Effects of Two Cooperative Learning Strategies on Secondary School Students' Achievement on Computer Studies in Awka Education Zone

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Abstract

The study determined the effects of two cooperative learning strategies on secondary school students' achievement in Computer studies in Awka Education zone. Two research questions guided the study and three hypotheses guided the study. Quasi-experimental research design was adopted for the study. The population of the study was 6,334 senior secondary year two (SS2) students offering Computer studies out of which 152 students was obtained using purposive and simple random sampling techniques. The instrument for data collection was Computer studies Achievement Test (CSAT) validated by three experts. The reliability of CSAT was established using Kuder-Richardson Formula 20, to be 0.76. The experiment groups were taught Computer studies using STAD and FTAI respectively while the control group was taught using lecture method. CSAT was administered as pretest and posttest to generate data for the study. Research questions were answered using mean and standard deviation and analysis of covariance was used to test the null hypotheses. There was a significant difference between mean achievement scores of students taught Computer studies using STAD, FTAI and lecture method in favour STAD followed by FTAI. Also, gender had significant influence on students' academic achievement in Computer studies. It was recommended that secondary school Computer studies teachers should adopt the use of STAD in teaching to encourage greater students' interactions and enhances academic achievement of students in Computer studies.

Keywords: Achievement, Computer, Cooperative

Introduction

The subject of Computer studies since its introduction in Nigeria in 2014, and given its ever growing scope and relative newness, secondary school teachers are often faced with new challenges of teaching the subject. These challenges are enormous and weigh heavily on the students offering Computer studies to the point that there achievement in the subject could be said to be unsatisfactory. Evidence from the West African Examination Council (WAEC) Chief Examiner's reports (2014-2019) since the inception of the subject shows a significant improvement in students' achievement in the subject. However, the students according to the Chief Examiner reports on students' weaknesses in 2018, showed lack of understanding of functions of registers. The Chief examiner however report in 2019 that candidates enrolled for computer studies had poor practical skills and wrong use of application packages. A common example is that whenever students are able to save a file practically on a computer system, they become knowledgeable enough to answer questions in basic operations of a computer that has to do with saving a file. This lack of practical understanding

of Computer studies therefore have continued to contribute to poor and unsatisfactory level of achievement in the subject.

Students achievement in the Computer studies has improved over the years, nevertheless, students still lack proper understanding into some of the Computer studies concepts. Aside the striking advancements in computer science, teachers lack the necessarily instructional materials to teach the subject adequately and instil in students the skills needed for greater achievement in the subject. Hence, teachers most often, settle for instructional methods which do not enhance students' achievement in Computer studies. Such teaching methods do no facilitate serious interaction between the students and learning materials and may lead to poor academic achievement (Nweke, 2018; Ezeanyika, 2021).

Academic achievement is the extent to which a student or institution has achieved either short or long term educational goals (Nwanze and Okoli, 2021). In a general sense, academic achievement is the current level of a student's learning. According to Egbutu and Okoli (2021), it represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and university. Academic achievement is often determined using teacher made or standardized test. It is therefore, the grades or scores obtained in a test in a subject and which represents the extent of a student's attainment of the learning objectives.

A lot of factors have been adduced for poor achievement of secondary school students both of which may negatively affect achievement. One of the factors according to Ezeanyika (2021) is the confusion arising from the global trends and advancements in computer technologies and its applications. Teachers and students are aware of the advancements in computer and these new development are not in syllabus/scheme of work for Computer studies. Teachers who want to highlight these new knowledge areas in the sense of being current, lack the necessary instructional materials to do so. This mismatch between what is taught and what is practiced in real life leaves the secondary school students especially those who have access to the new computer technologies uninterested in the Computer studies. Thus, innovative instructional approaches that have the potency to facilitate greater cooperation among students and which could lead to greater achievement in computer studies is needed.

There are many forms of cooperative learning strategies such as think-pair-share, think-pair-solo, jigsaw method, round robin and students team achievement division (STAD). Given it beneficial boost on students' achievement as established by literature (example Anaduka, Olaoye and Sunday, 2021), it is believed that the STAD instructional strategy would suit Computer studies instruction. Students team achievement divisions (STAD) is a cooperative learning strategy in which small groups of learners with different levels of ability work together to accomplish a shared learning goal (Agu and Samuel, 2018). STAD is considered as one of the most researched, simplest, and most straightforward of all cooperative learning. It was established based on the fulfilment of instructional pedagogy and is used in meeting well-defined instructional objectives.

In STAD, the students are placed in small groups or teams of four or five students with mixed ability level and gender. The class in its entirety is presented with a lesson and students then work in teams and ensure that they have mastered the lesson. Although the tests are taken individually, students are encouraged by the assistance of the team who work together before the test to improve the overall performance of the group. It is basically a team work, but students are graded individually. In the present study, STAD instructional strategy involves three phases namely: teaching stage, team study, evaluation and recognition. In the teaching stage, the teacher presents materials usually in a lecture-discussion format. Students are told what they are going to learn, what it is and why it is

important. In the team study stage, group members work cooperatively with teacher-provided guidelines and assignments. In the testing stage, each student individually takes a test and the teacher grades the test and notes the current scores as well as the improvement over previous test. Each team receives recognition awards depending on the average scores of each team.

The benefits of STAD and its potential effect on achievement of students' according to Ugwu (2019) derives from its basic elements. The five basic elements are: positive interdependence, individual accountability, promotive interaction, social skills, and group processing. The individualized accountability on the hand suggests the idea that despite being cooperative in nature, each student has an individual responsibility to their learning. Through individual study, the students make meaningful contribution to the team's effort, and without which the purpose of cooperative learning is defeated. Framing strategy is a visual arrangement that enables a substantial amount of information to be put in a form of grid, framework, spatial or matrix. Earliest studies by United Nations Educational, Scientific and Cultural Organization (UNESCO) as cited in Igwe (2000) described framing as a cognitive strategy for sequencing and synthesizing information for the purpose of designs. On the other hand, Team Assisted Individualized (TAI) instruction involves having students work on individualized units in heterogeneous, cooperative learning groups of four or six students. TAI combines cooperative learning with individualized programmed instruction.

The framing and team assisted individualized instructional (FTAI) strategy first involves individualized programmed instruction where materials to be learnt are arranged and presented in small sequenced units called 'frames'. These frames lead the learner from a body of known concept to unknown, from simple to complex concept within the same area with learners working at their pace, making frequent responses as they proceed through the materials and receiving immediate information (feedback) about the adequacy of their responses to attain mastery. Thereafter, students enter individualized sequence and then proceeds at their learning rates. In general, team members work on different units. Team mates check each other's work against answer sheet and help one another with any problems. Final unit tests are taken without teammates' help and rescored by student monitors. Each week, the teachers total the number of units/frames completed by all team members and give certificates or other team rewards to teams that exceed a criterion score based on the number of final tests passed, with extra points for perfect papers and completed assignment. Given that the cooperative structures of STAD and FTAI requires a heterogenous mix of students of different abilities and that gender may influence students' achievement during cooperative learning, the researcher is poised to further explore the influence of gender on students' achievement in Computer studies.

Gender is the social identity of being a male or female. Studies on gender gaps in achievement in Computer studies have remained inconclusive. For instance, while Adetumbi and Oluwafemi (2020) found significant influence of gender on students' achievement Computer studies. Yet Adigun, Onihunwa, Irunokhai, Yusuf and Adesina (2015) found out that male students outperformed female students in Computer Studies. Ibiteye and Emitha (2023), Umoke, Abonyi and Ndukwe (2022) and Onanuga, Saka, Adebanjo and Olanrewaju (2019) found no significant influence of gender on students' achievement in Computer Studies. These disparities in the findings of studies relating to the influence of gender in Computer studies suggest the need to further explore the influence of gender on students' achievement in the subject.

Purpose of the Study

The purpose of the study was to determine the effects of two cooperative learning strategies on students' achievement in Computer studies in Awka Education zone. Specifically, the study sought to determine the:

1. the mean achievement scores of students taught Computer studies using students team achievement division (STAD), framing and team assisted individualized (FTAI) instructional strategy and those taught using lecture method.
2. the mean achievement scores of male and female students taught Computer studies using STAD, FTAI instructional strategy and those taught using lecture method.
3. interaction effect of instructional strategies (STAD, FTAI and lecture method) and gender on students' achievement in Computer studies.

Research Questions

1 What are the mean achievement scores of students taught Computer studies using students team achievement division (STAD), framing and team assisted individualized (FTAI) instructional strategy and those taught using lecture method?
2 What are the mean achievement scores of male and female students taught Computer studies using STAD, FTAI instructional strategy and those taught using lecture method?

Hypotheses

1. There is no significant difference in the mean achievement scores of students taught Computer studies using students team achievement division (STAD), framing and team assisted individualized (FTAI) instructional strategy and those taught using lecture method.
2. There is no significant difference in the mean achievement scores of male and female students taught Computer studies using STAD, FTAI instructional strategy and those taught using lecture method.

Method

The quasi-experimental design, specifically, the pretest-posttest non-randomized control group design was adopted for the study. The study was conducted in Awka Education Zone of Anambra State. The population of the study is made up of 4,334 senior secondary year two (SS2) students offering Computer studies in the Awka education zone of the Anambra state. The sample size for the study is 152 SS2 students drawn from a population of theose offering Computer studies in the Awka Education Zone of Anambra State. To draw up the sample, a multi-stage sampling procedure was used. First, co-educational secondary schools in Awka education zone were listed out as they are in the local government areas. Random sampling technique (balloting with replacement) was used to select three local government areas (Anaocha, Awka North and Njikoka) out of the five local government areas under Awka zone. Secondly, in each of the three local government areas, a school is selected purposive. The reason is to ensure that only those schools offering Computer studies is selected as some offer data processing or ICT. Again, the researcher in choosing the schools ensured that they are far apart to avoid subject interaction. At the third stage, the selected schools are assigned to the two experimental and one control group at random (balloting with replacement). The control group has 51 students (33 males and 18 females), while experimental group one has 54 students (28 males and 26 females) while experimental group two has 47 students (22 males and 25 females).

The instruments for data collection are Computer studies Achievement Test (CSAT). The CSAT is a 50-item multiple choice test on the concepts of word processors, presentation software, computer viruses, file organization, classification, and basic operations, with four answers options denoted by the letters A through D. The questions were pulled from previous West African Examination Council (WAEC) test questions 2022 that are in line with the lessons that were taught. A Table of Specification was used to determine the questions for each unit taught so that every unit is adequately covered. Lesson package in form of lesson plans were developed using the three instructional strategies for treatment. The lesson plans have uniform contents except for the activities

of the teachers and students and the instructional strategies adopted which includes STAD for experimental group 1, FTAI for experimental group two and CM for control group.

Two lecturers in the Departments of Science Education and Educational Foundations and one from Computer Science all at Nnamdi Azikiwe University, Awka, was given the instrument, lesson plan, study objectives, scope of the study, research questions, and hypotheses for validation. The validators' corrections, comments, and recommendations and those of the supervisor were effected in the final copy of the instrument.

Since the CSAT is dichotomously scored, the reliability of the test was determined using the Kuder-Richardson Formula 20 (KR-20). The reliability coefficient of internal consistency obtained was 0.76 for CSAT. In STAD treatment group, the students were divided into groups of five members for the entire class. After assigning students to groups, the last group if less than four was distributed to other groups. In each group, a group head and group assistant was appointed who were replaced each week to give each member a chance of being a group head or at least a group assistance. The group is expected to work cooperatively to master the learning material and receive commendation for the teacher. The teacher introduced the lesson for each week and teaching the students the concepts. After the teaching, students were sent to the teams to study the material and ensure that each team member masters the learning content. The team activities were structured around students studying the material within a given time duration and taking turn to share what they have learnt with other members of the team. The whole activity was coordinated by the group head and the assisted. After the team activity, students were given evaluation exercise to answer as a team but each student wrote on his or her booklet and get and individual score. The mean of all team members was determined and the best performed team received recognition to motivate further team activity.

The students were placed into teams of eight members with one team head. Frames or unit of the instructional materials were formulated in a sequential order using the instructional objectives and the teachers gave the students general objectives and questions expected to achieve by their end of their study. Each team member study to master all unit within a specific time while seeking the help of team mates using the textbooks and computer systems provided for the instruction. The team head coordinated the team to answer all the questions relating to each unit before returning to the general class to take the evaluation test. The student took evaluation test given by the teacher and thereafter received a certificate reward based on their performance.

The control group was instructed using the traditional instructional strategy involving lecture method. Students were given the information for the lesson and the content of the materials along with a full explanation to make sure they understand it. Students had the chance to ask questions to further their comprehension and clear their confusions. They were taught in the computer laboratory but no use was made of any grouping and students' interaction or any form of cooperative learning strategy. The CSAT was given within the first week, and the treatment was given right after in four weeks. Students' pretest scores were recorded, but no performance feedback or corrections were given to them. The same instrument were used again and given as a posttest for achievement after the four weeks of treatment and the results were combined by recording them against each student's pretest score. The research assistants conducted the tests under the direct supervision of the researcher. Mean and standard deviation were used to analyze data pertaining to the research questions, and analysis of covariance (ANCOVA) was used to test the hypotheses at a significance level of 0.05. ANCOVA was used to eliminate the initial group differences among the students. The decision criterion is: if the probability value (p-value) is greater than 0.05 (P>0.05), do not reject the null hypothesis; otherwise, if P-value is less than or equal to 0.05 (P≤0.05), reject the null hypothesis.

Results

Research Question 1: What are the mean achievement scores of students taught Computer studies using students team achievement division (STAD), framing and team assisted individualized (FTAI) instructional strategy and those taught using lecture method (LM)?

Table 1: Mean Achievement Scores of Students taught Computer studies using Students Team Achievement Division (STAD), Framing and Team Assisted Individualized (FTAI) Instructional Strategy and Lecture Method (LM)

Source of Variation	n	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Gained Mean
STAD	54	22.04	5.34	82.48	6.34	60.44
FTAI	47	27.13	7.73	75.51	7.51	48.38
LM	51	36.10	7.99	58.80	9.87	22.70

Table 1 reveals that the students taught Computer studies using STAD has pretest mean achievement score of 22.04 and posttest mean achievement score of 82.48 with gained mean achievement score of 60.44, and those taught using FTAI had pretest mean achievement score of 27.13 and posttest mean score of 75.51 with gained mean 48.38 while those taught using lecture method has pretest mean achievement score of 36.10, posttest mean of 58.80 and gained mean achievement score of 22.70. Students taught using Computer studies using STAD had the most homogeneous score in their pretest (5.34) and posttest (6.34) followed by those taught using FTAI (7.73, (7.51) while those taught using lecture method had the least homogeneous scores in their pretest (7.99) and posttest (9.87).

Research Question 2: What are the mean achievement scores of male and female students taught Computer studies using STAD, FTAI instructional strategy and those taught using lecture method?

Table 2: Mean Achievement Scores of Male and Female Students taught Computer studies using STAD, FTAI and LM

Method	Gender	n	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Gained Mean
STAD	Male	28	22.32	4.66	79.04	1.37	56.72
	Female	26	21.73	6.07	86.19	7.45	64.46
FTAI	Male	22	26.41	6.27	80.41	6.14	54.00
	Female	25	27.76	8.90	71.20	5.80	43.44
LM	Male	33	33.64	7.40	62.24	8.56	28.60
	Female	18	40.61	7.16	52.50	11.89	11.19

Table 2 indicates that male students taught Computer studies using STAD have gained mean achievement score of 56.71 while female students have a gained mean score of 64.46. Males students taught Computer studies using STAD had a more homogeneous score in the posttest (1.37) than the female students (7.45). Male students taught Computer studies using FTAI have a gained mean achievement score of 54.00 while female students have gained mean score of 43.44. The males taught Computer studies using FTAI had a less homogeneous score in the posttest (6.14) than the female students (5.80). Again, male students taught Computer studies using LM have a gained mean achievement score of 28.60 while female students have gained mean score of 11.19. Males students taught Computer studies using lecture method have a more homogeneous score in the posttest (8.56) than the female students (11.89).

Hypothesis 1: There is no significant difference between the mean achievement scores of students taught Computer studies using students team achievement division (STAD), framing and team assisted individualized (FTAI) instructional strategy and those taught using lecture method.

Table 3: ANCOVA on Difference between the Mean Achievement Scores of Students taught Computer studies using STAD, FTAI and LM

Source of variation	SS	Df	MS	F	P-value	Decision
Corrected Model	18666.063ª	6	3111.011	71.628	.000	
Intercept	32295.288	1	32295.288	743.563	.000	
Pretest	507.077	1	507.077	11.675	.001	
Method	12194.585	2	6097.293	140.383	.000	Sig.
Gender	759.822	1	759.822	17.494	.000	Sig.
Method * Gender	2682.837	2	1341.418	30.885	.000	Sig.
Error	6297.805	145	43.433			
Total	821306.000	152				
Corrected Total	24963.868	151				

Table 3 shows that there was a significant main effect of the treatment on students' achievement in Computer studies, $F(2, 145) = 140.383$, $P < .0.05$. Therefore, the null hypothesis was therefore rejected meaning that there is a significant difference between the mean achievement scores of students taught Computer studies using students team achievement division (STAD), framing and team assisted individualized (FTAI) instructional strategy and those taught using lecture method. The order of the significance of difference was determined using Scheffe PostHoc analysis and presented in Table 4.

Table 4: Scheffe PostHoc on Significant Difference between the Mean Achievement Score of Students Computer studies taught using STAD, FTAI and LM

(I) Method	(J) Method	Mean Difference (I-J)	Std. Error	Sig.ᵇ	Decision
STAD	FTAI	8.185*	1.377	.000	Sig.
	LM	29.348*	1.784	.000	Sig.
FTAI	STAD	-8.185*	1.377	.000	Sig.
	LM	21.163*	1.581	.000	Sig.
LM	STAD	-29.348*	1.784	.000	Sig.
	FTAI	-21.163*	1.581	.000	Sig.

Table 4 reveals that a significant difference exists between the mean achievement scores of students taught Computer studies using STAD and FTAI in favour of STAD. Table 4 also reveals that a significant difference exists between the mean achievement scores of students taught Computer studies using STAD and LM in favour of STAD. Table 4 further shows that there is significant difference between the mean achievement scores of students taught using FTAI and LM in favour of FTAI. The most effective method is therefore STAD followed by FTAI.

Hypothesis 2: There is no significant difference between the mean achievement scores of male and female students taught Computer studies using STAD, FTAI instructional strategy and those taught using lecture method.

Table 3 shows that there was a significant influence of gender on students' achievement to Computer studies, $F(1, 145) = 17.494$, $P < 0.05$. Therefore, the null hypothesis was rejected meaning that there

is a significant difference between the mean achievement scores of male and female students taught Computer studies using STAD, FTAI instructional strategy and those taught using lecture method.

Hypothesis 3: There is no interaction effect of instructional strategies (STAD, FTAI and lecture method) and gender on students' achievement in Computer studies.

Table 3 shows that there is a significant interaction effect of instructional strategies and gender on students' achievement, $F_{(2, 145)} = 30.885$, $P < 0.05$. Therefore, the null hypothesis was rejected meaning that there is a interaction effects of instructional strategies (STAD, FTAI and lecture method) and gender on students' achievement in Computer studies.
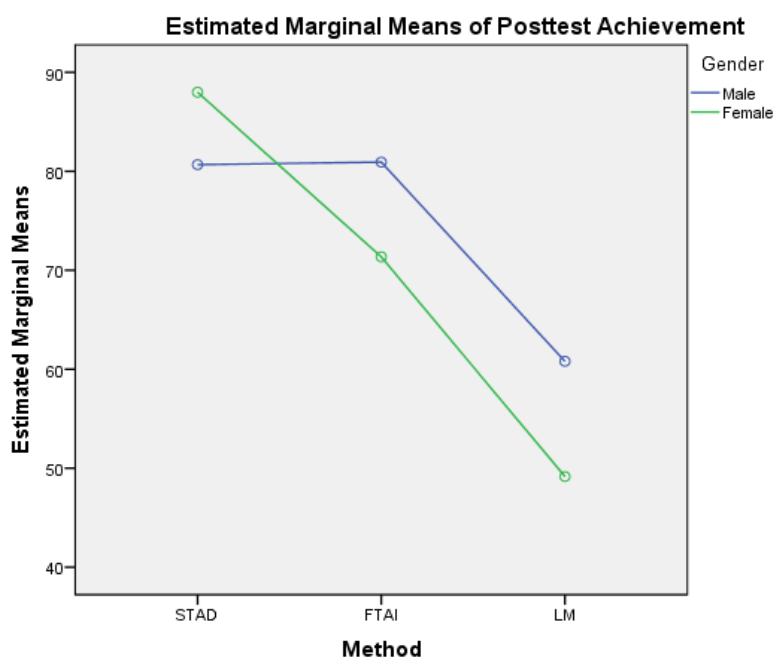
Figure 1: Plot of interaction between instructional strategies and gender on students' achievement in Computer studies

Figure 1 shows that the plot of interaction between instructional strategies and gender on achievement in Computer studies. The plot shows that there is an disordinal interaction between teaching methods and gender on achievement in Computer studies meaning the instructional strategies are gender sensitive as their effects on academic achievement changed with respect to the students' gender.

Discussion

The findings of the study showed that STAD significant improved students' academic achievement in Computer studies more than FTAI and lecture method. The findings of the study can be hinged on the fact that collaborations within the teams improved how students' understood the materials and finding solutions to questions arising from the materials learnt. Team learning leads to more innovation, efficient processes, increased success, and improved communication. Through listening to and learning from team members, students can help each other reach the instructional goals. Team work creates more opportunities for critical thinking and can promote student learning and achievement. Not every student processes information in the same way. Some students like to jump into problem-solving mode immediately, while others prefer time to gather their thoughts and consider multiple options before making a contribution. Asking each student within the team to

provide input asynchronously in team collaboration over the learning of a particular material allows each student the space to work study and learn in a way that is comfortable for them.

Diversity is a well-documented pathway to unlocking new learning opportunities and experiences, overcoming new academic challenges, and gaining new understanding into the learning materials and contents. When individuals learn together as a team, they can leverage their collective knowledge and expertise to develop creative solutions to complex problems and achieve common goals. Team members can work together to identify shared goals and objectives, establish clear communication channels, and regularly reflect on their progress and learning. Collaboration also fosters a culture of trust and respect that makes it easier for team members to communicate openly and honestly with one another, their learning deficiencies and challenges. Ultimately, increased collaboration through learning in teams can lead to improved problem-solving skills, higher productivity, and better outcomes for the team leading to improved academic achievement.

The findings of the study is in line with the findings of Gambari, Shittu and Yusuf (2016) that students taught physics with computer-based STAD performed better than their counterparts in individualized computer instruction (ICI) among others. The findings of the study support the findings of Zussette (2017) and that of Anaduka, Olaoye and Sunday (2021) that students under the experimental group taught using STAD performed better than those in control group. The findings of the study however contravened the findings of Gul and Hafiz (2011) that STAD has no significant effect on students' achievement.

The findings of the study also showed that students taught Computer studies using FTAI instructional strategy attained significantly higher academic achievement in Computer studies than those taught using lecture method. The use of framing allowed the teacher to provide a framework or context for the future learning that will take place by letting students know what they will learn, how they will go about learning it, and how they and their teacher will know that they have successfully mastered what they were supposed to learn. The framing allowed the students to know the objectives, the rationale for the objectives and activities, the directions and procedures, as well as the assessment criteria at the beginning of the learning process. Thus, they become more focused in the learning without wasting time learning unnecessary materials.

When teachers plan to help students make these connections, learning is much more likely to occur and much more likely to be permanent. With team assisted individualized instructional, teachers can purposefully pause during lessons to allow students to think about the new learning and to share their thoughts and reactions with fellow students and greatly increase the level of student engagement. During FTAI instruction, students become very actively engaged in the learning and with individualized study and team assistance; they properly conceptualize what is learnt. With a learning map which frames the learning so that students know the intended destination, the learning experiences they will have on their journey, how what they are learning relates to what they already know, why it is worth knowing, and how they can use what they are learning in future journeys. The result of the processes leads to a better and enhanced academic achievement.

The findings of the study Nneji (2013) which indicate significant main effect of treatment using framing and team assisted individualized instruction. The findings of the study support the findings of Wahyuningsih, Saharuddin and Wahidah (2021) and Syafitri (2021) that students who are taught using the Team Assisted Individualization type cooperative learning model (TAI) are higher than the mathematics learning outcomes of students taught using the conventional learning model.

The findings of the study revealed that gender had a significant influence on students' achievement in Computer studies. The interaction effect of gender and instructional strategies on

achievement was gender sensitive. When students are placed in groups, there is the tendency that the commonly stereotyped classrooms will be biased towards certain gender. Male students dominated most of the groups and interacted more among than the female students over the learning materials. The findings of the study is not line with the findings of Adigun, Onihunwa, Irunokhai, Yusuf and Adesina (2015) that even though the male students had slightly better performance compared to the female students, it was not significant. The findings of the study does not support the findings of Onanuga, Saka, Adebanjo and Olanrewaju (2019) that no significant gender difference in students' performance in Computer studies after the exposure to the use of demo kits. The finding of the study is however in collaboration with the findings of Adetumbi and Oluwafemi (2020) that gender has significant influence on students' competence in Computer studies and on students' achievement.

Conclusion

The findings of this study showed that students taught Computer studies using STAD had significantly higher achievement in Computer studies followed by those taught using FTAI. The study concludes therefore that STAD is an effective instructional strategy that enhances students' academic achievement of learning materials. The study also establishes that FTAI is more effective than lecture method in improving students' academic achievement in Computer studies.

Recommendations

Based the findings and conclusion of the study, the following recommendations are made:
1. Secondary school Computer studies teachers should always adopt teaching methods that encourages greater interaction among students over the learning materials such STAD.
2. Workshops and seminars should be organized by Science Teacher's Organisation of Nigeria (STAN) on how to plan instructions and Computer studies lesson using STAD and FTAI as well as how to use them to teach Computer studies.

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