Effects of Competitive, Cooperative and Individualistic Classroom Interaction Strategies on Learning Outcomes in Basic Science

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Abstract
this study investigated the effects of competitive, cooperative and individualistic classroom interaction strategies on learning outcomes in Basic Science. The sample for the study was drawn from JSS III Basic Science students from public Junior Secondary Schools in Abuja, Nigeria. Four schools were randomly selected from the area of study as a sample for the study. Treatment conditions were assigned to the sampled intact classes at random. The total sample of 161 students was used for the study. Two research questions guided the study, and Two hypotheses were tested at 0.05 alpha level. Basic Science Student Achievement Test (BASSAT) was developed as an instrument for data collection. Split-half method of reliability was used to obtain a reliability coefficient of 0.84. Mean and Standard Deviation was used to answer the research questions while the hypotheses were tested using Analysis of Variance (ANOVA) and Analysis of Covariance (ANCOVA). Tukey HSD post- hoc test was used to determine the direction of the differences. The findings of the study revealed that significant differences were found in the achievement of students exposed to competitive, cooperative and individualistic classroom interaction strategies than the conventional teaching strategy. Gender was found to be a significant factor affecting the achievement of Basic Science students exposed to competitive, cooperative and individualistic classroom interaction strategies and the conventional teaching strategy
Keyword: *Achievement, Cooperative, Competitive, Individualistic and Instructional Strategies.*

INTRODUCTION

Basic Science is the first form of science a student encounters at the secondary school level, and it prepares them at the Junior Secondary school level for the study of core science subjects at the Senior Secondary school level (Bukunola & Odowu, 2012). This implies that for a student to study single science subjects at the Senior Secondary school level successfully, such a student must be well grounded in Basic Science at the Junior Secondary school level (Samuel, 2017). The paramount reasons for infusing Basic Science formerly known as Integrated Science as a teaching subject in Nigeria Secondary Schools according to the Federal Republic Nigeria of (2014) are as follows:

- It provides students at the junior secondary school level a sound basis for continuing science education either in single science subjects or further Integrated Science;
- It enhances the scientific literacy of the citizenry;
- It allows students to understand their environment in its totality rather than in fragments.
- It allows the students to have a general view of the world of science.
- The process of science serves as a unifying factor for the various science subjects. It is necessary for the learner to know these processes through an integrated approach to learning science.

Studies in Basic Science teaching and learning have reported that many students at the Junior Secondary school level have developed negative attitudes towards the subject. Many of the students at this level, because of their dismal achievement in the subject, are not benefiting much from the Basic Science curriculum (Bukunola & Idowu, 2012, Osokoya, 2013 & Oni, 2014). This according to the researchers, has prevented many of the students from taking core science subjects or achieving better in the core science subjects at the Senior Secondary school level. The Nigerian Government's efforts towards making sure that Nigerian children show interest in science and science-oriented programmes include the 60:40 ratio admission policies in favor of the science-oriented programmes have not yielded many results. This is because many of the students after graduation from the Junior Secondary School level show less interest in studying core science subjects (physics, chemistry, and biology) at the Senior Secondary school level, this has therefore affected their choice of science-

oriented programmes at the nation's tertiary institutions level. The problem according to many observers stems from the conventional-lecture method being used by the Basic Science teachers at the J.S.S level (Bukunola & Idowu, 2012, Osokoya, 2013 & Samuel, 2017). The persistent underachievement of Basic Science necessitates the need to explore other strategies that could enhance students' achievement in the subject.

Different teaching techniques have been adopted by pedagogues in order to shore up students' achievement in Science ranging from some teacher-centered techniques to other learner-centered methods. In this part of the world, the commonest type of teaching technique seems to be the teacher-center whole-classroom teaching referred to in this study as the conventional teaching strategy (CTS). This technique requires that the learners sit and listen to the teacher as he/she presents the content of the day's lesson, with students asking few questions when necessary and supplying responses when asked to do so by the teacher.

The competitive classroom is a more traditional form of learning. Students study alone and complete their own assignments while trying to learn the presented subject matter. Tests and quizzes measure each student's progress, and letter grades or percentages are given for both assignments and tests. In this type of setting, students may become competitive with each other for the best grades and for recognition.

Pros of a competitive classroom structure include:

- Children face the real-world challenge of competition.
- Students are encouraged to do their very best.
- Independent thinking and effort are encouraged and rewarded.
- Children can still work in teams, but compete against other teams—it can be a great way to enliven the classroom environment (Johnson & Johnson, 1991; Griffiths & Podirsky, 2002).

Competitive interaction strategy as used in this study is where students work in groups. Members of each subgroup work strictly on his/her own, strive to be the best in the subgroup for price or reward.

Johnson & Johnson (1991) describe cooperative instructional strategy as an instructional strategy where students of different levels of ability are grouped into small ties to improve their understanding of a subject. Each member of a team is responsible not only for comprehending what is being taught but also for helping teammates learn, thus creating an atmosphere for improved achievement. Students work through the assignment until all group members successfully understand and complete it. Teachers can use this approach to stimulate students to acquire the knowledge, as well as create interpersonal and team skills. Some authors have identified cooperative learning as an edge over other teaching methods in terms of its effectiveness for improved cognition, social skills and motivation (Ajaja & Eravwoke, 2010; Anowar & Rohanni, 2012; Bukunola & Idowu, 2012; Gull & Shehzad, 2015; Kabuttu, Oloyede & Bandele, 2015 and Gambari & Yusuf, 2017; Eriba & Samuel, 2018; Agu & Samuel, 2018).

The individualistic strategy is an instructional strategy in which an individual student works alone based on the student's ability to use a variety of instructional activities to improve each student's understanding. This strategy requires each individual to present solutions to the problem given in classroom situations without the cooperation or assistance of other classmates. In this approach, the achievement of each student is unrelated to others; there is no concern about competing for grades since there is an individualistic goal structure and student's goal achievement is independent. In this way, the individualistic instruction is like direct instruction, which also places greater reliance upon carefully prepared instructional materials and explicitly prepared instructional sequences ((Johnson & Johnson, 1991; Griffiths & Podirsky, 2002).

Gender remains an important factor to be considered in the determination of the effects of cooperative and individualistic instructional strategies on the academic achievement of students. Gender has been identified as a major factor that affects students' achievement in Basic Science and Technology examinations and higher Science and Technology as fields of academic endeavor. Omiko (2017) and Oni (2014) posited that in Nigeria, women are marginalized while men are given greater opportunities to advance based on their science background. In the Nigerian setting, this factor has been found to offer males an unfair advantage over their

female counterparts. Alabi 2014 reported that women are hindered from progressing through discrimination on the basis of gender, early marriage, and childbearing and as a result, they are deprived of sound education, job opportunities and in some cases, incapacitated and rendered passive in the society.

This study examined the classroom interaction strategies with a view to finding their relative efficiency and effectiveness in improving students' achievement in Basic Science. It sought to determine which of the interaction strategies would improve the achievement of Basic Science students.

Research Questions

The study was guided by the following research questions:

1. What are the mean achievement scores of Basic Science students exposed to Competitive, Cooperative, Individualistic Interaction Strategies and those taught with Conventional Teaching strategy?
2. What is the difference between the mean achievement scores of male and female Basic Science students exposed to Competitive, Cooperative, Individualistic Interaction Strategies and those taught with Conventional Teaching strategy?

Hypotheses

The following hypotheses were tested at 0.05 level of significance;

1. There is no significant difference in the mean achievement scores of Basic Science students exposed to Competitive, Cooperative, Individualistic Interaction Strategies and those taught with Conventional Teaching strategy.
2. There is no significant difference in the mean achievement scores of male and female Basic Science students exposed to Competitive, Cooperative, Individualistic Interaction Strategies and those taught with Conventional Teaching strategy.

Methodology

A quasi-experimental pretest-posttest design was employed for the study. The design included four interaction groups; experiential groups – Competitive, Cooperative, Individualistic Interaction Strategies and the Conventional Teaching Strategy (control group). The sample for the study was drawn from JSS III Basic Science students from public Junior Secondary Schools in Abuja, Nigeria. Four schools were randomly selected from the area of study as a sample for the study. Treatment conditions were assigned to the sampled intact classes at random. The total sample of 161 participants was used for the study. The regular Basic Science teachers were used as research assistants. They were trained on how to utilize the strategies by using lesson plans prepared by the researcher. The pretest was administered before the commencement of the treatment. Four lessons of 80 minutes were taught for four weeks.

Basic Science Student Achievement Test (BASSAT) was developed as an instrument for data collection. BASSAT had 30 multiple choice items with option A-E developed by the researcher from selected topics-Work, Energy, and Power. BASSAT was validated by three experts in the Science, Technology, and Mathematics Education Department, Nasarawa State University, Keffi. Item analysis of BASSAT gave average difficulty and discrimination indices of 0.59 and 0.68, respectively. Split-half method of reliability was used to obtain a reliability coefficient of 0.84. Mean and Standard Deviation was used to answer the research questions, and Analysis of Covariance was used to test the research hypotheses at 0.05 level of significance. Tukey HSD post-hoc test was used to determine the direction of the different treatment conditions.

Results

Research Question One

What are the mean achievement scores of Basic Science students exposed to Competitive, Cooperative, Individualistic Interaction Strategies and those taught with Conventional Teaching strategy?

The data that were used to answer the research question one is presented in Table 1.

Table 1
Means Scores and Standard Deviation of the Achievement of Basic Science students Exposed to Competitive, Cooperative, Individualistic Interaction Strategies and those taught with Conventional Teaching Strategy

Interaction Strategy	Type of test	No of students	Mean	SD	Mean gain
Competitive	Pre-test	40	24.01	0.77	
	Post-test	40	49.41	1.11	25.40
Cooperative	Pre-test	35	28.22	0.90	
	Post-test	35	55.04	1.25	26.82
Individualistic	Pre-test	36	26.43	0.86	
	Pre-test	36	43.75	1.10	17.32
Conventional	Pre-test	50	21.15	0.65	
	Pre-test	50	37.54	0.97	16.39

The result in Table 1 shows the mean scores and standard deviations in the achievements of Basic Science students exposed to Competitive, Cooperative, Individualistic Interaction Strategies and the Conventional Teaching strategy. It is observed that the students achieved better under Competitive Interaction Strategy, Cooperative Interaction Strategy compared to those exposed to Individualistic Interaction Strategy and Conventional Teaching Strategy as indicated by the magnitude of their mean gains.

Research Question Two

What is the difference between the mean achievement scores of male and female Basic Science students exposed to Competitive, Cooperative, Individualistic Interaction Strategies and those taught with Conventional Teaching strategy?

The data that were used to answer research question two is presented in Table 2

Table 2

Means Scores and Standard Deviation of the Achievement of Male and Female Basic Science students exposed to Competitive, Cooperative, Individualistic Interaction Strategies and those taught with Conventional Teaching Strategy

Interaction Strategy	Gender	Mean	Std. Deviation	No. of Students
Competitive	Male	61.92	1.85	18
	Female	59.95	1.70	21
Cooperative	Male	51.70	1.86	15
	Female	47.70	1.55	20
Individualistic	Male	48.63	1.74	16
	Female	43.51	1.48	20
Conventional	Male	40.57	1.38	21
	Female	34.97	1.10	29

The result in Table 2 shows that the male Basic Science students exposed to Competitive, Cooperative, Individualistic Interaction Strategies and the Conventional Teaching strategy achieved higher than their female counterparts.

Hypothesis One

There is no significant difference in the mean achievement scores of Basic Science students exposed to Competitive, Cooperative, Individualistic Interaction Strategies and those taught with Conventional Teaching strategy.

The data to test this hypothesis are presented in Table 3.

Table 3

The result of Analysis of Variance (ANOVA) of Students' Mean Achievement Scores Exposed To Competitive, Cooperative, Individualistic Interaction Strategies and those taught with Conventional Teaching strategy

Source	Sum of Squares	Mean Squares	Df	F	Sig
Between group	165.725	298.860	3	52.141	0.002
Within group	254.078	101.248	160		
Total	202.413				

Table 3 shows a significant difference among the learning strategies with an F= ratio of 52.141, P<0.05. The null hypothesis was therefore rejected. The difference in the mean achievement Scores of Basic Science exposed to Competitive, Cooperative, and Individualistic Interaction Strategies And the Conventional Teaching strategy was observed using a post-hoc (A Tukey HSD Test) Comparison as presented in Table 4.

Table 4

A Tukey HSD post-hoc Comparison of the Mean Achievement Scores of Basic Science Exposed to Competitive, Cooperative, Individualistic Interaction Strategies

I (Performance)	J (Performance)	Mean difference scoring (I-J)	Std. error	Sig.
	Cooperative	28.806	1.324	.000
Competitive	Individualistic	49.708	1.963	.000
	Conventional	51.061	1.681	.000
	Competitive	-28-806	1.324	.000
Cooperative	Individualistic	24.107	1.758	.000
	Conventional	29.901	1.726	.000
	Competitive	-49.708	1.963	.000
Individualistic	Cooperative	-25.107	1.758	.000
	Conventional	25.604	1.770	.000
Conventional	Competitive	-51.061	1.765	.000
	Cooperative	-29.901	1.680	.000
	Individualistic	-25.107	1.694	.000

The Tukey HSD test in Table 4 indicates that the difference in the mean achievement scores of Basic Science exposed to Competitive, Cooperative, Interaction Strategies were significantly better than that of the individualistic Interaction Strategy at P.000. Hence, the null hypothesis was rejected.

Hypothesis Two

There is no significant difference in the mean achievement scores of male and female Basic Science students exposed to Competitive, Cooperative, Individualistic Interaction Strategies and those taught with Conventional Teaching strategy.

Table 5

The result of Analysis of Covariance on Students' Achievement Scores According to Treatment using BASSAT

Source	Type III sum of squares	Df	Mean square	F	Sig	Result
Corrected model	8592.971	3	4175.120	100.121	0.00	S
Intercept	9551.112	1	1176.006	31.417	0.00	S
Pretest	5613.089	1	7063.115	108.321	0.00	S
Gender	5972.780	1	3517.227	65.631	0.00	S
Error	9316.033	155	99.057			
Total	39045.985	161				

The result in Table 5 shows that the F-ratio of 65.631 and P=0.000< 0.05 level of significance. This means that there was a significant difference in the mean academic achievement of Basic Science students exposed to Competitive, Cooperative and Individualistic Interaction Strategies achieved better than the Conventional Teaching strategy.

Discussion

The findings of the study indicated a significant difference in the achievement of students among the interaction strategies. Those in the Cooperative Interaction Strategy gave a higher achievement followed by the Competitive and the Individualistic groups. Students in the Individualistic group achieved less than the other experimental groups. It could be stated that although this method is good, it is not well suited for students' achievement in Basic Science. Cooperative Interaction Strategy group's significance could be due to the interactiveness, friendliness, and teamwork provided for the students. The Competitive Strategy, when compared to the Individualistic and Conventional Interaction Strategies, yielded a better achievement among the students. This reason may be due to rewards attached which might have motivated the students to achieve better than their counterparts in Individualistic and Conventional Interaction Strategies. It could be inferred from these findings that the Cooperative Interaction Strategy has the tendency of enhancing Basic Science students' achievement more than the conventional method. This finding is in conformity with the findings of Bukunola and Idowu (2012); Kabuttu, Oloyede and Bandele (2015), Gambari and Yusuf (2017) Eriba and Samuel (2018), and Agu and Samuel (2018) where they discovered that cooperative learning strategies enhance students' achievement and retention in Science related subjects.

The study also revealed that gender did significantly influence the achievement of Basic Science and students exposed to Competitive, Cooperative, Individualistic Interaction Strategies and the Conventional Teaching Strategy. This finding disagrees with that of Omiko (2017); Oni (2014) and Alabi (2014) who reported that gender is not a factor that determines the achievement of students in Basic Science and Technology. But agrees with the findings of (Eriba & Samuel, 2018; Agu & Samuel, 2018) who found out that gender is a significant factor affecting the achievement of Basic Science students probably because there is no equality in the learning opportunities.

Conclusion

From the findings of this study, the Cooperative Interaction Strategy was found to be most effective in enhancing achievement of Basic Science students.

Recommendations

Based on the findings of this study, the following recommendations were made;

1. In order to solve the problem of underachievement of Basic Science students at both internal and external examinations, Cooperative Instructional Strategy should be included as a method of teaching and learn Basic Science.

2. Regular workshops, seminars, and symposia should be organized from time to time by experts for Basic Science teachers in Junior Secondary schools in order to expose them to Cooperative Instructional Strategies which would aid in the knowledge transfer and stimulate students to relate classroom knowledge to real life situation.

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