the effect of conventional learning strategy on students' academic achievement in posttest in Biology based on urban-rural school location the Federal Capital Territory, Abuja?.
3. What is the effect of cooperative learning strategy on students' academic achievement in a post-test in Biology when compared to conventional learning strategies based on location in the Federal Capital Territory, Abuja?.

1.5. Research Hypothesis

H₀₁: There is no significant difference between rural and urban students' mean achievement in a post-test in Biology when taught using cooperative learning strategy.

H₀₂: There is no significant difference between rural and urban students' mean achievement in posttest in Biology when taught using conventional learning strategy

H₀₃: There is no significant difference between rural and urban students' mean achievement in posttest in Biology when taught using Cooperative Learning and Conventional Learning strategies

2. METHODOLOGY

The study adopted a pretest-posttest quasi-experimental design. The population consists of 27,160 SS 11 Biology students of 2017/2018 academic session in 51 co-educational public secondary schools in the six (6) Area Councils of the Federal Capital Territory (FCT), namely Abaji, Bwari, Gwagwalada, Kuje, Kwali, and Municipal Area Councils.

A sample of 379 (181 boys, and 198 girls) was obtained using a simple random sampling technique. Four co-educational schools were selected – two from urban and two rural school locations from which 2 schools were selected and an intact class selected and assigned to experimental and control groups, all through simple randomization technique, bringing the number of intact classes to four (4).

The instrument was a Biology Achievement Test (BAT) - consisting of fifty (50) multiple-choice question types with 4 options. It measured the performance of students in the experimental (cooperative learning) and control (conventional learning) groups before and after treatment. The content validity of BAT was assured by the use of a table of specifications, based on different levels of objectives of the cognitive domain. Further validation was done by two specialists in science education and two teachers from the experimental group schools. Using the test-retest

technique, two (2) pairs of scores were correlated by applying the Pearson-Product-Moment-correlation, and a reliability of 0.74 was obtained.

2.1. Data Collection Procedure

With permission from the selected schools to enable the use of intact classes for treatment and testing, the experimental group teachers were trained on the basic principles of the Jigsaw 11 model of cooperative learning strategy. This was followed by an orientation program for the students in the experimental groups on group goals, division of labor, group rewards, and social skills development. A day before the commencement of the first lesson, a pre-test of Biology was administered to the four intact classes (experimental and control groups). Treatment commenced, thus: For the *Experimental group* - Jigsaw 11 operational model was adopted. Students were assigned to heterogeneous study teams of three to six members each. Academic materials were broken down into smaller topics/sections, and each member of the home group was then assigned a different topic/section and was responsible for learning that portion of the assigned material. Students from different home teams, but with the same assigned learning portion met with each other in expert groups to discuss and help one another learn the common material. After learning their portion of the material in the expert groups, students returned to home groups to teach home team members what was learned. Students were then tested on what they learned. At the end of each sub-topic, an assignment was given, and at the beginning of the next lesson, the workbooks in which students did the assignment were collected or exchanged and marked. Any item answered wrongly by students was noted and corrections were effected at each home group. *Control group*:-the first lesson was introductory as well. Subsequent lessons were taught following teachers' regular manual (conventional learning strategy). A day after the completion of lessons, the BAT post-test was administered without advanced notice. It took five weeks to complete the study.

2.2. Method of Data Analysis

Mean and standard deviation was used to answer research questions, while a t-test of significance was used in accepting or rejecting the hypotheses formulated. Since the data in the study is continuous (numerical), it justifies the use of a t-test of significance. The decision rule is to reject H_0 if $P < 0.05$; accept H_0 if $P > 0.05$.

3. RESULTS

3.1. Descriptive statistics

Research Question One:

What is the effect of cooperative learning strategy on students' academic achievement in posttest in Biology based on urban-rural school location?

Table 1: Mean Score and Standard Deviation of urban and rural Students taught Biology using a cooperative learning strategy

Learning Strategies	Location	No. of students	Mean	Std. Dev.	Std. error of mean
Cooperative learning Strategy	Urban	118	79.5	9.77	0.72955
	Rural	73	75.2	9.75	0.76453

The result presented in Table 1, shows that there was a difference in the mean achievement of the senior secondary school students located in the urban area who were taught Biology using the cooperative learning strategy because their mean score (mean = 79.5, SD = 9.77) was higher than the mean score of the students that resides at the rural area (mean = 75.2, SD = 9.75).

This result implies that the mean achievement of students located in the urban area and who learned Biology through the cooperative learning strategy varies from the achievement of students that resides in the rural area of FCT, Abuja. It can be concluded from the result presented in Table 1, that the cooperative learning strategy had a higher effect on the urban students than the students in the rural area of FCT Abuja.

Research Question 2:

What is the effect of conventional learning strategy on students' achievement in a post-test in Biology based on school location?

Table 2: Mean Score and Standard Deviation of urban and rural Students taught Biology using conventional teaching method

Teaching Strategy	Location	No. of Students	Mean	Std. Dev.	Std. error of mean
Conventional Learning Strategy	Urban	126	65.7	10.91	0.92072
	Rural	62	61.4	8.99	0.92123

The result presented in Table 2, shows a difference in the mean achievement of the senior secondary school students located in the urban area, and who were taught Biology using conventional teaching method because their mean score (mean = 64.7, SD = 10.91) was higher than the mean score of the students that resides at the rural area (mean = 61.4, SD = 8.99).

This result implies that the mean achievement of senior secondary school students located in the urban area that learned Biology through the conventional teaching method differs from the achievement of the senior secondary school students that resides in the rural area of FCT, Abuja. It can be concluded from the result presented in Table 2, that the conventional teaching method had a higher effect on the urban students than the students in the rural area of FCT Abuja.

Research Question 3

What is the effect of cooperative and conventional learning strategies on students' academic achievement in a Post-test in Biology based on location?

Table 3: Mean score and standard deviation of urban and rural students taught using cooperative and conventional learning school strategies.

Learning Strategy	Gender	Mean	Std. Div.	Std. error of Mean	No. of students
Cooperative Learning Strategy	Urban	79.5	9.77	0.72955	118
	Rural	75.2	9.75	0.76453	73
Conventional Learning Method	Urban	65.7	10.91	0.92072	126
	Rural	61.4	8.99	0.92123	62

The result indicates a difference in the mean achievement of students located in the urban area who were taught Biology using the cooperative learning strategy because their mean score (mean = 79.5, SD = 9.77) was higher than the mean score of the students that resides at the rural area (mean = 75.2, SD = 9.75). Similarly, the mean achievement of the urban senior secondary school students that were taught Biology using the conventional teaching method (mean = 65.7, SD = 10.91) was higher than the mean score of the rural student taught Biology using conventional learning strategy (mean = 61.4, SD = 8.99).

This result implies that the mean achievement of students located in the urban area that learned Biology through cooperative and conventional learning strategies varies from the achievement of the students that resides in the rural area of FCT, Abuja. It can be concluded from the result presented in Table 3, that cooperative learning strategy and conventional learning method had a higher effect on the urban students than the students in the rural area of FCT Abuja.

3.2. Inferential Statistics

Hypothesis 1:

H₀: There is no significant difference between urban and rural students' mean achievement in Biology when taught using cooperative learning strategy?

Table 4: Two-tailed t-test result of achievement in Biology between students taught using cooperative learning strategy based on location

Location	N	Mean	Std. error	t – value	d.f.	P-Value	Decision
Urban	118	79.5	8.92	-2.9211	189	0.003	H ₀ is rejected
Rural	73	75.2	9.77				

An independent two samples t-test was run to determine if there were differences in academic achievement between urban and rural senior secondary school students taught Biology using cooperative learning strategy. The test was found to be statistically significant because there was a higher mean score in the Biology test for urban senior secondary students (mean = 79.5, SD = 8.92) when compared to rural senior secondary students (mean = 75.2, SD = 9.77). The mean difference in senior secondary school students' achievement in Biology between the urban and rural students was 4.3. This difference was significant because $t_{(189)} = -2.921$ was greater than the t-critical of -1.96 and P-value = 0.003 < 0.05 level of significant at the 189 degree of freedom. The null hypothesis is rejected and the alternative hypothesis was accepted, this implies that; there is a significant difference between urban and rural students' mean achievement in Biology when taught using cooperative learning strategy.

Hypothesis 2:

H₀: There is no significant difference between urban and rural students' mean achievement in Biology when taught using conventional teaching methods.

Table 5: Two-tailed t-test result of achievement in Biology between students taught using conventional teaching method based on location

Location	N	Mean	Std. error	t – value	d.f.	P-Value	Decision
Urban	126	65.7	10.91	2.6827	186	0.0079	H ₀ is rejected
Rural	62	61.4	8.99				

The results of an independent two samples test found a statistically significant difference in academic achievement; there was a higher mean score in Biology test score for urban senior secondary students (mean = 65.7, SD = 10.91) when compared to rural senior secondary students (mean = 61.4, SD = 8.99). The mean difference in senior secondary school students' achievement in Biology between the urban and rural students was 4.3. This difference was significant because $t_{(186)} = 2.6827$ was greater than the t-critical of -1.96 and P-value = 0.0079 < 0.05 level of significant at the 186 degree of freedom. The null hypothesis is rejected and the alternative hypothesis was accepted, this implies that; there is a significant difference between urban and rural students' mean achievement in Biology when taught using conventional teaching method.

Research Hypotheses 3

H₀: There is no significant difference in achievement mean score in a post-test in Biology between senior secondary school students taught using cooperative learning strategy and those taught using conventional learning strategy based on location.

Table 6: Two-tailed t-test result of achievement between students taught using cooperative learning and conventional learning strategy based on location.

Location	N	d.f.	Mean	Std. error	t – value	P – Value	Decision
Urban	244	377	70.3	11.39	-0.674	0.501	Accept H ₀
Rural	135		71.2	13.02			

The result of an independent two samples t-test ran to determine if there were differences in students' achievement in Biology between cooperative and conventional learning strategies based on their location, was found to be statistically insignificant: They had almost the same

mean score in the Biology test for students located at the urban area (mean = 70.3, SD = 11.39) and students located at the rural area, (mean = 71.2, SD = 13.02). The mean difference in students' achievement in Biology between the urban and rural students was -0.86709. This difference was not significant because $t_{(377)} = -0.674$ was less than the t-critical of 1.96 and $P = 0.501 > 0.05$ level of significance at the 377 degrees of freedom.

The null hypothesis is accepted, this implies that; there is no significant difference in mean score achievement of students in a post-test in Biology between rural and urban schools' students taught using cooperative learning strategy and those taught using conventional learning strategy.

3.3. Discussion of Major Findings

Three findings were obtained from this study. First, there was a significant difference between urban and rural students' achievement in Biology when taught using cooperative learning strategy, and in favor of urban students. This result is consistent with that of Matthew (2014) that school location has a significant effect on students' achievement, in favor of urban students; Nwagu (2010) in Ntibi, Edoho (2017) found that school location was significant in learning aspects of Mathematics and Basic Science, with rural students exhibiting more learning difficulties than their urban counterparts and with the higher failure rate. Nwalado (2018) equally reported a significant difference in terms of treatment group (Jigsaw) and school location on students' academic achievement in Social Studies. However finding by Haliru (2015) was in favor of riverine students, while Bamidele (2015) reported that location does not affect students' achievement.

What could be responsible for the inconsistencies? Could it be the operating procedure of the learning strategy, or other factors within the environment such as parental background, educational level of parents, availability of resources (Olufemioladebinu, Adediran, and Oyediran, 2018) attitude of teachers or students (Ekperi, Onwuka, & Young, 2019; Rafiu, 2020).

Ridding and Walberg (2015) stated that many of the issues confronting urban students confront rural students and that research is yet to substantiate that motivation to learn is particularly lacking in the rural area. Additional studies are therefore required to confirm the effects of urban-rural school environment on academic achievement of students, as results are inconclusive.

Secondly, there was a significant difference between urban/rural students' mean achievement in Biology when taught using conventional learning method which was in favor of urban students. This result is consistent with findings by Opoku-Asare, & Abena. (2015), and (Akinwumi, 2017); while contrary to findings by Ja'afar, Abdullahi, and Badgal (2014) in which lecture method of instruction was more effective than a combination of Demonstration and Lecture methods (though not based on urban-rural school location, but on the method of instruction). Additionally, Lak, Soleimani, and Parveneh (2017) reported that both Learner-centered and Teacher-Centered teaching methods had a positive result on learners reading comprehension performance, with the learner-centered method being more effective. Omwirhiren and Ibrahim (2016) reported that Lecture produced a higher mean score achievement than the Demonstration method in senior secondary Chemistry.

From a review of previous studies, it stands to reason that cooperative and conventional methods enhance the learning of senior secondary students, therefore, both are viable with the potentials to enhance academic achievement.

Thirdly, there was no significant difference in achievement in a post-test in Biology between students taught using cooperative learning strategy and those taught using conventional learning strategy, based on location. This result is contrary to findings by Kingdom-Aaron, Etokeren, and Okwelle (2019) where students in cooperative learning class scored significantly higher than those in the lecture method group. Ekeanyanwu & Anene (2020) reported that cooperative learning strategy is more effective than conventional learning strategy in enhancing students' academic achievement. However, contrary to findings by Lak, Solemane, and Parveneh (2017) that both

strategies enhance academic achievement. Concerning urban/rural school location, Alok and Arijesugo (2013), found no significant difference in academic achievement due to environment. Oredain (2016), Yaduvandu & Singh (2018) recorded no significant difference in student's achievement based on school location. In essence, rural students do not suffer disadvantages in academic achievement as a result of their residence or attendance at rural schools (Alok and Arijesugo, 2013).

However, Mathew (2014), as well as Ramos, Digue, and Nieto (2016), while comparing cooperative learning strategy and conventional method recorded significant differences in performance due to school location in favor of rural location. On the other hand, findings by Haliru (2015), Mega (2014); Amadi, Nnamani and Ukoha (2018), and Umar and Samuel (2018) were in favor of students in urban located schools. Could this be attributed to the fact that educational facilities in rural areas of Nigeria are either lacking or in a deplorable condition (Olawale, 2016).

In support of this, Program for International Students Assessment, (PISA, 2014 pg 1) stated that schools in urban areas perform at higher levels than others. They tend to benefit from better educational resources, and often enjoy greater autonomy in resource allocation. Be it as it may, over-bloated classes (with enrolment over a hundred were some of the prevailing conditions in urban schools). Large numbers of students are left in the hands of a single teacher. Though urban schools may be the preference of teachers, handling classes this large daily comes with many challenges which bear on the effectiveness of teachers as well as students' academic achievement. In the light of these finding, results on the effect of location on academic achievement (irrespective of learning strategy) is inconclusive, hence the need for further investigation.

There is overwhelming literature on Jigsaw 11 cooperative learning strategy having a comparative advantage over the conventional lecture method in enhancing students' academic achievement. This is due to the high degree of preparedness the teachers brought to instructional planning; practices in self and peer teaching, engagement in discovery, problem-solving and learning, development of expertise that enabled contributions to group efforts. On urban-rural school location, all but one of the studies reviewed was in favor of urban students which could be attributed to the presence of physical facilities, family aspirations, better-qualified teachers, and reputation of schools.

Though the current study was a comparative effect of cooperative and conventional learning strategies, relative to school location, findings were inconsistent. Studies should therefore be conducted to affirm the appropriateness of the jigsaw model; other cooperative learning strategies, and lecture method for teaching Biology in secondary schools (in both rural and urban locations).

4. RECOMMENDATIONS

Based on the results of this study, it was recommended amongst others, that workshops and seminars be organized on cooperative and conventional learning strategies; their operating procedures for teachers; Biology students be exposed to jigsaw II cooperative learning strategy to promote motivation to learning, as well as conventional learning strategy whose operating procedures instill practices through drills in ways that enables mastery of concepts; both cooperative learning and conventional learning interventions be given for a longer period to observe their effectiveness; curriculum outlay to reflect the operational procedures of cooperative learning strategy in a way that ensure teachers position themselves as guides or facilitators of knowledge as well as the conducted of more location-related studies.

Some of the conditions beyond the ability of the researcher that may have placed restrictions on the conclusion of the study and its application include the large size of science class, especially in the experimental group (Jigsaw 11) classes. Enrollment in each of these classes was more than one hundred and ten students. This had consequences for class control and distribution of

instructional materials. Secondly, the study was on the aspect of Biology that deals with the plant as stipulated in the Senior Secondary School Biology Curriculum.

It is suggested that the study be replicated in public single-sex schools, “Private” school sector (and with more than one class at each level to determine if the outcomes would be the same. Secondly, research designs that entail random assignments of learners to treatment groups be used along with regression analysis to control for student differences. Thirdly, other models of cooperative learning and conventional learning strategies be employed in further studies in Biology and on the topic “Reproduction in Plants”. Additionally, more urban/rural school location-related studies are conducted on cooperative and conventional learning in the Federal Capital Territory (FCT) and Nigeria in general, to conclusively determine if results will be the same as in the current study.

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