

Effects of Think-Pair Share Teaching Strategy on Secondary School Students' Achievement and Retention in Biology in Abia State

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Abstract

This study was to determine the Effects of Think-Pair Share Teaching Strategy on Secondary School Students' Achievement and Retention in Biology in Abia State. The study adopted a non-equivalent pre-test-post-test design of quasi-experimental research design. The population was 52,197 consisting of 26015 males and 26132 females of senior secondary school Biology students in public schools in Abia State. Senior secondary school 2 (SS2) Biology students in two (2) intact classes from two (2) public co-educational school selected using Purposive sampling served as sample for the study and sampling size was 102. The instrument for data collection was a Biology Achievement and Retention test adapted from WAEC and NECO past questions and was validated by three experts; 1 from Measurement and Evaluation department and 2 from Biology department. Two Research questions were used and two hypotheses tested. The results from the data were analysed using mean and standard deviation while the null hypothesis were tested at 0.05 level of significance using analysis of Covariance (ANCOVA) and further subjected Scheffe Post Hoc analysis. The findings showed that there is a significant difference between the mean achievement scores of students taught Biology using Think pair share and those taught with lecture methods. The mean retention scores of students taught Biology using Think pair share teaching strategy and those taught with lecture teaching methods differed significantly. Biology students using Think pair share had the higher retention score while those taught with lecture teaching methods had the lower retention score. Based on the findings, the researcher recommended that think-pair share teaching strategy should be actively used by Biology teachers as it has been observed to enhance the academic achievement of students. Biology teachers should be trained and retrained on how to effectively employ Think-pair share teaching strategy in other to improve achievement and enhance students' retention ability. The curriculum planners should integrate Think-share pair teaching strategy into the nation's curriculum and allocate time for its effective implementation; and Researchers as well should investigate more on the effect of Think-pair share on students' attitude towards learning of Biology.

Keywords: Think-pair share, Retention, Achievement, Biology

Introduction

The enhancement of the quality of life in our world today depends on the knowledge of Science. Life itself revolves around sciences. Railsback (2020), quoting the Academic Press Dictionary of Science and Technology states that science "is the systematic observation of natural events and conditions in order to discover facts about them and to formulate laws and principles based on these facts; it is the organized body of knowledge that is derived from such observations and that can be verified or tested by further investigation." Science therefore, is an act of systematic exploration and innovation the exploration of the natural world to gain knowledge which is used by man to adapt to his environment and to sustain and preserve it through

innovation. Science has the potency of propelling a nation's economic growth, forming a path for the young people in a competitive global market space; it can ignite the passions of the imagination and it is summarily put, an engine of human prosperity (Mariette, 2014). Having such inexhaustible potentials, the teaching of Science is therefore a very essential aspect of Education. It is not surprising that Science Education is, has been and will continue to be one of the foremost and important part of educational pursuit. Science Education refers to both concepts and practices in learning Sciences; which include terms such as aims, different interactive and instructional designs, teaching-learning processes, both process and product-based

measurement and assessment techniques related to internalizing science concepts and their daily life applications (İlke & Kaan, 2020). Science Education plays prominent roles in determining scientific and technological advancement for every individual and nation as a whole. Bamiro (2015) argued that Science Education also play the major role of developing scientifically literate persons and individuals with high competence for rational and ingenious thoughts and actions, he equally noted that the Nigerian Government have understood that the development and advancement of technology and industrial sector in the nation hinge on science education. Science education also help to build citizens who can apply their science knowledge in response to socio-scientific issues and participate effectively in democracy (Nurse, 2016). Hence, strategic actions should be taken towards developments of science education for improving the nation's technological and industrial endeavours. One of the subjects in Science Education is Biology.

Biology as the study of life and living organism extends its coverage from the minute workings of chemical substances inside tiny living cells of both tiny unicellular organisms and multicellular organisms, to the broad scale concepts of ecosystems and global environmental changes. It is also concerned with the physical characteristics and behaviours of organisms living today and long ago, how they came into existence, and what relation they possess with each other and their environment. The preservation of the environment, improvement of health and medicine, peaceful coexistence, inclusiveness and gender equality, values such as intellectual, moral, vocational, aesthetic, cultural, creative and disciplinary is credited to the study of Biology. The knowledge of Biology has immensely aided the researching for solutions to vital concerns such as increasing world food supply, controlling pest and diseases, environmental protection and studying the biology of certain microorganisms such viruses causing global pandemic include the recent corona virus has wrecked great havoc in our world (Ugwu, Jatau & Gwanma, 2021). To further explain the importance of Biology, Augustine (2018) noted that humans through the knowledge of Biology, man can now produce antibiotics and vaccines, grow disease-resistant crops, transplant organs and manipulate genes. Among the major aspects of Biology that have helped in the roles stated above is Ecology

As our world advances, diseases evolve and infectious micro-organism (bacteria and viruses) surface and human health and those of animals and plants species

are threatened, it becomes imperative that the study of Biology and especially Ecology should be enhanced to improve the quality of life and life expectancy of living organisms.

Ecology is the study of animals and plants and their relation and interactions to each other and to their environment. The understanding of these interactions and relationship between organisms leads to purpose and utility as "ecology provides new knowledge of the interdependence between people and nature that is vital for food production, maintaining clean air and water, and sustaining biodiversity in a changing climate" (British Ecological Society, n.d.). One core goal of ecology is to understand how living things are distributed and their population in any given locality within the entire physical environment (OpenStax, 2015). Ecology is a major area in Biology and poor knowledge of ecology as a concept could directly or indirectly affect students' academic achievement.

Academic achievement is a measure of the extent to which set out aims and objectives of an academic or learning activity are met. It is an important aspect of every learning endeavour as it clearly reveals the efficacy and competence of the such a learning setting. Ogenevwede (2020) viewed academic achievement as the level of knowledge attained and skills gained in school subjects as determined by test scores. Speaking of tests as a tool for determining academic tests, there are different kinds of achievement tests that can be administered for the purpose of evaluation like oral examination, true/false answer, matching test, fill-in the blank exams, short answer tests, multiple choice tests, written examinations, open ended questions, two phase testing etc. When such tests are administered by a recognised body over a geographical region is referred to as a standardised test. An example of standardised test is the Senior Secondary Certificate Examination (SSCE) administered across West Africa and Nigeria by West African Examination Council (WAEC) and National Examination Council (NECO) respectively.

Reports from these examination bodies over the few years indicates that students have poor achievement in Ordinary Level Biology examinations. In terms of raw mean score and standard deviation, WAEC Chief Examiner's reports have 29 and 11.87 respectively in 2015, 31 and 10.91 in 2016, 31 and 11.92 in 2017 and 30 and 9.00 in 2018. The reports show a generally low but sinusoidal performance. But these reports pick on few topics including ecology.

It was indicated that in these results precisely 2018 that there was: lack of sequence in the carbon cycle, making

a diagram of the nitrogen cycle instead of the carbon cycle, constructing a food chain without showing the direction with arrow heads, inability to define test cross correctly, not attempting the compulsory question 6 which was on ecology.

Studies have suggested a number of factors responsible for the students' poor achievement in Biology and sciences to include poor primary school background (Obioma, 2006), parental socioeconomic background (Udida, Ukwai & Ogoto 2012; Ogunshola & Adewale, 2012) lack of interest and motivation in students (De Silva, Khabiti & Azam, 2018), poor teaching and learning environment (Shimbi, 2016), teachers' lack of Pedagogical-Content Knowledge (PCK) (Olanipekun & Aina, 2014), absence of good teacher-students relationship (Chukwuemeka, Ananti & Onyekwelu, 2019). More still, Obomanu and Adaramola (2011) opined that the poor performance in Biology can be traced to the inability of the students to grasp the abstract concepts in the subject (Okwuduba & Okigbo, 2018); this can be blamed partially on poor and ineffective methods of instruction. These studies placed the teacher at the pinnacle of the learning process arguing that the quality of the teacher himself, his self-confidence, the level of his knowledge of his subject and the technique he employs in teaching make a great difference in his job.

Moreover, WAEC Chief Examiner's Report (2022) emphasized on the need to improve teaching methods to enhance academic achievement of students in Biology and also that students should be taught how to answer questions correctly and be provided with opportunities to learn, appreciate and cover all topics in appropriate depth as well as carry out all mandatory practical activities in field and laboratory. Okwuduba and Okigbo, (2018) confirmed that innovative instructional strategies proved to be significant in the improvement of academic achievement of students in science, listing studies done on Learning Cycle method in teaching, Demonstration strategy, Jigsaw method, Concept Mapping, Experiential and Generative learning strategies, and Computer Simulations. Ogunleye (2011), described some of these innovative learning strategies as co-operative, collaborative and total participative strategies which improves information acquisition and retention of higher-level thinking skills, interpersonal and communication skills and self-confidence, mentioning strategies like Jigsaw, Reciprocal Peer Questioning, Three Step Interview, Round Robin Brainstorming, Numbered Heads

Together, Circle the Sage, Team Pair Solo and Think Pair Share strategies.

Think-pair-share method is a collaborative, share learning strategy which involves the students brainstorming through, ideas questions and answers in three distinct steps: Think: students think independently about the question that has been posed, forming ideas of their own. Pair: students are grouped in pair to discuss their thoughts. This step allows students to articulate their ideas to consider those of others. Share: students pair and discuss their ideas with a larger group such as the whole class. Often, students are more comfortable presenting ideas with the support of a partner.

Following this method, the students' ideas would have become more refined through these three steps. In contrast to the traditional pedagogic practices, in which teachers pass the knowledge to the learners and learners receive the information passively and memorize it, the method enhances deep understanding in students as students learn best by being interested fully in their own work, by seeing themselves, doing themselves, by puzzling themselves, by verifying their own supposition and experimenting it themselves, by drawing conclusion themselves on the strength of evidence which they have collected themselves (Agbede & Ba'aba, 2019, Bamiro, 2015, Ogunyebi, 2018). This strategy allows them to criticize their ideas or inferences and to adjust them, should it fall short of acceptance by others. The think-pair-share concept modifies the traditional pedagogic methods by adding some participatory, social interaction, togetherness and action-driven communication to them; making it very effective. By employing this method, the cognitive and social aspects of learning is properly blended, enhancing independent thinking and the construction of knowledge in learning (Agbede & Ba'aba, 2019).

In addition, the think-pair-share strategy inculcate the time consciousness skill to the learner as a specific and appropriate time frame is assigned for independent thinking and group discussion. It allows all the students to develop answers longer and more elaborate answers that will have reasons and justification since they have been thought-out thoroughly and discussed. Students will feel at ease to share their ideas to the whole class since it has been tested within their paired groups.

According to Haqie (2021) learning retention is the process of transferring new information into long-term memory. This means that students have effectively taken in the information and are able to recall it in the future. Without retaining what have been learned, it will leave short-term memory after a certain amount of time

has passed. In order to improve learning retention, it's necessary to find new strategies and solutions to ensure students engage with the lesson material. This will help biology students' brain identify this new information as important.

Knowledge retention both promote achievement and compliment it as it follows that learners must retain what is learned through teaching/learning process for them to achieve maximally in Biology (Agaba, 2013). After achievement is measured and found satisfactory, retention of knowledge helps in application of knowledge because what is stored in the memory is being recalled and applied to real life situations. Thus, achievement is justified and defended. Students' gender is another important variable in students' achievement and retention.

Gender can be defined as the social behaviour of male or female. According to World Health Organization (WHO), gender refers to the socially constructed characteristics of boys and girls, men and women which includes behaviours, norms and roles associated with being male or female. Gender also varies from society to society and can change over time and gender differences in students' achievement continue to yield inconsistent results.

Theoretical Framework

Learning theories are a set of principles that explains how best a student can acquire, retain and recall knowledge or information. The two treatment methods examined in this research found to be based on learning theories like Bandura' Social cognitive learning theory, Kolb's Experiential learning theory.

Bandura's Social Cognitive Learning Theory

Social Cognitive Learning theory posits that people are not just shaped by their environment but are active participants in their environment. This theory was developed by Albert Bandura in 1986. The social cognitive learning theory which is a modification of the Social learning theory adds cognition (thought-pattern and intrapersonal behavioural development) to the social aspect (interaction and observation) to the learning process.

Bandura' theory brings about the notion of self-efficacy. It is defined as the believe in one's capabilities to organise and execute the courses of action required to manage prospective situations (Bandura, 1993). High self-efficacy results to confidence and mental dexterity in handling challenging situations. Bandura (1993), is also of the opinion that the idea of self-efficacy applies

to both teachers and students alike and noting that a teacher who has no trust his or her efficacy will try to avoid dealing with academic problems and instead turn his or her effort inward to relieve his or her emotional distress. A Teacher must have trust in his or her ability to teach any aspect of the subject curriculum for students to understand (Olanipekun & Aina 2014).

The social cognitive learning theory has the following implications, as adapted from Zhou and Brown (2015)

- i. Students can learn by observing others.
- ii. Teachers are seen as models and must model appropriate behaviours.
- iii. Teachers are should ensure that they motivate to face challenging issues and improve their self-efficacy.
- iv. It is expected that the teachers are to set high standard and guide the students to reach those standards.

The think-pair-share treatment used in this research is rooted in the social cognitive theory since there is the individual inference and idea generation and development (cognitive) activity in the individuals' thinking stage and the social interaction during the pairing stage where the paired students are to relate their ideas, brainstorm as a group and unanimously come up with what is acceptable to the duo.

Kolb's Experiential Learning Theory

The Experiential Learning theory developed and published by David Allen Kolb in 1984 advocates a holistic learning process which is combination of perception, cognition, behaviour and experience. It is an adult oriented process where learning is enhanced by experience. Experiential learning guarantee retention of knowledge and remembrance of fact. According to Kolb, experiential learning works in four stages linked in cycle which are concrete learning, reflective observation, abstract conceptualization and active experimentation. A learner can enter the cycle from any stage and still arrive at a targeted objective.

Experiential learning provides the following benefits to teachers and students as adapted from Teaching and Education (2020):

- i. Opportunity to immediately apply knowledge to real world situation which is an important factor in retention.
- ii. Promotion of team work.
- iii. Improved motivation and increased interest in learning in turn improve achievement.
- iv. Opportunity for reflection and critical thinking.

As adapted from Zhou and Brown (2015), the experiential learning theory suggests that teachers should

- i. set up the experience by introducing learners to the topics and basic material that cover what the learner must know beforehand.
- ii. Engage the learner in a realistic experience that provides intrigue as well as depth of involvement.
- iii. Allow for discussion of the experience including the happenings that occurred and how the individuals involved felt.
- iv. The learner will then begin to formulate concepts and hypotheses concerning the experience through discussion as well as individual reflection.
- v. Allow the learners to experiment with their newly formed concepts and experiences (interpreting current conflict and conflict resolution scenario).

These aspects of instruction as outlined are seen in the treatment methods in this research. Particularly, in concept mapping teaching style, the learners are required to develop concepts and not just to study or observed the ones developed by the teacher. This is a hands-on way of learning and will provide the students with an experience to use throughout their life time given the wide application of concept maps. Think pair share teaching style result in the team work with a lot of instructiveness which is an experiential activity that will foster knowledge retention.

Review of Related Literature

Studies on Think Pair Share Teaching Strategy

Agbede and Ba'aba (2019) investigated the Effects of the Jigsaw and Think-pair-share Methods on Students' Performance in Principles of Account in Colleges of Education in North-east Nigeria. Three research questions were raised to guide the study while three null hypotheses were formulated and tested at 0.05 level of significance. A quasi-experimental design was adopted for the study. The population of the study was 900 NCE business education students in Colleges of Education in North-east, who offered principles of accounts in 2015/2016 academic session. One hundred and twenty (120) students were taught in their intact classes. The instruments used to generate data for the study was Principles of Accounts Achievement Test (PAAT).

Bamiro (2015) conducted a research to investigate the effects of three strategies (i.e., guided discovery, think-pair-share, and lecture) on senior secondary school

students' achievement in chemistry. A pre-test, post-test, control group quasi-experimental design with a $3 \times 3 \times 2$ factorial matrix was adopted for the study. Treatment was at three levels (guided discovery, think-pair-share, and lecture strategies).

Sampsel (2013) did a study captioned "Finding the Effects of Think-Pair-Share on Student Confidence and Participation" on students in Mathematics class (area and population of study not stated). The study used a pre-survey and post-survey instrument as well as a video coverage (field tape) analysis of the class activities to ascertain the difference in level of confidence and participation of during one week of teaching with conventional method and another week of teaching with think pair share treatment.

Wandi, Ananda and Nurdin (2018) conducted a research on The Effect of Think Pair Share Method and Students' Creativity on Students' Learning Outcome. The study was conducted on 112 eight grade students of Junior High School of SMP Negeri 24 Padang with implementation of think pair share method to measure the students' learning outcome in the field of social science. Using an experimental quantitative approach with survey design, the researchers used quasi-experimental design with pre-test and post-test approach on a control group and experimental group with instruments as achievement test and creativity questionnaire. Validity test was done by using content validity through the opinion of experts to examine the contents of the test systematically and to evaluate its relevance with target that has been determined. Analysis of quantitative data was done using mean, standard deviation and ANCOVA.

Pardeshi (2018) conducted a study on Improving the Student Performance Using Think-Pair-Share for Operating System. The study was conducted on 40 third-year students of Computer Engineering. The study sought to use TPS for Scheduling Algorithm concept of 'Operating System Course' covering the topics: Introduction to scheduling algorithm-First Come First Serve (FCFS), Shortest Job First (SJF), Pre-emptive and non-pre-emptive SJF. The activities consisted of the following steps for a given example: (i) how to draw Gantt chart, (ii) calculate waiting time for each process, (iii) calculate average waiting time, (iv) calculate turnaround time for each process (iv) And average turnaround time. In the study, one-group pre-test, post-test methodology was used and to get the student's perception regarding this activity, the feedback analysis was conducted after the activity using moodle. Instrument used are survey questionnaires and open-

ended questions. Before conducting the activity, simple black-board teaching was done and preceded by a pre-test of 25 marks. While checking the papers, the instructor found that there was confusion while drawing Gantt chart for shortest job first scheduling algorithm. If Gantt chart was wrong then automatically it results in wrong waiting time and turnaround time. After that, Think-Pair-Share treatment was used for the class then proceeded immediately by a feedback and post-test of 25 marks. Result shows that students performed better in post-test as compared to pre-test. The t-test statistical difference between the pre-test and post-test result based on $p < 0.05$ is as follows; degree of freedom 68, standard deviation 5.70, t-value 6.19, $p = 0.00001$. The students were graded in the pre-test and post-test performance on low ($< 50\%$), medium (50-69%) and high ($\geq 70\%$) grade ranges. The average again (difference) in the mean score of the three grades are 4.45, 0.8, 1.48 respectively.

The study of Sao and Adam (2023) on Efficacy of think-pair-share in improving the retention ability of secondary school students in biology shows that there is no statistically significant difference in the achievement of male and female pupil taught using the think pair share strategy. Anidu (2015) research on the effect of gender on the achievement of students in biology using the jigsaw method results showed that there was a significant difference between the mean scores in favour of the males. It revealed that the males gained more from the jigsaw method compared with the females.

This study examined the effect of think-pair share teaching strategy on the achievement and retention of students in Biology.

Statement of the Problem

The complexity and vastness of most science fields pose a problem to the teaching/learning process by teachers and instructors which in return causes poor students' achievement in these fields. Examination bodies and educational research institutions have consistently raised concerns over the poor students' achievement and retention in some keys topics in Biology. As suggested by stakeholders in the education sector, one of the major causes of the problem of poor academic performance and retention is the use of ineffective teaching techniques strategies in teaching of science and most especially biology. Suggestions are that innovative, participative, cooperative and visual-based techniques be employed to enhance students' achievement and retention in Biology. This study set

out to determine the Think Pair Share and Concept Mapping innovative teaching techniques in improving the students' achievement and retention in Ecology in Biology. It probes into the effect of interaction among the both gender on student's achievement in Ecology using the two techniques.

Research Questions

The following research questions were used to guide the study.

1. What are the mean achievement scores of students taught Biology using Think pair share teaching strategy and those taught with lecture methods?
2. What are the mean retention scores of students taught Biology with Think pair share teaching strategy and those taught with lecture methods?

Hypotheses

The following two null hypotheses were formulated for analysis at 0.05 level of significance

- H₀₁:** There is no significant difference among the mean achievement scores of students taught Biology using Think pair share teaching strategy and those taught with lecture methods.
- H₀₂:** There is no significant difference among the mean retention scores of students taught Biology using Think pair share teaching strategy and those taught with lecture teaching methods.

Methodology

This study adopted Non-equivalent control group design and Time-series design types of quasi experimental research design (for comparing the two groups and to measure the outcome overtime respectively) as developed by Martyn (2009) with a pre-test post-test approach on an experimental group and one control group. The students in the experimental group were taught using Think-pair share teaching strategy while the students in the control group were taught the same topics using lecture teaching method later after four weeks the test (BAT) is rearranged to measure their retention ensuring the control of extraneous variables such as Hawthorne effect, test wiseness, subject interaction e.t.c with help of the assistant teacher. Quasi experimental design is appropriate for the study because there is no randomization of subjects. This study used intact classes of SS2 from two (3) public co-educational secondary schools served as a sample and a sample size of 102. A Multi-stage random sampling was used

initially; In stage1 and 2, a simple random sampling technique by balloting was purposed to select an educational zone out of the 3 zones in Abia State as well as in selecting the local government from the educational zone selected and a purposive sampling was used to select the 2 public to educational schools. The population of this study was 52,147 Senior Secondary School Biology students in public schools. The area of the study was Abia State, Nigeria. The instrument used for this study was Biology achievement and Retention Test (BAT) which was adopted from WAEC and NECO past questions. The BAT was used for Pre, post and delayed post test. Test wiseness was avoided by reshuffling the questions, changing the characters of the options and structures of the question. The BAT covered topics in Biology SS2 curriculum under

Ecology as (1) Aquatic habitat (2) Terrestrial habitat (3) Association and (4) Adaptation.

Three experts validated the instrument and the reliability of the BAT was established on a circle of 30 Biology students drawn from Ahiaba High School which was not among the schools selected for the study. The reliability co-efficient was calculated using Kuder-Richardson's formula (K-R20). The reliability co-efficient of the BAT was obtained using K-R20 was 0.71 which shows that the instrument was reliable. The data collected for the research question were analyzed using mean and standard deviation. The hypothesis were tested at 0.05 level of significance using Analysis of covariance (ANCOVA). Analysis of Covariance was used to take of the differences in the initial status of the groups and to adjust for the independent variable and moderator variable.

Results

Research Question 1: What are the mean achievement scores of students taught Biology using Think pair share, Concept mapping and those taught with lecture methods?

Table 1: The mean achievement scores of students taught Biology using Think pair share and those taught with lecture method.

METHOD	N	Pre-test		Post-test		Gain score
		Mean	SD	Mean	SD	Mean
Think pair share	45	34.51	3.48	75.11	3.23	40.60
Lecture Method	57	20.90	1.55	42.26	2.37	21.36

Data in Table 1 shows that students taught Biology using think pair share had pre-test mean achievement score of 34.51, post-test score of 75.11 and gain score of 40.60. This indicates an enhanced achievement by the students while students taught with lecture methods had pre-test achievement score of 20.90, post-test score

of 42.26 and gain score of 21.36, also indicates enhanced achievements at post-test. However the group taught with Think-pair share had the higher gain score mean of 40.60, and those taught lecture method had the lower mean score gain of 21.36.

Hypothesis 1: There is no significant difference between the mean achievement scores of students taught Biology using Think pair share and those taught with lecture method.

Table 2: Analysis of Covariance of the mean achievement scores of students taught Biology using Think pair share and those taught with lecture method.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	28724.549 ^a	3	9574.850	646.950	.001
Intercept	9240.107	1	9240.107	624.333	.001
Pretest	225.835	1	225.835	15.259	.001
Method	9231.479	2	4615.739	311.875	.001
Error	2338.396	158	14.800		
Total	594631.000	162			
Corrected Total	31062.944	161			

a. R Squared = .925 (Adjusted R Squared = .923)

Data in Table 2 revealed that there is significant difference between the mean achievement scores of students taught Biology using Think pair share and those taught with conventional method with p-value of

0.001 which is less than 0.05 level of significance. Thus null hypothesis 1 is not upheld. However, it was further subjected to Scheffe Post Hoc analysis to discover the direction of the significant difference.

Research Question 2: What are the mean retention scores of students taught Biology with Think pair share teaching strategy and those taught with Lecture method?

Table 4: The mean retention scores of students taught Biology with Think pair share teaching strategy and those taught with Lecture method.

Method	N	Post-test		Retention		Mean diff.
		Mean	SD	Mean	SD	Mean
Think pair share	45	75.11	3.23	70.27	2.53	4.84
Lecture Method	57	42.26	2.37	38.46	3.28	3.80

Data in Table 4 shows that students taught Biology with Think pair share had post-test mean achievement score of 75.11, retention score of 70.27 and mean difference

of 4.84, while those taught using conventional method had post-test mean of 42.26, retention mean of 38.46 and mean difference of 3.80.

Hypothesis 2: There is no significant difference among the mean retention scores of students taught Biology using Think pair share teaching strategy and those taught with Lecture teaching method.

Table 5: Analysis of covariance of the mean retention scores of students taught Biology using Think pair share teaching strategy and those taught with Lecture teaching methods.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	27625.364 ^a	3	9208.455	724.962	.001
Intercept	74.195	1	74.195	5.841	.017
Post-test	1438.610	1	1438.610	113.259	.001
Method	172.090	2	86.045	6.774	.002
Error	2006.914	158	12.702		
Total	504295.000	162			
Corrected Total	29632.278	161			

a. R Squared = .932 (Adjusted R Squared = .931)

Data in Table 5 shows that there is a significant difference between the mean retention scores of students taught Biology using Think pair share teaching strategy and those taught with lecture teaching method with p-value of 0.002 at 0.05 level of significance, therefore, null hypothesis 2 is rejected.

Summary

The study investigated think-pair share and concept mapping teaching strategies on the achievement and retention of students in Biology. The study was guided by six specific objectives. Six research questions were developed and answered and six null hypotheses formulated and tested for the study. The design adopted for this study was quasi-experimental research design. Specifically, pre-test treatment and post-test non-equivalent intact group method was adopted. The study was carried out in Abia State. The population of this study is 52,197 Senior Secondary School Biology students in public schools in Abia State, consisting of 26,015 males and 26,132 females. The sample size is made up of 162 SS2 Biology students, 86 male and 76 females. The instrument to used for this study is Biology Achievement and Retention Test (BART). The BART used for this study were validated by three (3) experts from college of Education, Michael Okpara University of Agriculture, Umudike (MOUUAU); one expert in Biology Education, and two experts in Educational Measurement and valuation. The reliability of the BART was established on a sample of 30 Biology students drawn from a school which will not be among

the schools to be selected for this study. The reliability coefficient of 0.71 was obtained using Kuder-Richardson's formula (K-R20). At the commencement of the research experiment, BART was administered to all the students in the three groups. After the teaching of the groups, a post - test (Post-BART) was administered to the students in each group and their performance graded. After a period of two weeks, BART was rearranged and administered to the students to test for their knowledge retention. Data collected for the research questions was analysed using Mean and Standard Deviation. Hypotheses was tested as 0.05 level of significance using Analysis of Covariance (ANCOVA).

It was found that: There is a significant difference between the mean achievement scores of students taught Biology using Think pair share, Concept mapping and those taught with conventional methods. The mean retention scores of students taught Biology using Think pair share, Concept mapping teaching techniques and those taught with conventional teaching methods differed significantly. There is a significant difference in the mean retention scores of male and female students when taught Biology using Concept mapping strategies. There is no significant interaction effect of gender and teaching strategy on achievement in Biology.

Biology students taught using Think-pair share teaching strategy has a higher retention and achievement score while those taught with lecture/conventional teaching

method had a lower score. Table 2 and Table 5 further revealed that there is a significant difference between the mean achievement scores and the mean retention scores of students taught biology with Think-pair share teaching strategy and those taught with lecture/conventional method. The reason could be because student participatefully by doing it themselves. They are allowed to think critically, reason with each other, share their ideas and were able to relate different concepts and at the guidance of the teacher. This is in agreement with the findings of Agbede and Ba'aba (2019) which investigated the effects of the jigsaw and think-pair-share methods on students performance in principles of Account in colleges of Education in North-east Nigeria and reported that think-pair share methods has significant effects on student academic performance.

Conclusion

The findings of this study showed that Think-share pair method enhanced Biology students' achievement and as well improved their retention on concepts taught. Likewise, concept mapping teaching strategies which as well improved students' achievement scores and retention in Biology. It is therefore very important for teachers to master think-pair share and concept mapping strategies and effectively implement them in teaching and learning process as it has been proven to have the ability to enhance academic achievement and retention of students' knowledge.

Recommendations

Based on the finding of this study, the following recommendations were made.

1. Think-pair share teaching strategy should be actively used by Biology teacher as it has been observed to enhance the academic achievement of students
2. Biology should be trained and retrained on how to effectively employ Concept mapping teaching strategy in other to improve achievement and enhance students' retention ability.
3. The curriculum planners should integrate Think-share pair and concept mapping teaching strategies into the nation's curriculum and allocate time for its effective implementation
4. Researcher should investigate more on the effect of these strategies on students' attitude towards learning of Biology.

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