Three Instructional Strategies and Secondary School Computer Science Students' Retention in Oyigbo Local Government Area of Rivers State

IKECHI, CHINWE[1], PROF. O.F. NDIOHO[2]
[1, 2] *Department of Curriculum Studies and Educational Technology, Faculty of Education, University of Port Harcourt, Choba, Port Harcourt, Rivers State.*

Abstract- ***This study investigated the effect of Three Instructional Strategies and Secondary School Computer Science Students' retention in Oyigbo Local Government, Area of Rivers State. This study aims to find out if there was a difference in the academic retention of students taught with peer tutoring, think-pair-share, three-two-one (3-2-1) strategies, and those taught with chalk-talk instructional strategy. For the study quasi-experimental, pre-test-posttest non-equivalent group design was adopted. Three research questions and three null hypotheses guided the study. The population of this study comprised all the senior secondary school one students in mixed public schools in Oyigbo Local Government Area of Rivers State with a total of two thousand one hundred and eighty-nine students (2189). A sample of four schools was selected using a multistage sampling procedure with a sample size of two hundred students. In each school, an intact class of 50 students was used. Data were collected from the four selected secondary schools using Computer Science Retention Test. These were administered as pre-test and post-test respectively. Both contained twenty multiple-choice items. Mean and standard deviation was used to answer the research questions while the hypotheses were tested using Analysis of Covariance at 0.05 level of significance. The results of the findings showed that students who were taught Computer Science using Peer Tutoring and the 3-2-1 strategy retained better than their counterparts taught using Think-Pair-Share and chalk-talk strategies. The study also revealed that there was no significant interaction effect between Peer Tutoring, Think-Pair-Share, 3-2-1, and chalk-talk instructional strategies and gender on students' retention in Computer Science. Based on the findings, it was recommended among others that since the use of Peer Tutoring and 3-2-1 strategies were found to improve retention in Computer Science, Computer Science teachers should employ it more in teaching topics that are abstract and the students perceive to be difficult.***

Indexed Terms- ***Effect, Retention, Instructional Strategies, Computer Science, Peer- tutoring, Think-Pair-Share, 3-2-1***

I. INTRODUCTION

Computers are everywhere and used in almost every situation a person encounters throughout their everyday life. Computer is a vital part of life, from the checkout point in a grocery store to the chime door as one enters and exits in a car. The computers that are used in education are particularly important to teachers and students. The importance of computer technology cannot be overemphasized as the computer continues to evolve both in school and the workplace. Computers are actively and intensively applied in the 21st century educational environment to improve the quality of learning outcomes of 21st century digital students in the digital classroom as they relate to the digitally immersed ecosystem. At present computers have touched the lives of many students living in the remotest part of Nigeria, for impact students' lives, it becomes imperative that computer science education is taught in all the schools in the country.

Computer Science Education is of high importance to national development and it is on this ground that the Federal government of Nigeria pursued the introduction of computer studies in the education system from primary through to secondary schools and higher institutions. Now, after more than two decades of unfulfilled promises to revolutionize education, computer science education has finally been given an

opportunity in the education system in Nigeria. Computer Science Education is one of the pre-vocational education subjects taught in secondary schools that can be a key driver of skills acquisition if the appropriate instructional strategies are used to teach the students. This is because vocational education generally is aimed at providing the technical competence required for career application. The problems that the educational system is facing, it's not because the schools lack professional teachers alone, professional teachers may be there but how these professional teachers teach will be an issue that needs to be resolved. That is, the strategies these teachers use in teaching can hamper learning.

An instructional strategy is considered the most important aspect in teaching science subjects in senior sef4`wszcondary schools. The status of science education in Nigerian schools in terms of scientific concepts and development strategy of teaching, learners' interest in the subject continues to reduce (Ugwuadu, 2011; Oladimeji, Yusuf, Njoku and Owolabi, 2018). The teacher should be ready to use the most effective strategies to achieve educational objectives for learning to occur. One of the important duties of the teacher as a major facilitator in teaching and learning is to effectively teach, another is to effectively evaluate the students on the objectives of instruction. Instructional strategies have an important role to play in humanizing classroom instruction. Different instructional strategies are used on different occasions to achieve educational objectives in the classroom. To date, science educators are still searching for the best instructional strategies that would enhance better learning of computer science. Some of these strategies that are fast gaining recognition include humanizing, 3-2-1 instructional strategy, experimental, project-based learning, problem-solving, demonstration, laboratory, group, and think-pair-share. However, think-pair-share, peer tutoring, 3-2-1 and chalk-talk instructional Strategies were considered in this work

Peer-tutoring instructional strategy is also known as peer-assisted learning, peer education, child-teach-child, mutual instruction, and partner learning. Peer-tutoring instructional strategy as a pedagogical practice can reduce stress on teachers who are expected to teach large groups of multi-age and diverse students. Several methods can be used to set up a peer-tutoring instructional strategy in a classroom with a diverse student population to meet the learning needs of heterogeneous groups. Various students exist in a classroom while some can learn from a teacher others can equally learn from their peers. (Nawaz & Reman, 2017) defined peer-tutoring as a "teaching strategy in which the class is organized in pairs of two students that may be of different abilities to act as tutor and tutee in the learning process to get maximum benefits from each other"

A Three-Two-One (3-2-1) instructional strategy is an instructional strategy that helps students structure their responses to a text, film, or lesson by asking them to describe three takeaways, two questions, and one thing they enjoyed. It provides an easy way for teachers to check for understanding and to gauge students' interest in a topic (Wager, 2014). 3-2-1 instructional strategy is a strategy that aids reflection by providing a structure for students to summarize, organize and integrate what they are learning. When asked what they learned, students are often at a loss as to where to begin explaining their thinking. 3-2-1 helps by giving them prompts to jump-start the process of reflecting. The strategy may be used as admit or exit ticket. It may also be used to promote reflective dialogue among small groups of students (Garmston & Wellman, 2019).

Think-pair-share is a cooperative learning strategy that includes three components namely: time for thinking, sharing with a share among pairs to a larger group. The use of the strategy unites the cognitive and social aspects of learning, promoting the development of thinking and the construction of knowledge. Think-pair share strategy has many advantages over the traditional questioning structure. The "think time" incorporates the important concept of "wait time." Think time allows all students to develop answers, longer and more elaborate answers can be given, and answers will have reasons and justifications because they have been thought about and discussed. Students are more willing to take risks and suggest ideas because they have already "tested" them with their partners. Strategic steps of (Think-Pair-Share) posed some of the questions to the class about what has been explained about the activity or an issue or a task and then ask the students to think for a minute about this

question alone with the prevention of talking or walking around in the classroom at the time of thinking, then the teacher asks students to split up into pairs to discuss and think together about a question or posed activity for a period of five minutes, finally, the teacher is required to participate by displaying what has been reached of solutions and ideas about the question or activity and it is characterized by allowing the students to reflect (with himself internally and externally with colleagues) and thinking and revision before answering (Zaitun, 2007 in Ogunyebi, 2018). If good instructional strategies are used in teaching computer science it will influence the retention of the students.

Retention is the act of retaining, recalling and recognizing what has been learned or experienced over a long period of time. If what has been taught is retained over a long period of time, it may lead to higher academic performance because retention is measured in collaboration with performance (Ikechi, 2018).

- Statement of the problem

The use of inappropriate instructional strategies adopted by the teachers in teaching computer science has been one of the major reasons for the poor retention of students in the subject. the instructional strategies used in Nigerian secondary schools are based on behavioural learning theories which are content-driven, not learner-centred, and do not sufficiently give students the opportunities to participate in classroom instruction. Students taught with instructional strategies based on the behavioural theories do not sufficiently retain their learning and apply it to new situations

Seemingly, the behavioural theories based on instructional strategies tend to overlook the human, social, cultural and psychological, or affective problems of the students; and do not emphasize the development of basic skills essential for students to be employable in the 21stcentury. To reverse the problem of students' poor retention and meet societal and industrial needs, there is a need for innovative and more effective instructional strategies to be used by teachers in all classrooms. The problem of this study was to determine the effects of think pair share, peer – tutoring and 3-2-1 instructional strategies on student retention in Computer Science in secondary schools in Oyigbo Local Government area.

- Aim and objectives of the study

The aim of this study is to investigate three instructional strategies and Secondary School Computer Science students' retention in Oyigbo Local Government area in Rivers State.

Specifically, the objectives of the study were to:

1. examine the effect of think-pair-share, peer tutoring, 3-2-1 and chalk-talk instructional strategies on students' retention in Computer Science concepts.
2. ascertain the effect of think- pair -share, peer tutoring, 3-2-1 and chalk-talk instructional strategies in relation to male and female students' retention in Computer Science.
3. examine the interaction effect of methods and gender on students' mean retention scores in Computer Science?

- Research Questions

Three research questions guided the study,

1. What is the effect of peer tutoring, think-pair-share, 3-2-1 and chalk–talk instructional strategies on the mean retention scores of students in Computer Science?
2. What is the influence of peer tutoring, think-pair-share, 3-2-1 and chalk-talk instructional strategies in relation to male and female students' mean retention scores in Computer Science?
3. What is the interaction effect of methods and gender on students' mean retention scores in Computer Science?

1.5 Hypotheses

Three null hypotheses formulated were tested at 0.05 level of significance.

1. There is no significant difference between mean retention scores of students exposed to think-pair-share, peer tutoring, 3-2-1 and chalk-talk instructional strategies.
2. There is no significant difference between the mean retention scores of male and female students' who taught Computer Science using think-pair-share, peer tutoring, 3-2-1 and chalk-talk instructional strategies.

3. There is no significant interaction effect of methods and gender on students' retention scores in Computer Science?

II. METHODOLOGY

- Research Design

The design for the study is a quasi-experimental pre-test –post-test non -equivalent research design.

- Population of the study

The population for the study comprised all Senior Secondary School 1 (SS1) in public schools in Oyigbo local government area of Rivers State with a total number of two thousand, one hundred and eighty-nine (2189) students.

- Sample and Sampling Technique

A sample size of 200 hundred students from four schools was selected from the wards that make up Oyigbo Local Government Area. A multistage sampling procedure was used in selecting the four senior secondary schools from Oyigbo Local Government Area of Rivers State.

- Stage 1: Stratified random sampling was used to group Oyigbo local government into ten strata, each stratum representing the electoral wards.
- Stage 2: Simple random sampling was used in selecting four schools from the stratified wards
- Stage 3: Simple random sampling was used in selecting one intact class from each selected school. The four schools were assigned to treatment and control groups with a sample size of four hundred students.

- Research 1nstrument

The instrument used for data collection was Computer Science Retention Test (CSRT)

Computer Science Retention Test (CSRT): the CSRT consists of 20-item multiple-choice objectives tests and was scored 5 marks for the correct answer while any wrong answer attracts no mark. The maximum score for the data was 100 marks. The CSRT was used for both pre-test and post-test, and it was designed to measure students' retention in computer input and output device lessons. Specifically, the questions were drawn from' Computer input and output devices".

- Validity of the Instrument

The validity of the instrument named Computer Science Retention Test (CSRT) was done by constructing the Computer Science Retention Test, and lesson plan on the topics taught to the students. The content and face validity of the CSRT were done by contacting experts in the field of Computer Science Education and measurement and evaluation in the Faculty of Education, University of Port –Harcourt. A copy of the instrument was given to the experts and their contributions and corrections were incorporated into the final copy. The instrument consists of 20 multiple choice objectives test items.

- Reliability of the Instrument

A pilot test using 50 SS1 students from another school of the same background was not part of the study but was an equivalent sample of the group for which the instrument was developed and had covered the lesson on the topic chosen by the researchers. The pilot test was done by administering the CSRT to the 50 students in an intact class. The scripts were marked and the scores recorded. To estimate the reliability of the instruments, data collected from the CSRT was subjected to a reliability test and analysed using the Kuder Richardson Formula 20 (K-R20) reliability coefficient. Reliability indexes mean of 0.82 was determined.

- Method of Data Collection

A pre-test was administered to both the experimental and control groups before the commencement of treatment to determine the baseline knowledge of the sample. After the pre-test, the experimental group was taught using peer-tutoring, think-pair-share, and 3-2-1 instructional strategies while the control group was taught using the chalk-talk instructional strategy. The teaching lasted for a period of four weeks. After the four weeks training, the post-test was give to both experimental and control groups. The instrument was re-shuffled to avoid bias. Two weeks after the post-test retention test was reshuffled, again to ascertain how the students in both groups differ in remembering the content learned. Regular computer science teachers (research assistants) regulated treatment variables in their various schools.

- Method of Data Analysis

The research questions were answered using mean and standard deviation while the hypotheses were analysed using analysis of covariance (ANCOVA).

III. RESULTS AND ANALYSIS

Research Question1: What is the effect of peer tutoring, think-pair-share, 3-2-1 and chalk–talk instructional strategies on the mean retention scores of students in Computer Science?

Table 1: Mean retention scores of students taught Computer Science using peer tutoring, think-pair-share, 3-2-1 and chalk–talk instructional strategies.

SN	Method	Adjusted Mean	SD	n
1	Peer Tutoring strategy	62.60	13.79	50
2	Think-Pair share strategy	59.80	15.38	50
3	3-2-1 Strategy	60.92	12.19	50
4	Chalk-talk strategy	59.80	15.05	50

As shown in table 1 the peer tutoring strategy has high mean than the other three strategies in enhancing students' retention in Computer Science, this is followed by the 3-2-1 strategy. The result of the data analysed also showed that both the think-pair-share strategy and the conventional strategy are equal in terms of retention.

Research Question 2: What is the effect of peer tutoring, think-pair, 3-2-1 and chalk-talk instructional strategies in relation to male and female students' mean retention scores in Computer Science?

Table 2: Mean retention scores of male and female students taught Computer Science using peer tutoring, think-pair-share, 3-2-1 and chalk–talk instructional strategies.

SN	Strategy	Gender	Mean	SD	N
1	Peer Tutoring strategy	Male	67.00	10.56	30
		Female	59.67	15.02	20
2	Think-Pair share strategy	Male	57.31	17.33	26
		Female	62.50	12.77	24
3	3-2-1 Strategy	Male	63.57	12.97	28
		Female	58.64	11.67	22
4	Conventional strategy	Male	57.50	15.24	34
		Female	64.69	13.84	16

The result of data analysis in Table 2 indicates that for the peer tutoring and 3-2-1 strategies the male students are more favoured in enhancing retention in Computer Science than their female counterparts while females fared better with the think pair share strategy and the chalk-talk instructional strategy

Research Question 3: What is the interaction effect of the strategies and gender on students' mean retention scores in Computer Science?

Table 3: Interaction effect of method and gender on students' means retention scores in computer science

SN	Strategy	Gender Categories	
		Male	Female
1	Peer Tutoring Strategy	67.00	59.67
2	Think-Pair share Strategy	57.31	62.50
3	3-2-1 Strategy	63.57	57.38
4	Chalk-talk strategy	57.50	64.69

Results of data analysis in Table 3 also indicate that the peer tutoring and 3-2-1 strategy are superior at the two levels of gender in enhancing retention in Computer Science than the think-pair-share instructional strategy and chalk-talk strategy

- Hypotheses

Hypothesis 1: There is no significant difference between mean retention scores of students exposed to peer tutoring, think-pair-share, 3-2-1 and chalk-talk instructional strategies.

Table 4: Analysis of Covariance for students' overall computer science retention scores by instructional strategies and interaction

Source of variation	Sum of squares	df	Mean square	F cal	f- probability
Covariates (Pretest)	21080.598	1	21080.598	225.504	.000
Main Effects	166.295	4	41.574	.445	.776
Method	99.570	3	33.190	.355	.786
Gender	57.987	1	57.987	.620	.432
2-way Interactions: (Method and Gender	395.738	3	131.913	1.411	.241
Explained)	21642.631	8	2705.329	28.939	.000
Residual	17761.640	190	93.482		
Total	39404.271	198	199.011		

For hypothesis 1, the table above shows that the level of significance (0.05) is greater than the F-probability value (.000). Following the decision rule, it is concluded that there is a significant difference between the mean retention scores of students exposed to peer tutoring, think-pair-share 3-2-1 and chalk-talk instructional strategies.

Hypothesis 2: there is no significant difference between the mean retention scores of male and female students who were taught Computer Science using peer tutoring, think-pair-share, 3-2-1 and chalk-talk instructional strategies.

Data collected for males and females in each of the four methods for both pretest and posttest on retention were subjected to Analysis of Covariance. were presented separately for each of the methods as shown on 5 to 8

Table 5: Analysis of Covariance of Mean retention Scores of male and female students taught computer science using peer tutoring strategy only

Source of variation	Sum of squares	df	Mean square	F cal	F- probability
Covariates (Pretest)	3307.267	1	3307.267	25.900	.000
Main Effects (Gender)	3.167	1	3.167	.025	.876
Explained	3310.434	2	1655.217	12.962	.000
Residual	6001.566	47	127.693		
Total	9312.000	49	190.041		

Table 6: Analysis of Covariance of Mean retention Scores of male and female students taught computer science using think-pair strategy only

Source of variation	Sum of squares	df	Mean square	F cal	F- probability
Covariates (Pretest)	8043.901	1	8043.901	107.849	.000
Main Effects (Gender)	48.623	1	48.623	.652	.423
Explained	8092.524	2	4046.262	54.251	.000
Residual	3505.476	47	74.585		
Total	11598.000	49	236.694		

Table 7: Analysis of Covariance of Mean retention Scores of male and female students taught computer science using the 3-2-1 strategy only

Source of variation	Sum of squares	df	Mean square	F cal	F- probability
Covariates (Pretest)	5148.735	1	5148.735	99.515	.000
Main Effects (Gender)	121.575	1	121.575	2.350	.132
Explained	5270.310	2	2635.155	50.933	.000
Residual	2431.690	47	51.738		
Total	7702.000	49	157.184		

Table 8: Analysis of Covariance of Mean retention Scores of male and female students taught computer science using a conventional method only

Source of variation	Sum of squares	Df	Mean square	F cal	F- probability
Covariates (Pretest)	5618.523	1	5618.523	50.178	.000
Main Effects (Gender)	216.851	1	216.851	1.937	.171
Explained	5835.373	2	2917.687	26.058	.000

Residual	5262.627	47	111.971
Total	11098.000	49	226.490

Summary of results in Tables 5 to 8 shows that the F. probability values are .876, .423, .132 and .171 respectively. Since the F, probability values are greater than the alpha level (0.05) in all the cases, the null hypothesis was retrained. This means that there is no significant difference between the mean retention scores of male and female students who were taught Computer Science using peer tutoring, think-pair-share, 3-2-1 and chalk-talk instructional strategies.

Hypothesis 3: There is no significant interaction effect of methods and gender on students' retention in computer science

Table 9: Analysis of Co Variance for students' overall computer science retention scores by instructional strategies and interaction

Source of variation	Sum of squares	df	Mean square	F cal	f- probability
Covariates (Pretest)	21080.598	1	21080.598	225.504	.000
Main Effects	166.295	4	41.574	.445	.776
Method	99.570	3	33.190	.355	.786
Gender	57.987	1	57.987	.620	.432
2-way Interactions: (Method and Gender	395.738	3	131.913	1.411	.241
Explained)	21642.631	8	2705.329	28.939	.000
Residual	17761.640	190	93.482		
Total	39404.271	198	199.011		

For hypothesis 3, the result in table 9. reveals that for two ways interactions, the f-probability value at 0.05 significance level is .241. Because the alpha level (0.05) is less than the F. probability value (.241), the null hypothesis was retained. That means there is no significant interaction effect of methods and gender on students' retention in computer science.

Discussion of Findings Peer tutoring, think-pair-share, 3-2-1 and chalk–talk instructional strategies on the mean retention scores of students in Computer Science

The result in Table 1 shows that Peer Tutoring is also superior to the other three strategies in enhancing retention in Computer Science, followed by the 3-2-1 strategy. The result of data analysis however showed that both the think-pair-share strategy and the chalk-talk strategy are equal in terms of retention. The result of this study is in agreement with the findings of Agu and Samuel (2019) who confirmed that peer tutoring if effectively adopted would to an extent enhances students retention and aid students gain an understanding of abstract topics.

The finding showed that the 3-2-1 group retained better when compared with think-pair-share and chalk-talk. The finding also revealed that the think-pair-share and chalk-talk were retained equally.

Peer tutoring, think-pair, 3-2-1 and chalk-talk instructional strategies in relation to male and female students' mean retention scores in Computer Science

The result in Table 2 also indicates that for the peer tutoring and 3-2-1 strategies males are more favoured than their female counterparts in enhancing retention in computer science while females fared better with the think pair share strategy and the conventional method. The results in tables 4-8 however showed that there is no significant difference between the mean retention scores of male and female students' who taught Computer Science using peer tutoring, think-pair, 3-2-1 and chalk-talk instructional strategies. The researcher also upholds the null hypothesis.

The findings above agree with the findings of Gloria & Peter (2017), who reported that there was no

significant difference in treatment and gender in the achievement of senior secondary school students in computer studies.

Interaction effect of methods and gender on students' retention in computer science

The findings as seen in Table 4 showed that there is no significant interaction effect of methods and gender on students' retention in computer science. This means that instructional strategies did not significantly interact with the students' retention of computer Science Okolocha and Nwaukwa (2020) found significant differences in the academic achievement and retention of students taught financial accounting.

CONCLUSION

the findings of the study showed that students retain the Computer Science topic taught better when they were exposed to Peer Tutoring and the 3-2-1 strategy than when exposed to the Think-pair-share and chalk-talk strategy. Peer Tutoring and the 3-2-1 strategy proved Superior in enhancing students' retention in Computer Science. Peer Tutoring is most effective in enhancing male and female students' retention ability. It is evident that students' retention of Computer Science concepts is not dependent on gender, but is a function of instructional strategies. Instructional strategy and gender have no interactive effect on students' retention in Computer Science.

RECOMMENDATIONS

since the use of cooperative instructional strategy was found to enhance and retention in computer science, computer science teachers should employ it more in the teaching of the topics that are abstract that students perceive to be confusing. the Federal, State and Local Government in Nigeria should equip the classroom with desks that can easily be rearranged at any time to allow students to interact with each other. the teachers should make effort to shift from traditional teaching to a more learner-centred strategy.

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