

## EFFECTS OF GUIDED DISCOVERY AND COMPUTER-ASSISTED INSTRUCTIONAL STRATEGIES ON BASIC SCIENCE CONCEPTUAL CHANGE OF SECONDARY SCHOOL STUDENTS IN OSUN STATE, NIGERIA

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### Abstract

The study determined the effects of Guided Discovery (GD) and Computer-Assisted Instructional (CAI) strategies on Basic Science conceptual change of secondary school students in Osun State. This was with a view to improving students' conceptual change and retention of the changed concepts in Basic Science in junior secondary schools in Osun State. The study adopted the pre-test, post-test control group quasi-experimental research design. The population of the study comprised all junior secondary school class two students in Basic Science in Osun State. The study sample comprised 180 Junior Secondary two students. Six schools were randomly selected through simple random sampling technique (three urban & and three rural). An intact class of JSII was selected using simple random sampling technique from each school. The selected intact classes were assigned to two experimental groups and one control group in both urban and rural areas. Two instruments used for data collection are: Basic Science Concept Test (BSCT) and Basic Science Achievement Test (BSAT). Data collected were analyzed using mean, standard deviation and Analysis of Covariance (ANCOVA). The results showed a significant effect of the instructional strategies on students' conceptual change ( $F = 18.048$ ;  $p < 0.05$ ) with CAI having the highest significant effect on students' conceptual change ( $\bar{x} = 17.8667$ ). The results further revealed a significant effect of the instructional strategies on retention ability of learned concepts in Basic Science ( $F = 108.034$ ;  $p < 0.05$ ). The students taught with CAI having a higher retention ability. The results finally showed a significant interaction effects of school location and methods on conceptual change of secondary school students ( $F = 10.929$ ;  $p < 0.05$ ) with urban learners performing better ( $\bar{x} = 17.8667$ ) than the rural learners in BSCT and BSAT. The study concluded that GD and CAI are effective and innovative teaching methods in improving students' conceptual change and retention of the changed concepts in Basic Science in junior secondary schools in Osun State.

**Keywords:** Guided discovery, Computer and instruction, Conceptual change, Retention, Misconception

### Introduction

For any nation to enjoy all round development in industrial, social, educational, political and all other sectors, there must be high level of scientific development since science cut across every sector of a nation (Olajide & Aladejana, 2016). According to Jibrin (2012) and Danjuma (2013) cited in Akinbayo, Olajide and Aladejana (2019), science and technology are viable tools to assist individuals to totally and intelligently be involved in the productive sector of the economy which may lead to national development. Ogbonna (2014) defined science as the study of nature and natural phenomenon in order to discover their principles and facts. Science is defined as logical and experimental means by which veritable knowledge about nature and natural phenomenon is attained (Olajide, 2017). Since Basic Science and technology are inseparable, hence great importance is placed on it globally. Training students is one of the major underlining principle in science and technology so as to equip them to manage the dynamic nature of science world and apply novel ideas in technological innovations in their fields.

In order to achieve an enviable and desirable science and technological attainment in Nigeria, a well consolidated background in Basic Science is inevitable right from primary to junior secondary school levels. Hence, the Federal Government of Nigeria in the National Policy on Education FRN (2014) stressed that the teaching of science and technology is germane to nation building. To achieve such objectives, it is pertinent that teachers employ effective instructional methods that are learners-centered involving the students in the learning process. In Nigeria, the national objectives for science education are: developing scientific and rational mind of the learner so as to become a useful member of the society; producing scientists for national growth; sharpening the power of observation of the students and continuing the process of learning science through practical (FRN, 2004).

In order to attain these objectives, Basic Science is included as one of the primary subjects in the junior secondary school curriculum. At the conclusion of junior secondary school education, a child acquire knowledge in science and he or she is empowered to explain natural occurrences. Despite the role of

science in nation's building, students' performance at terminal and standardized examinations has drastically reduced over the years at both primary, secondary and tertiary levels of education in Nigeria (Ojogan & Oganwu 2006; Olajide & Aladejana 2016; Aladejana, 2015; Olajide 2017).

One of the primary challenges confronting science teacher is not the curriculum or instruction but the method of passing the instruction as part of the factors responsible for students' poor performance in internal and external examinations (Olajide, 2017) At the completion of the students' course, the interest and mastery expressed is a function of how well they were taught (Ojogan & Oganwu, 2006; Aladejana 2008; Olajide, 2017). Although, a couple of factors apart from teaching strategies, like teachers' qualification, inadequate trained teachers, learning environment, availability of resource materials, learning difficulty, teachers' factor, inadequate evaluation or probably, anxiety and fear for the subject among others, (Akinbayo, Olajide & Aladejana, 2019) can be responsible for students' poor performance.

Furthermore, there had been various developmental changes on pedagogy of Basic Science yearly over the years throughout the world. The reason for this clarion call is to have a science classroom where student centered activities are carried out and where understanding of concepts are of uttermost priority rather than memorisation which encourages ordinary knowledge reproduction (Olajide & Aladejana, 2016; Olajide 2017). The pedagogy of Basic Science has metamorphosed from just diagrammatic representation of systems to the in-depth understanding of processes and from mere classroom discussion to the relation and relevance of such concepts from day to day activities. Educationists and educational psychologists have painstakingly worked on how science should be taught to bring about the desired results. To this end, scientists assumed that useful learning occurs when students are properly engaged in the process of getting knowledge (Olajide & Aladejana 2016). To achieve this, many innovative teaching methods have been devised to teach Basic Science concepts in our schools. Among these are guided discovery and computer-assisted instructional strategies. These teaching methods ensure a move from teachers- centered classrooms to learners-centered classrooms. In such conditions, the teacher facilitates the students to get knowledge and equip their minds to be explorative and inquisitive so as to enable them to discover new principles and facts to reconstruct knowledge. This is in contrast to the common teachers' expository strategy (Olajide, 2019).

Apart from the teaching strategy, location is another

variable that strongly affects learning. Okeke (2000) explained location as urban and rural areas. Secondary schools in Nigeria are located in urban and rural areas. Several years back people have argued whether school location can influence both students' attitude and their performance. The school is responsible for a couple of things that are pertinent to learning such as learning facilities, environmental factors, social amenities, population and quality of tutors and the class population (Nwana, 2012; Bamidele & Ariyo, 2017; Olajide, 2017). Sufficient provision of or inadequate equipment respectively may foster or hinder learning by students. No two school environments are the same. The difference in school environment is expected to result in differential impact in the acquisition of skills in Basic Science.

The classroom environment is determined by the location of a school which is essential to teaching process. The characteristics of classroom environment can affect learning (Ogunkola, 2008; Nwana, 2012; Aladejana, 2015). They opined that a good learning environment has the following advantages; fostering desirable behaviour and attitude, developing problem solving skills and thus encouraging students' interrelationships and when well-planned and properly arranged can be effective in accommodating learner centered methods like guided discovering method and so on. Unfortunately, schools in the rural areas cannot boast of classroom environment thus described. The result is that students in this area are disadvantaged due to poor staffing, lack of laboratory equipment and other educational materials (Olorode & Abiodun, 2013).

Students do not enter the class blank rather they enter with an elaborate and diverse form of knowledge. They form their own ideas and use it to explain scientific occurrences in their world. These opinions are referred to as native beliefs and misconceptions. Such misconceptions are not usually in consonance with the scientific explanation that are taught in the science classrooms. Some of these misconceptions include the beliefs by students that day and night is as a result of some gases interacting in the atmosphere, others believed that change in season is merely caused by change in the atmosphere and not revolution of the earth, some believed that the earth does not move, it is static, some believed that eclipse occurs when some marine spirits are bathing in the sea. Others believed that the sun is a big ball of fire, the earth is the middle of the solar system about which the other objects revolve, the solar system is the same as our galaxy, everybody experience day and night at the same time, earth is nearer to the sun during summer and distant away during winter, pregnant women must not look at

the eclipse it will affect their foetus, an eclipse occurs as a result of fight between the sun and moon and so on. Therefore, based on this premise, Jiya (2011) stated that alternative conceptions and misconceptions are common among students and these negatively affect subsequent learning of science and are not easily changed. Systematic investigations have shown that learners' understanding of Basic Science concepts showed that students at varying ages have wrong beliefs about science (Aladejana, 2015). Educationists agree that the prevalence of misconception do not only hinder learning but also interfere with further learning (Tekkaya, 2002; Akani, 2017).

Generally, in-depth knowledge and better performance in Basic Science could be hindered by students' misconceptions. According to Aladejana and Ehindero, 1995 as cited in Aladejana 2015 identified the primary sources of students' misconceptions to include textbooks, teachers, language, cultural beliefs and practices and so on. Since, Basic Science at Junior Secondary School experience is a building stage for learning science at senior secondary schools and beyond, students' misconceptions of Basic Science concepts could be derived from religious, cultural and societal related sources (Olorode, & Abiodun, 2013; Akani, 2017). If these misconceptions are not changed, they may remain with students throughout their life.

For students to learn meaningfully and effectively, every iota of misconceptions has to be eradicated. To achieve this, it is necessary to identify the causes of such misconceptions and find means to correct or prevent the re-occurrence. One can infer that for learning to occur, conceptual change becomes inevitable. Conceptual change is defined as the knowledge re-structuring as a result of exposure to new information or learning. In conceptual change, an already known concept is primarily metamorphosed or substituted and makes the conceptual structure which the learners used to find solutions to their problems and become functional in their worlds and to embrace conceptual change is to face the learners with different occurrences which opposes their conception. This is termed conceptual conflict, (Piaget 1979).

However, the poor achievement in science have been largely attributed to tutors' use of ineffective strategies in science teaching and bad disposition to science at the junior secondary schools (Aladejana, 2008; Izezet & Ozkan, 2008; Olajide & Aladejana, 2016; Olajide, 2017). Since information and communication technology is developing at a very high rate, it is necessary to employ computers in education. The

application of technology in education affords students a better learning environment, provides a student-centered learning environment, and assist to increase students' interest and motivation (Aladejana, 2008; Izezet & Ozkan, 2008; Olajide & Aladejana 2016). Discovery learning is a type of constructivist learning in which the learners acquire knowledge personally by constructing testing hypothesis and not by passive listening (Guisti, 2008).

In guided discovery the teacher does not give direct information or principal content to students but they are allowed to discover it themselves by their active participation in learning (Afolabi & Akinbobola, 2010). In reality, discovery learning strategy entails little guidance. However, students are not permitted to do whatever pleases them rather their actions are guided by the teacher.

Another teaching strategy that may enhance conceptual change and retention is computer assisted instructional (CAI). CAI is defined as the kind of instruction that exploit computer software to assist teachers teach information or skills related to a particular topic and students can interact directly with lessons programmed into a computer system (Izezet & Ozkan, 2008; Olajide & Aladejana 2016).

In order to achieve a result-oriented science delivery in schools, Akubuilu (2004) propounded the application of student-centered and activity-based learning methods like guided discovery, computer assisted instruction, demonstration, cooperative learning and so on. Hence, studies in Science Education in Nigeria have continually search for more effective teaching methodologies for Basic Science at the junior secondary school level so as to facilitate a sound academic performance of students (Okebukola & Jegede, 1998; Ojogan & Oganwu 2006; Akani, 2017).

#### Statement of the Problem

Researches have clearly revealed that learners' performance in science subjects has been consistently poor over the years (Aladejana, 2015; Olajide & Aladejana, 2016; Olajide, 2019). This poor level of performance has often been blamed on poor teaching methods employed by the teachers in imparting knowledge to the students at the Junior Secondary School (JSS) level and the alternative conceptions that students bring to the class. Previous studies have shown that innovative methods such as guided discovery and computer-assisted instructional strategies enhance students' achievement in Physical science subjects like Physics, Chemistry and Biology. The extent to which these strategies could assist junior

secondary school students to clarify some mythically wrong concepts (conceptual change), retain the clarification over time and improve their knowledge in Basic Science as a subject in junior secondary schools requires investigation, hence this study.

#### Purpose of the Study

The study aims at determining the effects of guided discovery and computer assisted instructional strategies on Basic Science conceptual change of secondary school students in Osun State. The specific objectives of the study are to;

- i) investigate the effects of guided discovery and computer-assisted instructional strategies on junior secondary school students' Basic Science conceptual change in Osun State;
- ii) examine the effects of the two strategies and teacher expository method on students' retention of the changed concepts overtime in Basic Science; and
- iii) investigate the interaction effects of the two strategies and location on Basic Science conceptual change by junior secondary school students in the study area.

#### Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significant

H<sub>0</sub>1: There is no significant effect of guided discovery and computer assisted instructional strategies on junior secondary school students' Basic Science conceptual change.

H<sub>0</sub>2: There is no significant effect of the two strategies and teacher expository method on students' retention of changed concepts in Basic Science.

H<sub>0</sub>3: There is no significant interaction effect of the two strategies and location on Basic Science conceptual change by junior secondary school students.

#### Methodology

The study employed the pretest-posttest control group quasi-experimental research design. The pretest-posttest quasi experimental research design was used for the study because secondary schools exist in intact classes and randomization of students into groups for experimental purpose was not permitted to prevent disruption of classes. The population of the study comprises all Junior Secondary School two (JSS II) Basic Science students in Osun State. The sample consisted of 180 JSS II students who were randomly selected from two local governments' areas (LGAs) in the state using simple random sampling technique. Three junior secondary schools from each of the selected LGAs were selected using simple random sampling technique in both urban and rural areas.

From each of the selected schools, one intact class of JSS II students was selected using simple random sampling technique and they were randomly assigned to two experimental groups and one control group respectively from each local government. Two instruments were used for data collection. They are: Basic Science Conceptual Test (BSCT) and Basic Science Achievement Test (BSAT). The BSCT consisted of 30-item German questions (fill in the gaps) to serve as pre-test to ascertain the equivalence of ability of the students and determine students' misconceptions in Basic Science. The BSAT also comprised of 30-item multiple choice questions with four options to serve as post-test to investigate the effect of the treatments on learners and also as retention test to know the ability level of the subjects to recall the learned concepts in Basic Science. The test items contained questions on concepts on solar system, rotation and revolution of the earth, eclipse and shadow. Most of the test items were gotten from Junior Secondary School Certificate Examination (JSSCE) conducted by NECO in Nigeria. The topics treated in the subject were used to prepare the table of specification for the items based on Bloom's taxonomy of educational objectives for both BSCT and BSAT so as to determine the validity of the instruments. The two instruments were trial tested in a school outside the scope of the study and the reliability coefficients yielded 0.75 and 0.81 respectively which were considered very high and therefore good for the study. The treatments lasted ten weeks. Data collected were analysed using mean, standard deviation and Analysis of Covariance (ANCOVA). All these were achieved through the use of Statistical Packages for Social Sciences (SPSS).

#### Results

**Hypothesis One:** There is no significant effect of guided discovery and computer assisted instructional strategies on junior secondary school students' Basic Science conceptual change.

In order to test this hypothesis, data collected on students' conceptual change posttest scores having been exposed to guided discovery strategy (GDS), computer assisted instruction (CAI) and teacher expository method (TEM) were subjected to descriptive analysis, analysis of covariance (ANCOVA) and post-hoc analysis were covariate with the pretest scores of the students. The results are presented in Tables 1, 2 and 3 below.

**Table 1: Descriptive Analysis of the Effects of Guided Discovery and Computer Assisted Instructional Strategies on Secondary School Students' Conceptual Change**

S/N	Strategies	N	Mean	Standard Deviation
1.	GDS	50	16.6000	2.77010
2.	CAI	60	17.8667	3.17547
3.	TEM	70	15.4000	1.42849
	<b>Total</b>	<b>180</b>	<b>16.5556</b>	<b>2.70365</b>

The data presented in Table 1 showed the descriptive analysis of the effect of guided discovery and computer assisted instructional strategies on secondary school students' conceptual change in Basic Science in the study area. It can be deduced from the table that students exposed to guided discovery strategy have a mean score of ( $\bar{x}$ =16.6000), those

exposed to computer assisted instruction have a better mean score of ( $\bar{x}$ =17.8667) and those exposed to teacher expository method have a mean score of ( $\bar{x}$ =15.4000) in Basic Science conceptual change of secondary school students in the study area. However, Table 1 does not show the effects of the instructional learning strategies on Basic Science conceptual change of secondary school students.

**Table 2: Analysis of Covariance (ANCOVA) of the Effects of Guided Discovery and Computer Assisted Instructional Strategies on Secondary school Students' Conceptual Change**

Tests of Between-Subjects Effect						
Dependent Variable: Posttest						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	703.782 <sup>a</sup>	3	234.594	68.283	.000	.538
Intercept	1695.779	1	1695.779	493.592	.000	.737
Pretest	507.069	1	507.069	147.593	.001	.456
Strategies	124.011	2	62.005	18.048	.001	.170
Strategies	124.011	2	62.005	18.048	.001	.170
Total	50644.000	180				
Corrected Total	1308.444	179				

The results in Table 2 showed a significant effect of guided discovery and computer assisted instructional strategies on secondary school students' conceptual change in Osun State ( $F=18.048$ ,  $p < 0.05$ ). Therefore, the null hypothesis that states that there is no significant effect of guided discovery and computer assisted instructional strategies on secondary school

students' conceptual change in the study area is hereby rejected. The partial eta squared value of 0.170 accounted for 17.0% of the two learning strategies on secondary school students' conceptual change in the study area. Table 3 showed the post-hoc analysis of the effect of the strategies on secondary school students' conceptual change in the study area.

**Table 3: Post-hoc Analysis of the Instructional Strategies on Secondary School Students' Conceptual Change**

Pairwise Comparisons						
Dependent Variable: Posttest						
(I) Strategies	(J) Strategies	Mean Difference (I-J)	Std. Error	Sig. <sup>b</sup>	95% Confidence Interval for Difference <sup>b</sup>	
					Lower Bound	Upper Bound
GDS	CAI	-.871*	.356	.047	-1.733	-.010
	TEM	1.093*	.343	.005	.263	1.923
CAI	GDS	-.871*	.356	.047	.010	1.733
	TEM	1.964*	.329	.001	1.170	2.759
TEM	GDS	-1.093*	.343	.005	-1.923	-.263
	CAI	-1.964*	.329	.001	-2.759	-1.170

Based on estimated marginal means

\*. The mean difference is significant at the .05 level.  
Adjustment for multiple comparisons: Bonferroni.

Table 3 showed the post-hoc analysis of the effect of the instructional strategies on secondary school students' conceptual change in Basic Science in the study area. It can be observed from the table that students exposed to GDS are significantly different from those exposed to TEM (Mean Difference = 1.093,  $p < 0.05$ ). Likewise, the significant difference of CAI and TEM (Mean Difference = 1.964,  $p < 0.05$ ) of the conceptual change of secondary school students in Basic Science. In addition, there is significance difference between GDS and CAI at (Mean Difference = 0.871,  $p < 0.05$ ) of the conceptual change of the students in Basic Science in the study area

**Hypothesis Two:** There is no significant effect of the two strategies and teacher expository method on students' retention of changed concepts in Basic Science.

In order to test this hypothesis, data collected on students' conceptual change retention scores having been taught with guided discovery strategy (GDS), computer assisted instruction (CAI) and teacher expository method (TEM) were subjected to descriptive analysis, analysis of covariance (ANCOVA) and post-hoc analysis. The results are presented in Tables 4, 5 and 6 respectively.

**Table 4: Descriptive Analysis of the Effects of the Two Learning Strategies and Teacher Expository Method on Secondary School Students' Retention of the Changed Concepts overtimes**

S/N	Strategies	N	Mean	Standard Deviation
1.	GDS	50	22.6400	2.07768
2.	CAI	60	23.4333	2.42422
3.	TEM	70	16.7714	2.83953
	<b>Total</b>	<b>180</b>	<b>20.6222</b>	<b>3.97640</b>

The results in Table 4 showed the descriptive analysis of the effect of guided discovery and computer assisted instructional strategies and teacher expository method on secondary school students' retention in Basic Science conceptual change in the study area. It can be observed from the table that students that were taught with computer assisted instruction with a mean score of ( $\bar{x}$ =23.4333) had better retention ability than

their counterparts taught with guided discovery strategy with a mean score of ( $\bar{x}$ =22.6400) and teacher expository method with a mean score of ( $\bar{x}$ =16.7714). The table does not show the effects of the instructional strategies on retention in Basic Science conceptual change of secondary school students.

**Table 5: Analysis of Covariance (ANCOVA) of the Effects of the Instructional Strategies on Secondary School Students' Retention of the Changed Concepts Overtimes**

Tests of Between-Subjects Effects						
Dependent Variable: Retention						
Source	Types III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1871.877 <sup>b</sup>	3	623.959	114.579	.000	.661
Intercept	852.241	1	852.241	156.499	.000	.471
Posttest	156.163	1	156.163	28.677	.001	.140
Strategies	1176.630	2	588.315	108.034	.001	.551
Error	958.434	176	5.446			
Total	79380.000	180				
Corrected Total	2830.311	179				

R Squared = .661 (Adjusted R Squared = .656)

( $F = 108.034$ ,  $p < 0.05$ )

The results in Table 5 showed that there is significant effect of guided discovery and computer assisted instructional strategies and teacher expository method on secondary school students' retention of the changed concepts in Basic Science in the study area ( $F = 108.034$ ,  $p < 0.05$ ). Thus, the null hypothesis that states that there is no significant effect of the two

strategies and teachers' expository method on secondary school students' retention of the changed concepts in Basic Science in the study area is hereby rejected. The partial eta value of 0.551 accounted for 55.1% effect of the instructional strategies on students' retention in Basic Science conceptual change.

**Table 6: Post-hoc Analysis of the Effects of the Instructional Strategies on Secondary School Students' Retention of the Changed Concepts Overtimes**

		Pairwise Comparisons				
		Dependent Variable: Retention				
(I) Strategies	(J) Strategies	Mean Difference (I-J)	Std. Error	Sig. <sup>b</sup>	95% Confidence Interval for Difference <sup>b</sup>	
					Lower Bound	Upper Bound
GDS	CAI	-.319	.456	.001	-1.420	.783
	TEM	5.419*	.440	.000	4.355	6.483
CAI	GDS	.319	.456	.001	-.783	1.420
	TEM	5.737*	.445	.000	-4.661	6.814
TEM	GDS	-5.419*	.440	.001	-6.483	-4.355
	CAI	-5.737*	.445	.001	-.6814	-4.661

Based on estimated marginal means  
 \*. The mean difference is significant at the .05 level.  
 Adjustment for multiple comparisons: Bonferroni.

Table 6 showed the post-hoc analysis of the effect of the instructional strategies on secondary school students' retention of the changed concepts in Basic Science in the study area. It can be deduced from the table that retention ability of students exposed to GDS are significantly different from those exposed to TEM (Mean Difference = 5.419,  $p < 0.05$ ). Also, the significant difference in the retention of the students exposed to CAI and TEM (Mean Difference = 5.737,  $p < 0.05$ ) in Basic Science. Although participants in the other groups also show some differences in the retention of the conceptual change in Basic Science however, the differences were not significant. This is applicable to students that were exposed to GDS AND CAI at (Mean Difference = 0.319,  $p > 0.05$ ) in the study area.

**Table 7: Descriptive Analysis of the Effect of the Two Strategies and Location on Conceptual Change of Secondary School Students**

Descriptive Statistics				
Dependent Variable: Posttest				
Strategies	Location	Mean	Std. Deviation	N
Guide Discovery Strategy	Rural Area	16.6000	2.77010	30
	Urban Area	17.8667	3.17547	30
	Total	17.8667	3.17547	60
Computer Assisted Instruction	Rural Area	14.7500	.44721	35
	Urban Area	15.5926	1.56034	35
	Total	15.4000	1.42849	70
Teacher Expository Method	Rural Area	16.0769	2.27136	25
	Urban Area	17.2105	3.09975	25
	Total	16.6000	2.77010	50
	<b>Total</b>	<b>16.5556</b>	<b>2.70365</b>	<b>180</b>

The data presented in Table 7 showed the descriptive analysis of the effect of guided discovery, computer assisted instructional strategies and location on conceptual change of secondary school students in the study area. From the table, it can be drawn out that students in urban area with a mean score of ( $\bar{x}=17.8667$ ) were better off their counterparts in rural area with a mean score of ( $\bar{x}=16.6000$ ) having been exposed to guided discovery strategy. Also, students in urban area with a mean score of ( $\bar{x}=15.5926$ ) were better off their counterparts in rural area with a mean

score of ( $\bar{x}=14.7500$ ) having been exposed to computer assisted instruction. In the same vein, students in urban area with a mean score of ( $\bar{x}=17.2105$ ) were better off their colleagues in rural area with a mean score of ( $\bar{x}=16.6000$ ) having been taught with teacher expository method in Basic Science conceptual change in the study area. But the table does not indicate the effects of the instructional strategies and location on students' conceptual change in Basic Science.

**Table 8: Analysis of Covariance (ANCOVA) of the Effect of the Two Strategies and Location on Conceptual Change of Secondary School Students**

Tests of Between-Subjects Effects						
Dependent Variable: Posttest						
Source	Types III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	205.474a	3	68.491	10.929	.000	.157
Intercept	35690.474	1	35690.474	5695.097	.000	.970
Strategies * Location	205.474	3	68.491	10.929	.001	.157
Error	1102.970	176	6.267			
Total	50644.000	180				
Corrected Total	1308.444	179				

R Squared = .157 (Adjusted R Squared = .143)

( $F = 10.929, p < 0.05$ )

The results in Table 8 showed a significant effect of the two strategies and location on conceptual change of secondary school students ( $F = 10.929, p < 0.05$ ). Hence, the null hypothesis that states that there is no significant effect of the two strategies and location on conceptual change of secondary school students in the study area is hereby rejected. The partial eta squared value of 0.157 accounted for 15.70% of effect size of guided discovery and computer assisted instructional strategies and location on conceptual change of secondary school students in the study area.

### Conclusion

The study has found out that the use of guided discovery and computer- assisted instructional strategies for instructing Basic Science concepts enhances students' achievement significantly better than teacher expository method, It was also found that students have higher preference for the use of guided discovery and computer-assisted instructional strategies than the teacher expository method of teaching the subject and that the two strategies significantly improved students' achievement, retention ability and improved students' science conceptual change than the teacher expository method.

### Recommendations

Owing to the discoveries of the research, the following recommendations were made:

- (1) There is need for tutors to adopt guided discovery and computer- assisted teaching strategies as part of the teaching methods at grassroots since they are discovered to be efficient for fostering students' achievements in Basic Science.
- (2) Workshops must be done for science teachers on the application of appropriate teaching strategies.
- (3) The teacher training institutions should include the use of guided discovery and computer-assisted teaching methodologies in their science method course content to ensure the training of pre-service science teachers.
- (4) Authors of Basic Sciences textbooks should include guided discovery and computer-assisted instructional strategies in their textbooks for easy access for students and teachers.
- (5) The curriculum planners should include guided discovery and computer- assisted teaching strategies in junior secondary Basic Science scheme for teachers and students.

## References

- Afolabi, F. & Akinbobola A. O (2010): Constructivist problem-based learning technique and the achievement of physics students with low academic level in Nigerian secondary schools. *Eurasium Journal on Physics and Chemistry Education 1* (1), 45-51.
- Akani, O. (2017). Effect of guided discovery method of instruction and students' achievement in chemistry at the secondary school level in Nigeria. *International Journal of Scientific Research and Education*, 5(2), 626-634.
- Akinbayo, T. O., Olajide, S. O. & Aladejana, F. O. (2019) Effects of Mind Mapping and Concept Mapping Instructional Strategies on Students' Learning Outcomes in Basic Science in Junior Secondary Schools in Ile-Ife. *Ife Journal of Educational Studies*. 17(1).
- Akinbobola & Ado (2007): Constructivist Practices Through Guided Discovery Approach: The Effects on Students' Cognitive Achievements in Nigerian Senior Secondary School Physics. [www.researchgate.com](http://www.researchgate.com)
- Akubuilu (2004). The Effects of Problems Solving Instructional Strategies on Students' learning outcomes. *Mediterranean Journal of Social Sciences*. Vol 6(5).
- Aladejana, F. O. (2006). Teacher education roles, curriculum and competence, In Ehindero O. J. and Aladejana, F. O (eds) Introduction to Teaching Profession, Institute of Education Publication, Literamed Publication Nigeria Limited
- Aladejana, F. O. (2008). Blended learning and improved science teaching in Nigerian Primary schools. Conference Proceedings, 3<sup>rd</sup> *International Conferences on ICT Development, Education and Training Accra, Ghana, eLearning Africa, Berlin Germany, ICWE, GmBH*, p225-258
- Aladejana, F. O. (2000). An assessment of the science classroom learning environment. *Ife Journal of Behavioural Research* 1(2), 82-88
- Aladejana, F. O. (2015), Teaching and Learning of Science; Imperatives of Specialized Pedagogy in a Changing world. *274th Inaugural lecture series of Obafemi Awolowo University, Ile-Ife. Obafemi Awolowo University, Ile-Ife University press*.
- Aladejana, F. O. (2015), The Teaching learning of Science: Imperatives of Specialized Pedagogy in inaugural lecture 274
- Aremu, A. S. & Salami, O. (2012). Towards the wholistic development of Children in Oyo State. *Journal of Emerging Trends in Educational Research and Policy Studies. Scholar links Research Institute Journal*
- Bamidele, E. F & Ariyo O. S. (2017). Relative Effectiveness of Guided discovery and Demonstration Teaching techniques in on students' performance in senior secondary schools in Ile-Ife, Nigeria, *academia*, 3, 9.
- Bamidele, E. F Adetunji A. B. & Alrinloye J. (2013). Attitude of Nigerian Secondary School *Common Misconceptions* about Day and Night. Beyond penguins.ehe.osu.edu
- Ezendu, F. O. & Obi T. N (2013). Effects of Gender and Location on Students' Achievement in Chemistry in Secondary Schools in Nssuka Local Government, Area Of Enugu State, Nigeria. *Research in Humanities and Social Sciences*. Vol 3(15)
- Guisti, G. (2008): Integrated Method as a Strategy for Teaching Integrated Science (Basic Science) in Junior Secondary School in Zamfara State Nigeria. ZAJES.
- Izezet K. & Ozkan, K. (2008): The effects of Computer Assisted Instruction on the Achievement of Students on the Instruction of Physics Topics of 7<sup>th</sup> Grade Science Course. *Journal of Applied Science* 8(6) 1067-1072, 2008.
- Jiya, A. (2011). Effects of Teaching-with-Analogy on Academic Performance and Retention of Evolution Concepts among Nigeria Certificate in Education Biology Students. A Published Thesis submitted to the Postgraduate School, Ahmadu Bello University Zaria Learning for Teacher Education. In A. O'Donnell and A. King (Eds.),
- Nigeria Integrated Science Project 2000 cited in Oludipe & Sanial Idowu 2011: Developing Nigeria Integrated Science Curriculum. *Journal of Soil Science and Environmental Curriculum* 2(8) pp 134-145.
- Nwafor, C. E. & Oka, O. (2016): Effects of Computer Assisted Instruction On Junior Secondary School Students' Achievement In Basic Science: *International Journal of Scientific & Engineering Research*, Volume 7, Issue 10, October-2016 1940 ISSN 2229-5518 IJSER © 2016 <http://www.ijser.org>
- Nwana, S. (2012): Challenges in the Application of E-Learning by Secondary School Teachers in Anambra State, Nigeria. Article. DOI:10.21083/ajote.v2i11913
- Ogunkola, B. J. (2008). Parental Involvement Interest In Schooling And Science Achievement Of Junior Students in Basic Science in Junior Secondary Schools in Osun State. *International Journal of Trend in Scientific Research and Development (IJTSRD)*. 1 (6) 244-249.
- Olajide, S. O. & Aladejana, F. O. (2019) Comparative Effectiveness of Three Active Learning Strategies in Transforming Learners' Outcomes in Basic Science for Social Change in Osun State. *IOSR Journal of Humanities and Social Science*. 24(8). 36-41.
- Olajide, S. O. (2019) Effects of Field Trip and Peer Tutoring Instructional Strategies on Students' Science Process Skills Acquisition in Basic Science and Technology in Junior Secondary Schools in Osun State. *Journal of Education, Society and Behavioural Science*. 32(4). 1-12.
- Olorode, J. & Abiodun, G. (2013) Effectiveness of Guided Discovery Learning Strategy and Gender Sensitivity on Students' Academic Achievement in Financial Accounting in