Rima International Journal of Education (RIJE), Vol. 3 (No. 1): June 2024; Pg. 245 - 261 ISSN: 2756-6749

EFFECTS OF COOPERATIVE INSTRUCTIONAL STRATEGY ON ACADEMIC PERFORMANCE AND RETENTION AMONG BIOLOGY STUDENTS OF DIFFERENT COGNITIVE STYLES IN GOMBE STATE, NIGERIA

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Abstract

The study was carried out to investigate the Effects of Cooperative learning Instructional Strategy on Academic Performance and Retention among Biology Students of Different Cognitive Styles in Gombe State, Nigeria. The study adopted quasi experimental control group design comprised pre-test post-test and post posttest. The population of the study comprised of two thousand one hundred and five (2105) SSII Biology Students of Public Secondary Schools in Akko Education Zone. The sample of the study comprised one hundred and eleven (111) SSII students from four (4) Schools randomly selected in the Zone. Three (3) Schools were designated as the experimental groups and the other one School was the control group. Two instruments were used for the study; one of the instruments was for the determination of the participants Cognitive Styles. Group Embedded Figure Test (GEFT) with a reliability coefficient of 0.83 was used to establish the cognitive style of the participants while Biology Performance Test (BPT) with a reliability coefficient of 0.76 was used to measure the performance and retention of the subjects after treatment. The reliability of BPT was determined using Pearson Product Moment Correlation Coefficient (PPMC) after test-retest method was applied. The experimental groups were taught using Cooperative Learning Instructional Strategy (CLIS) while the control group was taught using the lecture method. Four research questions were answered using descriptive statistics, mean and standard deviations and four null hypotheses were tested at P≤0.05 the data collected were analysed using t–test and Analysis of Variance (ANOVA). Least Significant Difference (LSD) was used to indicate the significant level among the groups. Among the other results revealed: (a) A significant difference exist in the mean performance scores between the Experimental group and the control group (b) A significant difference exist in the mean retention score between the Experimental group and the control group. Based on these finding, it was concluded that think-pair-share enhanced the performance and retention of senior secondary school students of both field dependent and independent cognitive style in ecology. Based on these findings, the research recommends (a) Think-Pair-Share should be used to help both the field independent and field dependent learners learn effectively (b) Workshops and seminars should be organized to train teachers on how to teach using Cooperative Learning Instruction Strategy.

Keywords: Retention, Ecology, Performance, Cooperative Instructional Strategy and Lecture method

Introduction

Science education plays prominent roles in determining scientific and technological advancement of every individual and the nation as a whole. According to Twan, Danjuma and Useni (2022), the major goal of science education is to develop scientifically literate and personally competent individuals with higher competence for rational thought and actions. According to Godek (2014), there cannot be any meaningful development without science education. In view of its importance, the teaching of science and technology in all institutions is emphasized by the Federal Government of Nigeria as contained in the National Policy on Education (FRN, 2013). Biology is a science subject offered in senior secondary school in Nigeria; which study living organisms (Martin & Robert, 2015). Biology is a very important subject that enables living thing to understand oneself and its' environment (Twan et al., 2022). The knowledge of biology is vital to the study of medicine, pharmacy, nursing, dentistry, agriculture, industry, biotechnology (Abimbola, Omosewo & Upahi, 2014)). Biological knowledge has largely contributed to humanity's welfare in a variety of domains such as medicine often employed in organ and tissue transplant, in disease control and identification, as seen in the recent identification of the Ebola and Corona Viruses host, which are rats and pangolins respectively.

Biology has witnessed high enrolment compared to any other science based subject in the final year of external examinations without a corresponding increase in the students' academic performance (Piwuna & Mankilik, 2023; Twan & Useni, 2022). The WAEC and NECO Chief Examiners have consistently lamented the poor performance of candidates in biology for more than twenty years, by using phrases like, "not satisfactory"; "downward trend"; "abysmal/dismal performance" "decline in pass rate"; "fluctuating performance"; and persistent failure"; in describing the performance of students (WAEC and NECO Chief Examiners' reports, 2021, 202, 202023). The Chief Examiners' annual report gives a résumé of each subject area according to the number of papers written, for WAEC biology, there is Biology paper I, which is a multiple-choice (objectives) type paper. Biology II is a theory paper and Biology III is a practical paper. For NECO biology, Biology paper I is practical, Biology paper II is essay, and Biology paper III is multiple choice objective questions. The résumé for assessing biology follows the format of the National résumé found in the WAEC and NECO reports and the analysis is in-depth and very specific. General comments by both Chief Examiners on each year's paper are given and the responses to each question highlighted. The reports of the two major examining bodies in Nigeria may hold the answer to improving motivation of students of biology thereby addressing the perennial poor performance of students in public examinations. The continuous decline in performance alongside the annual recommendation of the Chief Examiners report which is presumed to hold the solution to low performance in biology recorded in Nigeria, reasons by Akubuilo (2012), Ajaja (2013), Sakiyo and Waziri (2015); Twan and Useni (2022) attributed to issues such as teacher preparation, overcrowding, poor instructional methods, insufficient laboratory equipment, poor students' attitude toward learning, ambiguous nature of some concepts, difficulty of some biology concept and also the students' Cognitive styles.

Cognitive style is a psychological concept that emphasizes the fact that individuals perceive and process information differently. According to Olagbaju (2020), cognitive style determines how individuals perceive, receive, and process information. Cognitive styles can also be an attitude that determines an individual's mode of retention and

performance (Twan, 2021). The effects of Cognitive Style on student's Performance have been investigated in a number of studies, for example, Ezekiel (2007) investigated on Students Achievement in Chemistry, Okoruwa (2007) on integrated science, Fakeye (2008) and Olagbaju, (2020) in English, also Abubakar (2018) and Twan (2021) investigate on Performance and Attitude/Interest in Biology. These studies found Cognitive Style to have contributed significantly to improving learning outcomes in those subject areas. Cognitive Styles are categorized into different types. Some of the common cognitive styles are outlined by Shi (2011), among which are: Field Independent and Field-Dependent Cognitive Style, Analytic and Holistic Cognitive Style, Reflective and Impulsive Cognitive Style, Deductive and Inductive cognitive style as well as Sharpener and Leveler Cognitive Style. However, the focus of this study is on the Field Independent and Field-Dependent Cognitive Style. Similarly, among all Cognitive Styles; Field Dependent/Independent has been acknowledged as the most widely researched and more applicable in education research by Cao (2009), Muhammad, Daniel and Abdurauf (2015); Abubakar (2018); Twan (2021). Participants who scored twelve (12) marks or above were classified as Field Independents while participants who scored eleven (11) marks or below were classified as Field-Dependents. These classifications were determined using the Group Embedded Figure Test developed by Witkin, Oltman, Raskin and Karp (1971). Students vary in their Cognitive Styles and this tends to reflect in the extent to which they are affected by a particular teaching method.

Teaching methods otherwise called instructional methods are many and varied. Various teaching methods are used by teachers in the teaching of Biology aimed at bringing about meaningful learning. These include lecture method, demonstration method, discovery, project, inquiry among many others. The most commonly used is the lecture method. Ahmadzaide & Shojoe (2013) criticized the Lecture Method which seems to be the most frequent used method by teachers, because only hardworking students can benefit from it. Okeke (2006) claims that the lecture method; is ineffective in science instruction. It is therefore very imperative to employ the use of innovative strategies that could improve the performance of students in Biology examinations such as WAEC and NECO. Some of the strategies that could be used are Cooperative Learning, Problem Solving. Current trend will require strategy that will allow students to interact, exchange ideas in other to retain concept and acquire knowledge for better performance. This may be achieved through the use of Cooperative Learning Instruction Strategy.

Cooperative Learning Instruction Strategy is an instructional method in which students work in small groups each with different levels of ability and different Cognitive Styles by using a variety of learning activities to improve their understanding of a subject, each member of a team is responsible not only for learning what is taught but also for helping teammates learn, thus creating an atmosphere of achievement to accomplish common learning goals under the guidance of the teacher (Gillies, 2016). According to Olarenwaju (2012), Students are organized in pairs or small groups to help each other understand the prescribed content in a Cooperative Learning Instruction Strategy. There are various strategies of Cooperative Learning Instruction, some of the most common strategy are: Think-Pair-Share, Round Table or Rally Table, Jigsaw II, Round Robin Brainstorming or Rally Robin, Three-Step Interview. However, for this study 'Think-Pair-Share' was adopted. Think-Pair-Share Instruction Model (TPSIM) is a Model of Cooperative Learning Instruction Strategy where students work together to solve a problem or answer a question about an assigned task. The strategy was first proposed by Frank Lyman (1992). Think-Pair-Share allows students to engage in individual and small-group

thinking before they are asked to answer questions individually in front of the whole class. There are four steps to this method; the first step, groups of four students listen to a question posed by the teacher. Secondly, individuals in this groups are given time to think and then write their responses. Thirdly, the students in each group are paired to read and discuss their responses. Finally, few students are called on by the teacher to share their thoughts and ideas with the whole class members. This model differs from the Lecture Method because it allows a great deal of interaction where students can reflect on their own ideas in a very active manner. According to Twan et al. (2022), Think-pair-share strategy has many advantages over Lecture Method. The 'think time' incorporates the important concept of 'wait time; in which it allows students to develop answers within few minutes, students are more willing to take risks and suggest ideas because they have already 'tested' them with their partner. Therefore, in order to attain their personal goals, students are likely to encourage each member within the group to achieve their objectives and group task. There is persuasive evidence that Think-Pair-Share team achieves higher levels of thoughts and retains information longer than students who work quietly as individuals. Sani (2017) opined that the shared learning gives students an opportunity to engage in discussions, take responsibility for their own learning, and thus become critical thinkers. This strategy supports the efforts to help students understand and apply Science concepts especially ecology concepts since researchers like Oyarole (2016); Danjuma (2017); Sani (2017) established it to be a difficult concept; encouraging thinking and social interaction thereby improving student's performance. For these apparent benefits of using Think-Pair-Share Instruction Strategy (TPSIS) as a learning strategy, the study will determine the effects of Cooperative Learning Instruction Strategy on the student's Academic Performance and Retention among Biology Students of different Cognitive Style.

Research Questions

The following research questions were raised to guide the study.

I. What is the difference between the mean performance scores of SSII students exposed to Think-Pair-Share (TPS) and those exposed to Lecture Method?

II. What is the difference between the mean retention ability of SSII Biology students taught ecology concept using Think-Pair-Share (TPS) and those taught using Lecture method?

III. What is the difference among the mean performance scores of SSII Biology students of field dependent (HFD), field independent (HFI) and field independent/dependent (HTFID) groups taught ecology concept using Think-Pair-Share (TPS) and their counterpart taught ecology concept using lecture method (LM)?

IV. What is the difference among the mean retention ability of SSII Biology students of field dependent (HFD), field independent (HFI) homogenous and field independent/dependent (HTFID) groups taught ecology concept using Think-Pair-Share (TPS) and their counterpart taught ecology concept using lecture method (LM)?

Research Hypotheses

The following null hypotheses are formulated and tested at $p \leq 0.05$ level of significance:

H_{O1} There is no significant difference between the mean performance scores of SSII Biology students taught Ecology Concept using Think-Pair-Share (TPS) and those taught using Lecture Method.

H_{O2} There is no significant difference between the mean retention level of SSII Biology students taught ecology concept using Think-Pair-Share (TPS) and those taught using Lecture Method.

H_{O3} There is no significant difference among the mean performance scores of SSII Biology students of field dependent (HFD), field independent (HFI) homogenous and field independent/dependent heterogeneous (HTFID) taught ecology concept using Cooperative Learning Instructional Strategy (CLIS) and those in the control group taught ecology concept using lecture method (LM)

H_{O4} There is no significant difference between the mean retention ability of SSII Biology students of field dependent (HFD), field independent (HFI) homogenous and field independent/dependent heterogeneous (HTFID) groups taught ecology concept using Think-Pair-Share (TPS) and their counterpart taught the same ecology concept using lecture method (LM).

Methodology

The study adopted quasi-experimental control group research design involving pretest, posttest and post posttest. The study was conducted in Akko Local Government Area (LGA), Gombe State, Nigeria. The target population of the study comprised of two thousand one hundred and five (2105) of all SSII Biology students of senior public secondary schools in Akko Education Zone of Gombe State, Nigeria. The choice of SS II students was because the class is stable, it is neither facing the problem of being freshly introduced to senior secondary biology nor preparing for any end of the course or terminal examination (as is the case with SS I or SS III). Simple random method of sampling technique was used to select four (4) Secondary Schools from the population, three (3) experimental groups and one control group. The four (4) Schools were designated as Experimental 1, Experimental 2, Experimental 3 and Control group. The samples of the participants present for the study were one hundred and eleven (111) Senior Secondary Schools Students which were selected from the SS II classes used. Two instruments were used, namely Group Embedded Figure Test (GEFT) and Biology Performance Test (BPT). GEFT was adopted from Twan (2022) and BPT adapted from the West African Examinations Council (WAEC) biology past questions from 2019 to 2022 with little moderation, hence, there was need validation and establishment of reliability. To ensure the reliability of the research instrument, the instruments were pilot tested. The test-retest method was used to determine the reliability coefficient and results yielded 0.83 and 0.76 respectively. Group Embedded Figure Test (GEFT) was administered to the students in order to establish their cognitive style categories (either field dependent or field independent), they were grouped into: Homogenous Field Dependent Group (HFD), Homogenous Field Independent Group (HFI) and Heterogeneous Field Independent/Dependent Group (HTFID) which comprised both field dependent and field independent students. The three groups served as the experimental

groups. The control group also comprised both Field Dependent (CFD) and Field Independent (CFI) students. All the three experimental groups were taught Ecology concepts using Think-pair share (TPS) which is a Cooperative teaching Model while the control group was taught the same Ecology concepts using the Lecture Method (LM).

Biology Performance Test (BPT) was employed for data Collection which is administered to the sample as pre-test, post-test and post-posttest. The pre-test was administered to determine the equivalence of the groups and whether the treatment has any effect on the participants. The experimental groups were exposed to the treatment (TPS) for six weeks while control group no treatment was also conducted for six (6) weeks. After the treatment, post-test was administered to the four (4) groups to determine their performance in ecology concepts. Thereafter, two (2) weeks after posttest, the post-posttest was also administered to both groups to determine the retention ability of the participants. The scores for the experimental and control groups were recorded accordingly and analyzed using appropriate statistical tools. Mean and Standard Deviation were used to answer the research questions while t-test and ANOVA were used to test the null hypotheses at $p \leq 0.05$ level of significant. The design for the study is presented in Figure 3.1.

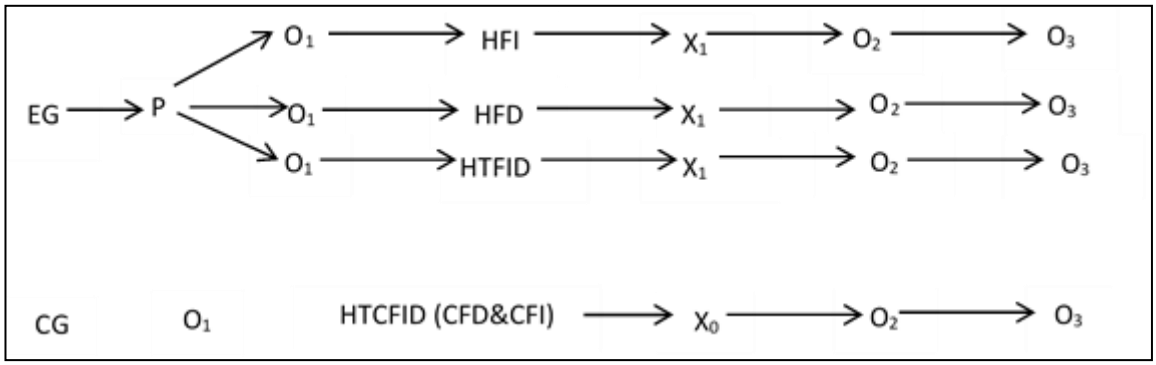

Figure 1: Research Design

Key:
EG = Experimental Groups: HFI {Homogenous Field Independent Group (Exp1)}
HFD {Homogenous Field Dependent Group (Exp2)}
HTFID {Heterogeneous field independent and field dependent Group (Exp3)}
CG = Control Group: CFI (field independent) and CFD (field dependent)
P= participant
O1 =Pretest;
O2= Posttest
O3= Post Posttest
X1= Treatment for Experimental Groups (taught using Cooperative Learning Instructional Strategy)
X0 = No Treatment (taught using Lecture Method)

Result

The results were analysed and presented in tables.

Answering Research Questions

Research Question One: *What is the difference between the mean performance scores of SSII Biology Students taught Ecology Concept using Think-Pair-Share (TPS) and those taught using Lecture Method?*

Table 1: Summary of Posttest Mean and Standard Deviation Scores for Experimental Group and Control Group

Groups	N	Mean Score	Std. Dev.	Std. Err	Mean Diff
Experimental	85	20.94	5.96	0.65	
					7.06
Control	26	13.89	5.04	0.99	
Total	111				

Table 1: shows the Summary of Posttest Mean and Standard Deviation Scores for the Experimental Groups and Control Group, the experimental group had a posttest mean score of 20.94 with a standard deviation of 5.96 while the Control group had a mean score of 13.89 with a standard deviation of 5.04. This means that the students who were taught using the Think-Pair-Share (TPS) had a higher mean score than those who were taught using the Lecture Method. The mean difference between TPS of CLIS and LM is 7.06.

Research Question Two: *What is the difference between the mean retention ability of SSII Biology students taught Ecology Concept using Cooperative Learning Instructional Strategy (CLIS) and those taught using Lecture method?*

Table 2: Summary of Post Posttest Mean Retention Score for the Students in Experimental and those in Control Groups

Groups	N	Mean	Std. Dev	Std. Err	Mean Diff
Experimental	85	21.11	6.05	0.66	
					8.30
Control	26	12.81	4.77	0.93	

The result in Table 2 revealed that the experimental group who were exposed to Cooperative learning instruction strategy had a mean gain score of 21.11 while the control group had a mean gain score of 12.11. This implies that the students taught biology using TPS retain better than those in the control group.

Research Question three: *What is the difference between the mean performance scores of SSII Biology students of field dependent (HFD), field independent (HFI) and field independent/dependent (HTFID) groups taught ecology concept using TPS and their counterpart taught ecology concept using lecture method (LM)?*

Table 3: Summary of Posttest Mean and Standard Deviation (SD) Scores for the Students in HFI, HFD, HTFID and Control Groups

Groups	**N**	**Mean**	**Std. Deviation**	Std. Error	Minimum	Maximum
HFI	26	21.38	5.71	1.12	14.00	35.00
HFD	23	19.44	5.36	1.12	7.00	35.00
HFID	36	21.58	6.47	1.08	11.00	34.00
CG	26	13.89	5.04	0.99	6.00	22.00

The mean posttest scores and SD of students in the HFI, HFD, HTFID, and Control groups are shown in Table 3. Students in the HTFID had the greatest mean performance score of 21.58 with SD of 6.47, while students in the CG had the lowest mean performance score of 13.89 with SD of 5.04. HFI, HFD, and HTFID were taught utilizing the treatment TPS and had greater mean performance values than the Control Group.

Research Question 4: *What is the difference between the mean retention ability of SSII Biology students of field dependent (HFD), field independent (HFI) homogenous and field independent/dependent (HTFID) groups taught ecology concept using Cooperative Learning Instructional Strategy (CLIS) and their counterpart taught ecology concept using lecture method (LM)?*

Table 4: Summary of Post Posttest Mean and Standard Deviation (SD) Scores for the Students in FI, FD, HTFID and Control Groups

Groups	**N**	**Mean**	**Std. Deviation**	Std. Error	Minimum	Maximum
HFI	26	23.50	5.87	1.15	12.00	36.00
HFD	23	18.09	4.07	0.85	10.00	26.00
HTFID	36	21.31	6.52	1.09	10.00	36.00
CG	26	12.81	4.77	0.93	4.00	22.00

Table 4 indicates the results of the mean retention scores of HFI, HFD, HTFID and Control Group. The mean retention scores and SD of the Homogenous Field Independent (HFI) Group was 23.50 and 5.87 respectively which is the group with the highest mean retention score, while CG had the lowest mean of 12.81 with SD of 4.77. The table also shows that HFI Group recalled better retention ability than those of the other groups. This indicated that the four groups were different in the retention of ecological concept.

Hypotheses Testing

$H0_1$: *There is no significant difference between the mean performance scores of SSII Biology students taught Ecology Concept using Cooperative Learning Instructional Strategy (CLIS) and those taught using Lecture Method.*

To test for the hypothesis, students' performance scores in the posttests were computed and subjected to t-test Analysis. The summary of the result Analysis of the statistics is presented in table 5.

Table 5: Independent t-test Statistics on the Students' Performance in Cooperative Learning and Lecture Groups

Groups	N	Mean	Std. Dev	Std. Err	Df	p	Remark
Experimental	85	20.94	5.96	0.65			
					109	0.001	Sig
Control	26	13.89	5.04	0.99			

Sig at $\alpha \leq 0.05$

Results in Table 5 Shows the mean posttest scores of the participants in the experimental group had high mean when compared with their counterpart in the control group. The significant value obtained 0.001 was less than $\alpha \leq 0.05$. Since the p-value is less than the set level of significance, then Independent t-test shows significant difference exists in the academic performance of students in the experimental group and those of control group, in favor of the experimental group. Therefore, the null hypothesis, which stated that there is no significant difference in academic performance of Biology students taught Ecology concept using TPS and those taught using lecture Method is hereby rejected, implying that Think Pair Share Model of Cooperative Learning Instructional Strategy significantly enhances secondary Schools Biology Students performance in Ecology than Lecture Method.

$H0_2$: *There is no significant difference between the mean retention level of SSII Biology students taught ecology concept using Cooperative Learning Instructional Strategy (CLIS) and those taught using Lecture Method*.

Table 6: Independent t-test Statistics on the Students' Retention Scores in Cooperative Learning and Lecture Groups

Groups	N	Mean	Std. Dev	Std. Err	Df	p	Remark
Experimental	85	21.11	6.05	0.66			
					109	0.001	Sig.
Control	26	12.81	4.77	0.93			
Total	111						

Sig at $\alpha \leq 0.05$

The t-test in Table 6 reveals a p-value of 0.001. The p-value is less than the set level of significance, $\alpha \leq 0.05$. This indicates that there is significant difference between the mean Retention ability of the Experimental group and their counterpart in the Control group. Therefore, the null hypothesis which stated that, there is no significant difference between the mean retention ability of the students taught ecology concept using TPS and those taught using Lecture Method is therefore rejected, implying that Think Pair Share Model of Cooperative Learning Instructional Strategy significantly enhances secondary Schools Biology Students' retention ability in Ecology than Lecture Method.

$H0_3$: *There is no significant difference between the mean performance scores of SSII Biology students of field dependent (HFD), field independent (HFI) homogenous and field*

independent/dependent heterogeneous (HTFID) taught ecology concept using Cooperative Learning Instructional Strategy (CLIS) and those in the control group taught ecology concept using lecture method (LM).

ANOVA test statistics was used to test this hypothesis at $\alpha \leq 0.05$ level of significance. Summary of the analysis is shown in Table 7

Table 7: Summary of One-way ANOVA on Mean Performance Scores of Experimental and Control Groups of Students

	Sum of Squares	**Df**	**Mean Sqare**	**F**	**P-value**	**Remark**
Between Groups	1063.67	3	354.52	10.69	0.001	Significant
Within Groups	4567.271	107	33.15			
Total	4610.78	110				

Sig at $\alpha \leq 0.05$

The result of the analysis in Table 7 shows students differed significantly by the two strategies used and their identified cognitive styles which were placed according to the indicated groups. The table also shows the observed p-value of the performance is 0.001 which is less than the level of significance set at $\alpha \leq 0.05$. The results indicate significant difference in the performance of student taught ecology concept. Thus by these observations, the null hypothesis which states non-significant difference between the mean performance scores of SSII Biology students of field dependent (HFD), field independent (HFI) homogenous and field independent/dependent heterogeneous (HTFID) taught ecology concept using TPS and those in the control group taught ecology concept using lecture method (LM) is therefore rejected, implying that Think-Pair-Share Model significantly enhances secondary Schools Biology Students' performance in Ecology than Lecture Method. A post-hoc test was conducted on the mean performance scores to determine the group that had more significant effect on the students' performance.

Table 8: Post-hoc (Scheffe) Test on Mean Performance Scores of Experimental and Control Groups of Students

(I) Experimental	**(J)Experimental**	**Mean Diff**	**Std. Error**	**Sig.**	**Remark**
HFI	HFD	1.95	1.65	0.706	NS
	HTFID	-0.20	1.48	0.999	NS
	Control Group	7.50*	1.60	0.001	Sig.
HFD	HFI	-1.95	1.65	0.706	NS
	HTFID	-2.15	1.54	0.584	NS
	Control Group	5.55*	1.65	0.013	Sig
HTFID	HFI	0.20	1.48	0.999	NS
	HFD	2.15	1.54	0.584	NS
	Control Group	7.70*	1.65	0.013	Sig.
Control Group	HFI	-7.50*	1.60	0.001	Sig.
	HFD	-5.55*	1.65	0.013	Sig.
	Control Group	-7.70*	1.48	0.001	Sig.

Sig at $\alpha \leq 0.05$

The result in Table 8: shows that students' in the Homogenous Field Independent (HFI) group and Heterogeneous field independent/dependent group (HTFID) had significant difference with the control group, but no significant differences were observed with the FD group, even though HTFID had higher mean values.

H0₄: *There is no significant difference between the mean retention ability of SSII Biology students of field dependent (HFD), field independent (HFI) homogenous and field independent/dependent heterogeneous (HTFID) groups taught ecology concept using Think-Pair-Share (TPS) and their counterpart taught the same ecology concept using lecture method (LM).*

Table 9: Summary of ANOVA on Mean Retention Scores of Experimental and Control Groups of Students Taught Ecology Concept

	Sum of Squares	**Df**	**Mean Sqare**	**F**	**P-value**	**Remark**
Between Groups	1731.08	3	577.026	18.812	0.0001	Significant
Within Groups	3282.003	107	30.673			
Total	5013.081	110				

Sig at $\alpha \leq 0.05$

The Analysis of Variance in table 9 reveals the calculated p-value for the effect of treatment on the students' retention ability in ecology as 0.0001. The p-value is less than the set level of significance, $\alpha \leq 0.05$. This indicates that there is a significant difference between the mean retention ability of the Field Independent and Field dependent students in the Homogeneous Group and their counterpart in the Heterogeneous field independent/field dependent Group. The hypothesis which stated that there is no significant difference between the mean retention scores of SSII Biology students of field dependent (HFD), field independent (HFI) homogenous and field independent/dependent heterogeneous (HTFID) in the experimental groups taught ecology concept using TPS and their counterpart taught using Lecture Method (LM) is therefore rejected.

Table 10: Post-hoc (Scheffe) Test on Mean Retention Scores of HFI, HFD, HTFIG and Control Group of Students

(I)Experimental	**(J)Experimental**	**Mean Diff**	**Std. Error**	**Sig.**	**Remark**
HFI	HFD	5.41	1.59	0.011	Sig
	HTFID	2.19	1.43	0.502	NS
	CG	10.69*	1.54	0.001	Sig.
HFD	HFI	-5.41*	1.59	0.011	Sig
	HTFID	-3.23	1.48	0.199	NS
	CG	5.28*	1.59	0.014	Sig
HTFID	HFI	-2.19	1.43	0.502	NS
	HFD	3.23	1.48	0.199	NS
	CG	8.50*	1.43	0.001	Sig.
CG	HFI	-10.69*	1.54	0.001	Sig.
	HFD	-5.28*	1.59	0.014	Sig.

HTFID	-8.50*	1.43	0.001	Sig.

Sig at $\alpha \leq 0.05$

The result in Table 10 shows the post-hoc test of retention. It indicated that HFD had significantly mean difference with the CG. The table also shows that HFI and HFD were also significantly different in their Retention ability in favour of HFI. Therefore, the observed table revealed that, students' exposed to Think-Pair-Share Model (Experimental Groups) had higher mean scores on the retention ability of ecology concept than their counterpart in the lecture method (Control Groups), and HFI had more effects compared with HFD in the Retention ability when taught using TPS.

Discussions

This study investigated the effect of Cooperative Learning Instructional Strategy (CLIS) on Retention and Performance among Secondary Schools Biology Students of Different Cognitive Styles in Gombe State, Nigeria. There were six (6) null hypotheses examined.

The findings of this study revealed that, there is a substantial difference in mean posttest scores between students who were taught ecology concepts using TPS of CLIS and those who were taught using the Lecture Method. These shows that the experimental group who were taught ecology concepts using TPS had a significantly higher mean Performance score than those in the Control Group who were taught using the Lecture Method. The result agrees with the findings of Eke, Mumuni and Nwanekezi (2016) who found a substantial difference in performance between students in Cooperative Learning group and those in Lecture group, favoring the experimental group, implying that students learn better while actively participating in the CLIS. However, the result disagrees with the findings of Tran (2014) who found out that there is no significant difference in the mean Achievement score of students in the Cooperative Learning Instructional Strategy with those taught using Lecture Method.

The findings of this study on the grouping pattern of different Cognitive Styles with regard to the performance of Homogeneous Field Independent (HFI), Homogeneous Field Dependent (HFD) and Heterogeneous Field Independent/Dependent (HTFID) groups vary significantly with their counterpart in the Heterogeneous control group (HTCFID) respectively. This indicated that the use of CLIS significantly enhanced the academic performance of students who were exposed to it. Their performance was significantly higher than that of students exposed to Lecture Method. The result obtained in this study could be due to the unique characteristics of CLIS which gave the learners the opportunity to interact with one another, thereby assisting in each other's learning. The finding is in agreement with the study by Samuel and Oka (2020) which revealed a significant difference in performance of students' cognitive styles. This study also support the findings of Okoye (2016), Pandhu (2018), Musa and Samuel (2019), Agu and Samuel (2019), in their various researches which reported that there is a significant difference between the mean performance scores of Science Students with Field Independent (FI) cognitive styles and those with Field dependent (FD) cognitive styles.

The analysis of results with regard to the Retention of Ecology Concept, the findings of the t-test analysis revealed that there is significant difference in the post posttest mean scores of the students taught Ecology Concept using TPS of CLIS and those taught using Lecture Method. This means that the retention ability of the students in the experimental

group improved more than the retention ability of the students in the Control group. The observed variability between the CLIS and the LM was found to be statistically significant in favor of the experimental group. The findings are congruent with those of (Olarewaju, 2012; Nwaukwa, and Okolocha, 2020), who found that Cooperative Learning Instructional Strategy is an excellent teaching technique for improving student retention in science. The findings also suggested that if the treatment administered has no impact, the two groups are likely to have similar Retention ability. This is an indication that, using CLIS in teaching learners enhanced their retention ability at Senior Secondary School level.

With regard to the retention of Ecology Concept based on the grouping of participant according to their cognitive styles, the results of the present study provide substantial evidence on the student's retention ability. The findings of the ANOVA test indicate significant difference in the mean retention ability of the different cognitive style grouping pattern. From the post-hoc test performed on the mean retention ability of HFI, HFD and the heterogeneous FID students and their counterpart in the control group vary significantly. The finding revealed that the field independent students taught using TPS, retained Ecology Concept better and are significantly different than those in the control group. This shows that CLIS significantly enhance student's retention ability irrespective of their cognitive styles. This finding is in agreement with the findings of Pandhu (2018) who observed that; field independent students typically demonstrate higher levels of retention in science concept.

The present result suggests that Field Independent cognitive style participants in Cooperative Learning Instructional Strategy had the ability to retain Ecology Concept more than Field Dependent and Field Independent/Dependent participants. A possible explanation is that the Field Independent participants who had been described by Samuel and Oka (2020) as less socially inclined, task-oriented, competitive and as one who does not limit his learning to the immediate environment might have enjoyed the social nature of Cooperative Learning Instructional Strategy and extend his experience to the wider environment and provided materials which assist the learner the ability to retain ecology concept better than the Field Dependent and Field Independent/Dependent learner. The result concurs with the result of Mehta and Thakur (2008) which indicate that Field Independent students exhibit better retention than Field Dependent group of students.

Conclusion

I. Think-Pair-Share (TPS) as a Model of Cooperative Learning Instructional Strategy (CLIS) enhanced the performance of senior secondary school students in ecology concept.

II. Homogenous Field Dependent (HFD), Field Independent (HFI) and those in heterogeneous field independent/dependent (HTFID) taught using Think-Pair-Share (TPS) did not differ significantly. This shows that Cooperative Learning Instructional Strategy (CLIS) enhance the performance of participant irrespective of their Cognitive Styles.

III. The Cooperative Learning Instructional Strategy (CLIS) appeared to help participant retain information significantly more effectively than the Lecture Method.

Recommendations

I. The schools authority should encourage Biology Teachers to acquire training on the use of Cooperative Learning Instructional Strategy (CLIS) in teaching some Biology concepts at Senior Secondary School level.

II. The Teachers should use Cooperative Learning Instructional Strategy (CLIS) to help the field dependent students learn effectively, it was established that CLIS helped field dependent learners learn better as well as the field independent learners.

III. The Government should provide Necessary facilities that can facilitate effective use of Cooperative Learning Instructional Strategy (CLIS) in all schools. The availability of adequate Instructional materials during lessons using the Cooperative Learning Instructional Strategy (CLIS) will enhance classroom interactions and thus improve students' performance, interest and retention of facts.

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