

## **EFFECTIVENESS OF CLASS WIDE PEER TUTORING INSTRUCTIONAL STRATEGY IN PROMOTING SECONDARY SCHOOL BIOLOGY STUDENTS' CONCEPTUAL UNDERSTANDING OF FLOWERING PLANTS**

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### **Abstract**

*Students' poor performance in Biology has been blamed on teachers' presentational competences and concepts that are difficult to learn and to teach. This study which adopted a non-randomized, pre-test, post-test, quasi-experimental design sought to find out the effectiveness of the class wide peer tutoring instructional strategy in promoting secondary school students' conceptual understanding of reproductive systems in flowering plants. Using the multi-stage random sampling technique, ninety-nine senior secondary school II students belonging to two schools in two LGA's in Aba Education Zone were used for the study. A twenty (20) item multiple-choice Biology Achievement Test (BAT) adopted from West African Senior Secondary Certificate Examination (WASSCE) Past Questions which had Kuder Richardson (K-R 20) reliability coefficient of 0.72 was used for data collection. Mean and standard deviation were used for answering the research question while the t-test for independent samples was used for testing the hypothesis at the 0.05 level of significance. The finding of the study was that class wide peer tutoring strategy promotes better conceptual understanding of flowering plants, as there were significant differences between the mean academic achievement of students taught using the class wide peer tutoring strategy and those taught using the conventional teacher-led discussion strategy. Based on the findings of this study, it was recommended that Biology teachers should use class wide peer tutoring strategies that have been identified as effective, by research, to teach specific topics or concepts to enhance students' understanding and achievement in Biology.*

**Keywords:** Class wide peer tutoring, Conceptual understanding, flowering plants, Biology

## **Introduction**

As a science subject, Biology, in contrast to Physics and Chemistry, enjoys overwhelming popularity among Nigerian secondary school students. This trend has been attributed to students' assumption that Biology is simpler to understand (Adewale, Nzewuihe and Ogunsola, 2016); has numerous importance (Ahmed and Abimbola, 2011); and provides a platform for teaching students to develop the ability to apply science concepts and principles in solving everyday problems (Agboghroma and Oyovwi, 2015). Unfortunately, this popularity has not resulted in Nigerian students' optimum performance in high-stake external examinations such as the West African Senior Secondary Certificate Examinations (WASSCE).

For example, of the 1,182,038 and 1,087,921 students that registered for Biology in 2015 and 2016, only 35.19% and 48.48% obtained grades 1-6. Similarly in 2017 and 2018, the 1,087,921 and 1,087,884 school candidates that registered for the examination had a raw mean scores of 31 and 30 with 11.92 and 9.00 standard deviations respectively.

The persistent poor performance of students in Biology has been blamed on unfavourable classroom learning environments (Ali, Toriman and Gasim 2014); teachers' incompetence in teaching some concepts (Isiugo-Abanihe, Long-John and Tandi, 2010; Nwagbo and Obiekwe, 2010) and Biology concepts that are difficult to learn (Okebukola, 2005; Etebro and Fabinu, 2017, Cimer, 2012). Some difficult to learn Biology concepts identified by research include Ecological management, nutrient cycling in nature, pests and diseases of crops and reproductive systems in plants (Etebro and Fabinu, 2017). This report confirms WAEC chief examiners reports that students rarely attempted examination questions on these Biology concepts, and that those that did were unable to "provide satisfactory answers" (WAEC 2015, 2016, 2017).

For students to "provide satisfactory answers" to examination questions, they need to have understanding of the concepts of interest. Having conceptual understanding connotes that a student's learning in class is transferrable to other situations or domains outside of the classroom (Ben-Hur, 2006; Omari and Chen, 2017). To improve students' learning and performance in external examinations, several research reports have advocated for the use of innovative, cooperative, learner-centred instructional strategies which provide students with opportunities to talk with each other, as well as solve problems together in class. These strategies are anchored on the constructivist learning theory which emphasizes the learner's critical role in constructing meaning from new information and past experiences. Researchers advocating for the use of these novel strategies in teaching Biology assert that they

encourage students to be actively engaged with the physical environment, interact socially, share ideas, collaborate, problem solve and construct new understandings (Gilles and Boyle, 2011). These strategies include jigsaw learning-teams, problem-based learning and peer-tutoring (Kalu-Uche and Emeka, 2018; Mumuni, Dike and Uzoma-Nwogu, 2017; Kalu-Uche and Alamina, 2014; and Ullah, Tabassum and Kaleem, 2018) among others.

Peer tutoring is a cooperative method of instruction in which two or more students help each other to learn by working together, teaching and learning from each other. It provides small group, intense, focused, individualized instruction that fosters creativity, self-confidence, development of problem solving skills, and active interaction among students (Hovarth, 2011; Ali, Anwer and Abbas, 2015). In peer tutoring, one student plays the role of a tutor and the other a tutee. A peer tutor may be anyone who is of a similar status (e.g. classmates, age mates) as the one being tutored or an older learner who takes on the tutoring role (cross age peer tutoring). The tutor/tutee roles are explicit and tutees receive direct and immediate error-correction feedback from the tutors.

The peer tutoring instructional model has several variants such as Cross-age peer tutoring, Reciprocal Peer Tutoring (RPT), Same-age Peer Tutoring, Peer Assisted Learning Strategies (PALS) and Class-wide Peer Tutoring (CWPT) (Kapil and Malini, 2017; Ali, Anwer and Abbas, 2015; Hott, Walker and Sahni 2012).

In class-wide peer tutoring, the entire class is divided into heterogeneous groups of two to five students based on their ability levels. Each student, irrespective of his ability, acts either as a tutor, a tutee or both, thus the students in the classroom actively learn from and strengthen each other's academic confidence as well as learn transferable skills such as cooperation, listening, and communication. Several researchers advocate for the adoption of Class-wide Peer Tutoring instructional strategies to improve students' academic achievement (Abdulmalik and Torpev, 2016; Mkpang, 2016). Academic achievement refers to the level of knowledge attained or skills developed by a learner in a school subject as measured by test scores or grades assigned by the teacher or examiner (Azubuike, 2012). Thus, academic achievement is used to ascertain the extent to which pre-defined objectives of an academic exercise has been realized.

Against the backdrop of students' continued uninspiring performance in high-stake external examinations in Biology, it has become pertinent to determine teaching strategies that may facilitate students' conceptual understanding of difficult to learn concepts in Biology. Although numerous research reports have supported the use of the Class wide Peer Tutoring

instructional strategy so as to enhance students' achievement in science, its value in helping students attain conceptual understanding of reproductive systems in flowering Plants has not been fully explored in Nigeria. Thus this study sought to determine the effectiveness of Class wide Peer Tutoring instructional strategy in promoting Senior Secondary School Biology students' conceptual understanding of reproductive systems in flowering plants.

One research question and one hypothesis guided the study:

- What are the mean achievement scores of students taught reproductive systems in flowering plants using Class wide Peer Tutoring instructional strategy and those taught using conventional method.
- The mean achievement scores of students taught reproductive systems in flowering plants using Class wide Peer Tutoring instructional strategy do not differ significantly from those taught using conventional teaching method

### **Method**

The study adopted pre-test, post- test non-randomized control group quasi-experimental design. The population of the study consisted of 2539 SS II students offering Biology in all the co-educational public secondary schools in Aba Education Zone, Abia State. Aba Education Zone has a total of 98 co-educational schools.

The education zone is made up of nine (9) Local Government Areas: Aba north, Aba south, Isiala Ngwa North, Isiala Ngwa South, Osisioma Ngwa, Obingwa, Ugwunagbo, Ukwa East and Ukwa (Planning, Research and Statistics Unit, Secondary Education Management Board Umuahia, Abia State, 2019). Using the multi-stage random sampling technique, two intact SS II classes from two different schools in one randomly sampled LGA were randomly selected and used for the study. The classes were assigned to experimental and control groups by balloting. The experimental class had 51 students while the control class had 48 students (The schools sampled for the study had few Biology teachers and as such, all the students in SSII offering Biology in those schools were taught at the same time in one class). The instrument for data collection was a twenty (20) item multiple-choice Biology Achievement Test (BAT) adopted from West African Senior Secondary Certificate Examination (WASSCE) Past Questions (1988 to 2018). A test blue-print, anchored on the Revised Bloom's Taxonomy, guided the choice of the test items to ensure that the items measured students' conceptual understanding of reproductive systems in flowering plants. The instrument was face validated by two experts in Science Education (Biology) and one

expert in Measurement and Evaluation. To determine the internal consistency of the items, the BAT was administered to a sample of 20 students from another school (not used for the study) in a different Local Government Area in Aba Education zone. The instrument had Kuder Richardson (K-R 20) reliability coefficient of 0.72. Equivalent forms of the Biology Achievement Test (BAT) were used for pre-test and post-test. Equivalence was achieved by reshuffling the test items.

The pre-test was administered by the regular Biology teachers (who served as research assistants) in the two schools before the commencement of the teaching sessions. The regular class teachers were trained independently for three days within two weeks prior to the instructional phase of the study. The teachers taught reproductive systems in flowering plants with validated lesson plans developed by the researchers. The regular class teacher was already conversant with the students' ability and as such did not have problems placing the students in heterogeneous groups according to their ability. The experiment lasted for two weeks within the officially assigned period for teaching flowering plants in the scheme of work. The students were taught reproductive systems in flowering plants as part of the lesson on Flowering plants, using two double periods of 80minutes each.

The experimental group was taught using incidental class wide peer tutoring. For the first lesson, the students were asked to pluck flowers from the school garden. Using verbal explanation, illustrations, demonstrations, and charts showing parts of a flower, the students were taught for 40 minutes. Then the teacher split the students into 10 heterogeneous groups based on the students' ability. The students were asked to observe, identify and carefully separate the petal, sepals, androecium and gynoecium. The students were allowed to collaborate on the given task for twenty-five minutes while the teacher went from group to group to provide assistance and to demonstrate how to identify and separate the floral and reproductive parts of the flower. To end the lesson, the students were asked to read up from their texts, the different positions and structure of the ovary in flowering plants in preparation for the next class. The students were informed that for the next class, they will work according to the grouping established for the first contact and that any student in any of the groups could be called to teach the class. They were also asked to bring flowers for the next Biology class.

For the second contact, the teacher gave a review of the first lesson and then asked the students to show each other the ovaries of their individual flowers, whilst the teacher explained the types and positions of the ovaries. The pupils were asked to collectively classify the different flowers in their groups into complete or incomplete, bisexual or unisexual, regular or irregular

flowers based on the presence or absence of floral leaves and essential organs. The students were taught how to cut the flowers longitudinally to expose the floral and reproductive parts, and were encouraged to ask questions which the teacher re-directed to other students who tried to answer based on their own understanding.

Students in the control group were taught reproductive systems in flowering plants using the conventional teacher-led discussion strategy for 80 minutes (one double period), each week, for two (2) weeks. For the first lesson, the students were taken out to the school garden/farm and were asked to pluck as many flowers as they could. Using charts, illustrations and verbal explanations, they were taught parts of the flower, how to identify and separate the petals, sepals, androecium (stamen) and gynoecium (carpel). The students were also encouraged to ask questions, which the teacher either answered or redirected to the class for other students to answer. To end the first lesson, the students were asked to read up different positions of the ovary of a flower from their textbooks. They were asked to write down any questions they had about the ovary in preparation for the next class. They were also asked to bring flowers.

For the second lesson, the teacher introduced the lesson by asking students questions to help them recall what they had learned during the previous lesson. The students were then asked to separate the floral and reproductive part of their individual flowers, and to show the positions of the ovaries of the various flowers. Students were encouraged to ask questions in order to get clarifications. The teacher also used probing questions to elicit students' understandings as well as to get all the students in class to participate actively.

The post test was administered two weeks later as part of the class test at the end of teaching Flowering plants. To answer the research question, the data collected were analysed using mean and standard deviation, while the hypothesis was tested using independent t-test.

**Results**

**Table 1: Pre-test and Post-test Achievement Scores of Students taught using Class wide Peer Tutoring and those taught using Conventional Teacher-led discussion strategy**

Groups	n	Pre test		Post test		Mean difference
		Mean	SD	Mean	SD	
Experimental	51	13.88	1.57	20.35	6.11	6.47
Control	48	13.61	1.44	18.52	3.85	4.91

Data in table 1 indicates that students taught using the Class-wide peer tutoring strategy had pre-test mean and standard deviations of 13.88 and 1.57; and post-test mean and standard deviations of 20.35 and 6.11 respectively. This gave a mean difference of 6.47. The students in the control group had pre-test mean and standard deviations of 13.61 and 1.44; and a post-test mean and standard deviations of 18.52 and 3.85. This gave a mean difference of 4.91. The standard deviation scores indicate that the students' individual post test scores varied reasonably from the mean. This result indicates that the class-wide peer tutoring instructional strategy and conventional teacher-led discussion strategies enhanced students' achievement in the Biology Achievement Test on reproductive systems in flowering plants. The results seem to suggest that using class-wide peer-tutoring promotes conceptual understanding of reproductive systems in flowering plants better than the conventional teacher-led discussion strategy.

**Table 2: T-test for independent samples analysis of students' achievement in the BAT**

Group	Number of students	Group mean	Standard deviation	Significance level	T-value	P-value	Decision
Class wide peer tutoring	51	20.35	6.11	0.05	1.782	0.008	Reject
Conventional Teacher-led Discussion	48	18.52	3.85				

Since the associated probability (0.008) was less than 0.05 set as level of significance, the null hypothesis which stated that the mean achievement scores of students taught reproductive systems in flowering plants using Class wide Peer Tutoring instructional strategy do not differ significantly from those taught using conventional teaching method is rejected. The alternative hypothesis that the differences in the students' mean achievement scores were significant is accepted.

Thus, inference drawn is that there were significant differences between the achievement mean scores of students taught using Class wide Peer Tutoring and that of those taught using Conventional method; with those taught using Peer Tutoring Instructional Strategy having a higher mean gain. This indicates that the Class wide Peer Tutoring strategy was more effective in

promoting the students' conceptual understanding of reproductive systems in flowering plants.

### **Discussion**

The students in the two groups had pre-test mean scores of 13.88 and 13.61 with standard deviations of 1.57 and 1.44 respectively. This indicated that the students had prior knowledge and ideas of reproductive systems in flowering plants. This could be attributed to previous instruction. This result agrees with the constructivist theories of learning which posit that learning outcomes do not depend solely on the activities in the learning environment, but also on the learner's previous knowledge which he or she brings into the learning situation. The pre-test standard deviation scores also indicate that the students' prior understanding of reproductive systems in flowering plants were similar. This also upholds the tenets of the constructivist view that some constructed meanings are shared (Yang, Lin, She & Huang, 2015; Goodman, 2009).

The post-test mean score of 20.35 and 18.52 obtained by the students in the experimental and control groups respectively, indicate that they made some gain in their achievement and by extension, their conceptual understanding of reproductive systems in flowering plants. The students taught using the Class wide Peer Tutoring Instructional Strategy had a mean difference of 6.47, while those taught using the conventional teacher-led discussion strategy had a mean difference of 4.91. This result indicates that the two instructional strategies had effect on the students' conceptual understanding of reproductive systems in plants. The observed differences in the students' post-test performance could be attributed to the use of incidental Class wide Peer Tutoring Instructional strategy. This finding supports Kalaian and Kasim's (2011) assertion that all forms of small group learning methods had positive impacts on students' achievement when compared with lecture-based instruction.

The findings of the study also indicate that significant differences exist in the mean performance/academic achievement of the students taught using the two instructional strategies as measured by their performance in the BAT. This finding suggests that the Class wide Peer Tutoring instructional strategy could yield better results if used to teach reproductive systems in plants. This finding aligns with Ullah, Tabassum and Kaleem's (2018) assertion that peer tutoring instructional strategy was an effective teaching method for Biology at the secondary school level.

### **Conclusion**

The students had prior knowledge of reproductive systems in flowering plants before they were taught with any of the instructional strategies. The students taught reproductive systems in flowering plants using Class wide Peer Tutoring instructional strategy performed better than those taught using the conventional teacher-led discussion strategy in the post-test even though their prior understanding of reproductive systems in flowering plants were similar. This result suggests that the Class wide Peer Tutoring instructional strategy was effective in promoting secondary school students' conceptual understanding of reproductive systems in flowering plants.

### **Recommendations**

Based on the findings of this study, it is recommended that Biology teachers:

1. Should use class wide peer tutoring instructional strategies that have been identified as effective, by research, to teach specific topics or concepts to enhance students' understanding and achievement in Biology.
2. Make efforts to adopt collaborative teaching strategies that will encourage opportunities for learner interaction where learners would be able to teach each other.

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