

## EFFECT OF GROUP INSTRUCTIONAL STRATEGY ON STUDENTS' PERFORMANCE IN SELECTED PHYSICS CONCEPTS

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### Abstract

*The study investigated the outcomes of using group instructional strategy on learning of Physics in senior secondary schools in Nigeria and also determined whether group instructional strategy will improve the performance of below average ability students. By the use of purposive sampling, 365 senior secondary school year one Physics students were selected from a school of science, in Ile-Ife, Osun State, Nigeria for the study. The study design was pre-post-test control experimental. A validated Physics achievement test consisting of ten theory items was used for data collection, and the data collected were analyzed using t-test. The study revealed that those exposed to group instructional strategy performed better than those exposed to individual learning treatment; the below-average students exposed to group instruction have gain score over what they scored when not exposed to this method, which shows that there was improvement in their performance hence, more understanding of the Physics concept. Also, there is a significant difference in the collective work done by students exposed to group instruction and their performance individually revealing that the students gained better when they worked assignments together than when it is done individually. Furthermore, the individual who submitted class work in the group learning treatment did better than their counterparts in the individual learning treatment.*

**Key words:** Group learning treatment, individual learning treatment, small group, instruction, Physics.

### Introduction

Science programme or teaching in the secondary (middle school) is now characterized by learning modules which makes learning procedure in science especially Physics to be more complicated and difficult for learners to grasp. If before now, poor performance has been recorded in science (Physics) subjects in the external examination

**Table 1: WAEC SSCE Results in Physics for Osun State in Nigeria**

Year	No of students that wrote examination	No of students that passed at credit level
2005	15970	5047 (31.60%)
2006	15947	6705 (39.57%)
2007	17308	4865 (28.10%)
2008	18239	5761 (31.58%)

Source: West Africa Examination Council (WAEC)

The worse may still be expected with the current learning modules. To avert this, the mode of dissemination of Physics to the students need to be looked into so as to help the learners. More often than not, the role of Physics in human day to day living surpasses what can be handled with levity. If the students perception of the science classroom as a place where authority delivers facts that are important for examinations but irrelevant to life outside

school, then the students will learn certain things and reject others. However, if they are made to see science as a means of enriching personal life and improving national economy through making the surroundings more interesting and comprehensible, then there must be a change in the way science is taught in schools and this will also require a change in the teachers' perception of the context and method in which they teach.

Cooperation is a life skill; nearly every job or social relationship involves cooperating with another individual to accomplish a shared goal. In cooperative learning, students are organized into groups. Each group is given a goal and the achievement of that goal often requires that group members support each other. Cooperative learning tends to be student (group) centered, whereas individual and competitive learning tend to be teacher-centered. In a cooperative learning environment, students help each other learn the subject matter, but they also learn how to be a contributing member of the group. There is more to cooperative learning than just having students work in groups. Cooperative learning strategies differ based on: group size and logistics, task specialization, inter-group competition, group rewards, method of student evaluation, and appropriateness to a given learning objective or situation.

Science (Physics) teachers have a unique opportunity to use cooperative learning strategies. Learning modules, which are beginning to dominate middle school science programs, are well suited to cooperative rather than individualistic learning. Problem solving and design can likewise be very effective if students work together toward a common goal, building on each other's ideas, expertise, and efforts. Certain tasks are just too large for a single individual and absolutely require cooperative efforts. As the Physics laboratory becomes a place for integration of learning with other science subjects, it is reasonable to use cooperative learning strategies that make use of a variety of students/experts in other science subjects.

Everyone learns individually. Our interests and genetic make-up determine what we can learn and how well we may learn. They also determine how well we can apply what has been learned. Some people excel at analytical tasks, such as determining how many gallons of paint it will take to cover the interior walls of a room, while others are more concrete in nature and can paint the rooms very efficiently. Not everyone has the innate abilities to perform these tasks easily. Consequently, all methods of instruction do not align with the learning capabilities of each individual learner.

Accepting that people learn individually is an important step toward improving instruction. Either we must devote time to each learner individually or rely on other means to assist each learner to progress. Individualized instruction requires more human resources than are available to schools, consequently, many teachers rely on large group instruction. Most students are capable of learning in large groups, but each may experience problems with particular methods of presentation, e.g., individual readings, questions and answers, experiments or projects.

However, in many work and social activities, teams of individuals must pull together to get tasks accomplished. Working together means cooperation. It also means taking the talents of individuals and pooling these together to get the job done. This is the basis for the theory behind cooperative learning. Cooperative learning is a teaching strategy where teams of two or more work together on learning tasks (James & John, 1994). This could include small group working together on a specific problem to get it solved, while the entire class (large

group) may be asked to prepare a write up on a general or just introduced problem. Each member of the team brings special talents to the group, i.e., concrete or analytical abilities or others. Also other team members cooperate on the achievement of the tasks and learn from each other. Thus, students learn both academic and social skills from a cooperative learning environment.

Science education in Nigeria has undergone many reforms. In recent years, a number of studies have investigated the teaching of Science subjects among which Physics is a core science subject. (Tobin & Gallagher, 1987) have investigated teachers' beliefs and epistemological commitments, and the effect of these beliefs on teaching of science and classroom management. There are different methods adopted by an individual in the teaching of science. In some, the teacher does all the talking and tends to disseminate the message that science is a bundle of facts, a collection of right answers determined by authority. A different method presents science as a set of opinions constructed from and supported by personal observations.

Johnson, Johnson and Smith (1998) worked on the effect of cooperative, competitive and individualistic efforts on student achievement and productivity and found that students in cooperative learning settings performed better than students in either competitive or individualistic settings. They also noted that cooperative learning resulted in more high-level reasoning, more frequent generation of new ideas and solutions. Interaction in a cooperative learning group also brings high self-esteem, more communication and better understanding. From the cognitive perspective, small-group instruction allows students to cognitively rehearse and relate course material into existing schema or conceptual frameworks, thus producing a deeper, contextualized level of understanding of content (Kurfiss, 1988). This can better be achieved when learners had been guided to adhere to cooperative learning principles so that the academic and interpersonal problems associated with groupwork in traditional course can be averted (Millis, 2000; Felder & Brent, 2001).

Students' understanding of Physics and the learning strategies that are consequently employed evolve throughout their school time. The way Physics is presented over the years of schooling is likely to affect students' understanding of the subject and consequently how they relate to science. The actual content and the types of competencies sought for within Physics as a science subject contribute to students' perceptions of Physics as well as in achievement, competence, sense of efficacy and learning strategies towards Physics (Stodolsky, Salk & Glaessner, 1991). What makes Physics learning truly meaningful? Okebukola (1990) stressed that meaningful learning can take place when a person consciously and explicitly links new knowledge to relevant concepts or propositions they already possessed. Thus, the Physics learning experiences provided by the teachers are very important. The way Physics is presented to students will inevitably affect its understanding by students and consequently how they relate to science in general.

To improve the quality of life, scientific education must generate curiosity, creativity, competence, compassion and conservation that really spring from a sense of compassion for the earth and all the living things on it. This is a worthy goal for science and technology. There is also the need for the development of instructional methods and materials that can be integrated into the existing science and technology (in which Physics is a core subject) activities both in and out of the classroom.

## Objectives of the Study

It is not enough for science teachers to know the subject matter they teach but it is also very important to know the techniques and methods to use to attain maximum learning among students. It is crucial for teachers to use the best effective teaching method, which could help to enhance academic achievement of students. The objective of this study was to improve the learning of Physics by enriching the teaching of the subject in the senior secondary schools through group instructional strategy. This study is therefore designed to:

- determine the outcomes of using group instructional method on learning of physics in senior secondary schools in Nigeria.
- assess the effect of group instructional strategy on the performance of below average ability students in learning Physics.
- investigate whether or not the report submitted could be a source of motivation to better performances of students
- investigate if working assignments together will improve the better understanding of students than when it is done by individual.

## Methodology

Subjects were 365 Senior Secondary School year one Physics students purposively sampled from Oluorogbo School of science, Ile-Ife, Osun State, consisting of boys and girls of average age 15 years. The subjects used for the group instruction are 60 students (with six students in a group) and those used for the whole class consist of 305 students (with average of 55 students in a class). Students with higher cumulative test scores and lower cumulative test scores were used to determine the effect of the group instructional method on both above average and below average learners. The cumulative test scores used were the result from their first term of the session. The study design is pre-post-test control experimental.

## Procedure

After administering the pre-test to all the students in the first week, the researcher through the help of the school principal introduced the new arrangement in the physics class. Members of each group were selected based on the outcome of the pre-test, from which above average students (those who scored above the median value) and below average students (those who scored below the median value) were chosen in ratio 2:4 as member of the small group. The students were instructed on how they are to work after which the researcher taught the control group using the traditional teaching method while the experimental group was taught using the small group method for five weeks. Assignments were given to each group to be done separately and another one to be done collectively. On the last day of the sixth week, the post-test was administered to test students' achievement and the scripts were marked and graded by the researcher.

## Results

For the test of homogeneity, the pre-test scores in the Physics achievement test of the students in the two groups were statistically analyzed and presented in tables 2 below.

**Table 2: Analysis of t-test of Pre-test scores of students in the Group Learning Treatment (GLT) and Individual Learning Treatment (ILT)**

Treatment level	Number of students (n)	Sum of their scores ( $\sum X$ )	Mean scores ( $\bar{X}$ )	Standard Deviation	Calculate d t-value ( $t_c$ )
GLT	60	1715	28.58	16.93	1.69
ILT	305	7530	24.69	12.82	df= 363

The t-test was computed for the pre-test scores to verify if there is any significant difference in the means of the two groups before being used. The result from the t-test showed that at  $P=0.05$  and  $df= 363$ ,  $t_c = 1.69$  is lesser than  $t_t = 1.96$  which means that there was no significant difference in the background knowledge of the students used for this study.

The post-test scores of the achievement test of the group and the individual classes were compared. Here, the GLT was instructed in small group while the ILT (control group) was instructed in whole class. The sum and mean scores of the group are as presented in table 3 below.

**Table 3: Descriptive Statistics of Post-test scores of those in the Group Learning Treatment (GLT) and the Individual Learning Treatment (ILT)**

Treatment level	Number of students (n)	Sum of scores ( $\sum X$ )	Mean scores ( $\bar{X}$ )	Standard Deviation	Calculate d t-value ( $t_c$ )
GLT	60	1571	25.34	9.54	2.52
ILT	305	6680	21.90	9.96	df=363

The result of the t-test for the post-test scores of the GLT and the ILT showed that at  $P=0.05$  and  $df=363$ , the t-calculated ( $t_c = 2.52$ ) is greater than the t-table value ( $t_t = 1.96$ ). This suggested that students exposed to group learning treatment performed better than those exposed to individual learning treatment.

Furthermore, the pre-test, the post-test and the mean scores of the above average (AA) and below average (BA) students exposed to the GLT were computed and the t-test was found to check the statistical significance of the difference in performance of these two groups as shown in the tables 4 and 5 below.

**Table 4: Descriptive Statistics of Pre-test scores of above average (AA) and below average (BA) students who were exposed to Group Learning Treatment (GLT)**

Treatment level	Number of students (n)	Sum of scores ( $\sum X$ )	Mean scores ( $\bar{X}$ )	Standard Deviation	Calculated t-value ( $t_c$ )
AA	12	640	53.33	17.10	9.18
BA	50	1015	20.30	9.35	df=60

At  $P=0.05$  and  $df = 60$ ,  $t_c = 9.18$  was found to be greater than  $t_t = 2.00$ .

Comparing this with the calculated t-value for the post test of the above average (AA) and below average (BA) students in GLT as shown in table 5.

**Table 5: Descriptive Statistics of Post-test scores of above average (AA) and below average (BA) students who were exposed to Group Learning Treatment (GLT)**

Treatment level	Number of students (n)	Sum of scores $\sum X$	Mean scores ( $\bar{X}$ )	Standard Deviation	Calculated t-value ( $t_c$ )
AA	12	644	58.50	10.82	3.73
BA	50	2097	41.15	15.21	df=60

At  $P = 0.05$  and  $df = 60$ ,  $t_c = 3.73$  was found to be greater than  $t_t = 2.00$ . The pre-test result on table 3 showed that there is significant difference statistically in the mean scores of the above average (AA) and below average (BA) students, but when compared with the post-test mean scores on table 4, there is gain scores of those in below average. Comparing the difference in the mean scores ( $\bar{X}$ ) of the pre-test and post-test of the above average (AA) students which are 53.33 and 58.50 with the difference in the mean scores ( $\bar{X}$ ) of the pre-test and post-test of the below average (BA) students which are 20.30 and 41.15, it could be deduced that there was improvement in the performance of the below average students, which implies that group learning treatment enhances the learning of the below average students which is revealed in their performance as shown by the post-test result.

**Table 6: Descriptive Statistics of the class assignments done by members of the Group Learning Treatment (GLT) Individually and Collectively as a group**

Type of work done	No of students/ Group (n)	Sum of scores ( $\sum X$ )	Mean scores ( $\bar{X}$ )	Standard Deviation	Calculated t-value ( $t_c$ )
Individual	60	4080	68	3.18	3.82
Collective	6	459	76.5	2.25	df=64

The t-test for the assignments done by members of the Group Learning Treatment (GLT) individually and collectively as a group was carried out and the results showed that at  $P = 0.05$  and  $df = 64$ ,  $t_c = 3.82$  is greater than  $t_t = 2.00$ . This result revealed that there is a significant difference in the performance of the students in the class assignment done individually and collectively. Thus, there was a better performance in the assignment carried out collectively than that carried out by individual in the GLT.

**Table 7: Descriptive Statistics of the class assignments done by members of the Individual Learning Treatment (ILT) Individually and Collectively as a group**

Type of work done	Number of students/ Group (n)	Sum of scores ( $\sum X$ )	Mean scores ( $\bar{X}$ )	Standard Deviation	Calculated t-value ( $t_c$ )
Individual	305	18759	61.5	11.28	16.16
Collective	38	2717	71.5	13.15	df=341

The t-test for the assignments done by members of the Individual Learning Treatment (ILT) individually and collectively as a group was carried out and the results showed that at

$P = 0.05$  and  $df = 341$ ,  $t_c = 16.16$  is greater than  $t_t = 1.96$ . This result revealed that there is a significant difference in the performance of the students in the class assignment done individually and collectively. Thus, there was a better performance in the assignment carried out together than that carried out by individual in the ILT group.

**Table 8: Descriptive Statistics of the scores of the class assignments done by individuals in the Group Learning Treatment (GLT) and individuals in Individual Learning Treatment (ILT)**

Treatment	No of students (n)	Sum of scores ( $\Sigma X$ )	Mean scores ( $\bar{X}$ )	Standard Deviation	Calculated t-value ( $t_c$ )
ILT	305	18759	61.5	11.28	3.80
GLT	60	4080	68	13.18	df = 363

The t-test for the scores of the class assignments done by individuals in the Group Learning Treatment (GLT) and individuals in Individual Learning Treatment (ILT) was carried out and the results showed that at  $P = 0.05$  and  $df = 363$ ,  $t_c = 3.80$  is greater than  $t_t = 1.96$ . This result further revealed that there is a significant difference in the performance of the students in the class assignment done by individuals in the Group Learning Treatment (GLT) and individuals in Individual Learning Treatment (ILT). Thus, there was a better performance by the individuals in the Group Learning Treatment (GLT) than the individuals in Individual Learning Treatment (ILT).

## Discussion

The results of this study revealed that the students exposed to group instructional strategy performed better than their counterparts in individual learning treatment class. This follows Soliven (2003) who studied the teaching styles of high school Physics teachers, and found out that Physics teachers uses different teaching styles and teachers who give students opportunity for Physical movement while learning and teach with visual aids to students in groups get a better result and Zemke, Elger and Beller (2004) who found that students overwhelmingly indicated that use of effective cooperative events enabled them to more easily master difficult material.

Furthermore, those who worked in small group were better motivated to learn, this might be as a result of better accessibility to the teacher during teaching-learning process than when one is in a whole class where there are many students. Also, there is much discipline of having to listen and have total attention to learning in the GLT class than when one in ILT class and being able to interact with the teacher in asking questions and interacting with others during discussion in the class, knowing fully well that knowledge does not belong only to a person.

Also, there was a gain of scores by the below average students than the above average students in the same group. This simply showed that the BA students benefited more than AA counterparts due to the fact that everyone in the GLT class were reached and taught in the class, and they were all actively involved in the teaching-learning process so that the slow learners which mostly fell among the BA students were gradually motivated and thus were able to develop academically. In addition, there is a significant difference in the performance of those who did class assignments together and those who did the assignments individually

in the GLT group and in the ILT group. This confirms that working together in a group to do assignments and group work enhances students' learning ability and improves their academic performances better than doing it alone. This is because it gives the students sense of belonging and they are motivated to work so that they are not left out in the group work.

### Conclusion and Recommendations

This study found that the use of group instructional strategy enhances the learning of students and thereby improve their performance in Physics than the whole class teaching method. It was also found that the method motivates students to learn better than the whole class instructional method. The use of group instructional strategy also enhances the performance of the below average students better due to the fact that the interaction that occurs among them with the above average students and the teacher during the class teaching and in solving problems together serves as encouragement and motivating factor for them so that they were able to do better than when they would have been in a larger class.

Based on these findings, the following recommendations are made:

- That teachers and curriculum planners be made to develop interest in the use of group instructional strategy as a method of teaching science.
- That group instructional strategy be used for the teaching of Physics and other science subjects because it provides useful insights and solutions to some problems of teaching and learning of Physics
- That the method be adopted at all level of education because of its emphasis on the importance of the social interaction that occurred among the students in the class.
- That if the method be adopted, a good number of learners would definitely benefit positively and would make the learning of Physics and other science subjects more encouraging

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