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Gender Difference in Cooperative Learning in Secondary School Students' Academic Achievement in Physics

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Abstract
This study investigates the effect of cooperative learning strategy on the academic performance of students, and to find out if there is any difference in gender, in the students' performance. A pre – test – post – test control group design was adopted for this study. A random sampling was used and four (4) secondary schools (comprising of one girl's school and one boy's school) were selected from Azare metropolis, in Bauchi state. All the students offering physics within the selected secondary schools constituted the population of the study, and a total of one hundred sixty (160) students constituted the sample of the study. Instrument for data collection were pre – test Physics Achievement Test and post – test Physics Achievement Test. The questions used for the pre – test and post – test was selected from the Senior Secondary School Certificate Examination (SSSCE) past questions papers which have been tested for validity and reliability and were proved to be standard. A t – test Statistical tool was used to analyze the data collected at 0.05 level of significance. The findings of the study suggested that; Cooperative learning strategy is more effective in the teaching and learning of physics, because it increased social interaction between students, thereby made the topic easier for them to understand. Based on the findings and conclusions of this study, recommendations were made for the enhancement of students' (especially females) achievement in secondary school physics, such as inculcating cooperative learning strategy into school curriculum; adaptation of cooperative learning strategy by both the teachers and students for effective teaching, learning and understanding of physics.

Keywords: Physics, Senior Secondary Schools, Cooperative, Gender Difference, Learning Strategies

Introduction

Women in Secondary schools and colleges in Nigerian are underrepresented in many science related disciplines particularly in physics related professions. Research studies suggests that women generally under-perform in physics related professions. This agrees with the findings of Wilson, Keuter, Dennis, Nulsen & Verdon, (2007) and Morris, Harshman, Branum-Martin, Mazur, Mzoughi & Baker, (2012) and Low & Wilson, (2015) and Wilson, Low, Verdon & Verdon, (2016). These became apparent that some aspects of physics and the ways Physic questions are framed contribute greatly to the under-performance of female students compared to their male counterpart in Physics (Low & Wilson, 2015). Some efforts have been made to increase the female students engagement in physics, yet, the reasons for the low percentages and the under-performance of women in physics are not yet fully understood.

Some researchers have hypothesized that the reasons may include, e.g., their prior preparation, career goals, self-efficacy, sense of belonging, mindset, and epistemology (Roth and Roychoudhury, 1994) [35]. Increasing the diversity in the field of physics hinges, in part, on taking student characteristics into account in instructional design and implementation to improve teaching and learning for all students. In the past few decades, physics education researchers have investigated the challenges students face in learning physics and developed research-based instructional tools to improve student understanding of physics and their problem-solving and reasoning skills (Kalman, Milner-Bolotin and Antimirova, 2010) [19] the findings of such researches left much to be desired. Zephaniah, (2006) [39] examined the relationship between physics test scores and measures of cultural, political and economic gender equity and observed that the gender gap in average scores is smaller in countries with greater gender equity. Hence, over the years, the influence of gender difference in physics achievement has been a matter of concern to all stakeholders of education

It has been shown that gender difference in performance and understanding exists with the observation that boy's dominant in the use of physics apparatus and express more confidence of handling practical equipment's. Killer, (2007) [20] asserted that

boys are ahead of girls, in every branch of science with the largest difference in mathematics and physics and practical test. Physics, as one of the natural sciences has been recognized as the foundation for advancement in technology and development. It is against this background that science educators are increasingly seeking ways of enhancing the quality of teaching and learning of physics in our secondary schools. Two of the general objectives of the physics curriculum in line with the curriculum document are to: "Provide basic literacy in physics for functional living in the society and to stimulate and enhance creativity" (FME, 2009). Adolphus *et al*, (2015) [1], opined that, it is very important to bear these objectives in mind, so that what we teach, how we present it and to whom, can only be decided when we know what we are trying to achieve. In line with the objectives, we recognize the role of physics in the nation and capacity building. They further explained that, the teaching of physics should show how facts are established by experiment and observation, how generalizations are built upon this knowledge and concepts developed. When this is achieved, our secondary school leavers should be able to adapt to the rapid and drastic changes in technology and social culture.

Physics, the foundation of other science subjects in senior secondary school which deals with the promotion of scientific literacy is one of the perceived difficult subjects by both students and teachers in senior secondary school in Nigeria. The factors militating against the teaching and learning of science include the teaching approach. How students understand physics and the methods used in presenting it to them moves in regular procession all through their time in school. This implies that, the teaching method used by the teacher in presenting physics to the students all the years of schooling most affect and influence the students understanding and mastering of the subject matter and how they understand science generally. There is considerable evidence in the literature to show that traditional physics instruction is predominantly based on conventional lectures and manipulation of formulae, to teach concepts is ineffective. In typical classroom setting, if students are involved in only passive learning, it would lead to limited knowledge retention, let alone engaging them in critical thinking or promoting functional understanding.

Research works have shown that involving students directly and actively in the learning process promotes meaningful learning. Good performance of students in physics is very eminent and necessary as it prepares the students for advanced scientific studies and economic development of the country. Unfortunately, the current trend in the teaching and learning of physics, where materials for teaching are not available in public schools (Onwioduokit, 2001) [28], has forced most teachers to use the traditional lecture method in teaching physics. This has made it difficult to realize the importance of physics in our national development. From the foregoing therefore, the difficulty students have in understanding concepts in physics and the quest for better ways of effectively teaching the concepts in physics was the drive for this study. This research work therefore explores cooperative teaching strategy, particularly, student's team achievement division cooperative learning strategy in enhancing students' understanding and performance in physics. For teaching to be effective in promoting learning and enhancing students' understanding of physics, it must involve interaction between teachers and students and between students. The interaction should be such that it encourages students to get involved in working and forming meaning from experiences themselves.

The theoretical foundations of cooperative learning grew out of the work of social psychologist, Morton Deutsch, who specialized in the study of social interdependence (Kimberly *et al*., 2003) [21]. Deutsch studied the effects of different group structures on the process and outcomes of group efforts in a variety of social and work settings. There are two major theoretical perspectives related to cooperative learning-motivation and cognitive (Rossini and Jim, 1997). The motivational theories of cooperative learning emphasize the students' incentives to do academic work, while the cognitive theories emphasize the effects of working together. There are two cognitive theories that are directly applied to cooperative learning, the developmental and the elaboration theories). The developmental theories assume that interaction among students around appropriate tasks increases their mastery of critical concepts. When students interact with other students, they have to explain and discuss each other's perspectives, which lead to greater understanding of the material to be learned. The struggle to resolve potential conflicts during collaborative activity results in the development of higher levels of understanding (Slavin, 1990) [36]. The elaboration theory suggests that one of the most effective means of learning is to explain the material to someone else. Cooperative learning activities enhance elaborative thinking and more frequent giving and receiving of explanations, which has the potential to increase depth of understanding, the quality of reasoning, and the accuracy of long-term retention.

Learning together strategy of cooperative learning was originally developed by David Johnson and Roger Johnson at the University of Minnesota. Students work in four or five heterogeneous groups on a group assignment sheet. During discussion, if students ask the teacher a question, the teacher will refer such students to their groups to find answer. After the group discussion, a leader is chosen to present group's result to the entire class, and groups receive reward together. Scores are based on both individual performance and the success of the group, but individual do not compete with one another. The learning together strategy of cooperative learning provides a conceptual framework for teacher to plan and tailor cooperative learning strategy according to their circumstances, students' needs, and school contexts (Ghazi, 2000). Conway (1997) [4] cited Vygotsky that all learning takes place in the zone of proximal development. This zone is the difference between what a child can do alone and what he/she can do with others' assistance. Thus, the child does not learn in isolation therefore the teacher should create room for cooperation amongst students for effective cross-fertilization of ideas and knowledge. Cooperative learning is based on the principle that knowledge is co-constructed through interactions with others. This is in line with Nwachukwu, (2008) [26] who opines that when learners exchange ideas with peers and the teacher, they develop shared meanings that allow group members to communicate effectively with one another.

Cooperative learning is the umbrella term for a variety of educational approaches involving joint intellectual effort by students, or students and teachers together (Wendy, 2005) [38]. It requires a small number of students to work together on a common task, supporting and encouraging one another to improve their learning through interdependence and

cooperation with one another (Larry and Hartman, 2002) [25]. The cooperative learning groups usually comprise two to five students in a group that allows everyone to participate in a clearly designed task (Wendy, 2005) [38]. Students within small groups' cooperative learning are encouraged to share ideas and materials and divide the work when appropriate to complete the task. Small group competitive learning provides students with opportunity to explore and discuss topics with peers in a Bonds-on, interactive environment (Larry and Hartman, 2002) [25]. Gillies (2004) [11] affirmed that students benefit academically and socially from cooperative small group learning. It represents the most carefully structured end of the collaborative learning continuum, where instruction involves small groups of students who work together to maximize their own and each other's learning with the group's learning being structured around precisely defined tasks or problems. Cooperative learning is based on the theory of social interdependence, which focuses on the effect of various types of cooperatives, competitive and individualistic goal structures (Johnson & Johnson, 1999) [15]. The type of social inter-dependence created by goal specification determines how individuals act and interact in a situation which in turn affects the outcome of that interaction.

Social inter-dependence can be positive, negative, or neutral. Positive goal inter-dependence exists where learning is cooperative. Students cooperate and perceive that their own chance of success is increased by the success of other students. In contrast, negative inter-dependence is created in competitive learning environment where students compete with each other and perceive that their chances of success are diminished by the success of fellow students. Neutral interdependence is when students learn in an individualistic manner such that success in one student is independent of success in other students. Johnson and Johnson (1999) [15] presented five essential features that define cooperative learning as an instructional activity. First, cooperative learning involves face-to-face interaction where students actively participate with one another in contributing to group performance. The second element is individual accountability which involves participants being responsible for their share of the work and helps to prevent unequal individual contribution. Third, students must possess interpersonal and small-group skills that are necessary for quality cooperative learning and must be motivated to use these skills. Group processing, the fourth key element, requires members to monitor goal achievement and can be fostered by instructors who set specific rather than vague goals, allow sufficient time for group work, and issue clear expectations about group performance. The last and most important feature is positive inter-dependence which involves students cooperating, supporting, and helping one another to be successful. This element can be accomplished through the setting of mutual learning goals, with students learning the assigned material and making sure their peers do the same (goal interdependence), having students share resource materials (resource interdependence), establishing group rewards (reward interdependence), or any combination of these.

Johnson, Johnson and Stanne (2000) [17] stated that the combination of theory, research, and practice makes cooperative learning a powerful learning procedure. Different types of cooperative learning methods are being used in teaching different subjects. Student Teams Achievement Divisions (STAD), Teams-Games-Tournaments (TGT), and Jigsaw-II are general cooperative learning strategies adaptable to most subjects and grade levels. However Cooperative Integrated Reading and Composition (CIRC) for reading and writing instruction and Team Assisted Individualization (TAI) for Mathematics are comprehensive curricula designed strategies. All the five methods incorporate team rewards, individual accountability, and equal opportunities for success, but in different ways. In the present investigation, only one strategy of cooperative learning i.e., Student Teams Achievement Divisions (STAD) have been employed. To address this gap in the research literature, the current study focused on possible gender differences in school students who were taught in a traditional learning (competitive learning) environment versus an alternative, cooperative learning environment. The using of cooperative learning might be a source of excitement, motivation, enhanced achievement and retention to our students (Gupta & Pasrija 2013) [13]. In cooperative learning strategy, all students are divided into smaller groups ranging from three to seven. Every group and team is assigned an objective and the achievement of that objective calls on all the students in a particular group to help one another in a peaceful way. The cooperative learning strategy is a student-cantered teaching method while the conventional teaching method is teacher cantered and dominated. In cooperative learning settings, learners assist one another study and learn task material or the subject matter and they make positive contributions to the group in general, (Theodora, 2008) [33].

Research works have shown that involving students directly and actively in the learning process promotes meaningful learning. Good performance of students in physics is very eminent and necessary as it prepares the students for advanced scientific studies and economic development of the country. Unfortunately, the current trend in the teaching and learning of physics, where materials for teaching are not available in public schools (Onwioduokit, 2001) [28], has forced most teachers to use the traditional lecture method in teaching physics. This has made it difficult to realize the importance of physics in our national development. From the foregoing therefore, the difficulty students have in understanding concepts in physics and the quest for better ways of effectively teaching the concepts in physics was the drive for this study. This research work therefore explores cooperative learning strategy, particularly, student's team achievement division cooperative learning strategy in enhancing students' understanding and performance in physics. For teaching to be effective in promoting learning and enhancing students' understanding of physics, it must involve interaction between teachers and students and between students. The interaction should be such that it encourages students especially females to get involved in working and forming meaning from experiences themselves.

The purpose of this study is to determine whether cooperative learning strategy will affect the academic performance of physics students, and whether the learning strategy has any effect on gender. The purpose of the study is to compare the effects of cooperative learning strategy and competitive learning strategy on the academic performance of secondary school physics students, and to also find out whether there is any difference in gender in the students' performance in Azare, Bauchi state. Specifically, the study intends to: Find out the mean academic

achievement of physics students in pre-test for both control and experimental groups. Find out the mean academic achievement of physics students in post-test, for the control and experimental groups. Find out the mean academic achievement of male and female physics students in control group. Find out the mean academic achievement of male and female physics students in experimental group.

The following research questions will guide the study.

- What is the difference in achievement between the pre – test of the control group and the experimental group?
- What is the difference in achievement between the post-test of the control group and experimental groups?
- What is the difference in achievement between the male and female physics students in the control group?
- What is the difference in achievement between the male and female physics students in the experimental group?

Based on the above research questions, the following hypotheses will be used to test the significant of the study.

- There is no significant difference between the mean achievement of students in pre – test of control and experimental group.
- There is no significant difference between the mean achievement of students in post – test of control and experimental group.
- There is no significant difference between the mean achievement of male and female physics students in the control group.
- There is no significant difference between the mean achievement of male and female physics students in the control group.

Methods

The research design adopted for this research is pre – test – post – test control group design, this was adopted because the researcher tends to compare a particular group with another, and find out their effects and differences on students, and to collect and analyzed data from students that form a representative sample of the entire population. The researcher was also interested in finding out the effect of cooperative learning strategy on academic achievement on secondary school students in physics as well as the gender difference. The study was based in Azare metropolis, Bauchi State, in Nigeria. It was restricted to four (4) Government secondary schools out of the twelve (12) Government secondary schools within the area of study. Stratified Random sampling method was employed in the selection of the four (4) secondary schools, the students offering physics in the selected schools constituted the population of this study, and a total number of one hundred and sixty (160) students constituted the sample size were sample using the total sampling techniques.

The instrument for data collection was pre – test physics achievement test and post – test physics achievement test. The instrument was collected from SSSCE past questions Papers, which have been tested for validity and reliability and was proved to be standard. The questions were selected based on the topic and concepts covered during the lessons. The pre – test was administered first to test the homogeneity of the two groups (i.e., the control and experimental groups) and it was administered to all the students before treatment. Post – test physics achievement test was administered after treatment. The pre – test physics achievement test and the post – test physics achievement test were two equivalent tests of multiple-choice items, comprising of twenty (20) items. The data collected were analyzed using t – test method, and this was used to test the hypothesis at 0.05level of significance.

Results

Research Question 1: What is the difference in achievement between the pre-test of control and experimental groups.

Table 1: T-Test analysis of pre – test score of control and experimental groups

Source of variation	N	m	sd	df	tcal	tcrit	Result
Control group	80	50.6	10.72	79	9.10	1.69	Significant
Experimental Group	80	33.1	13.38				

Hypothesis 1: There is no significant difference between the mean achievement of students in pre -test score of control and experimental groups**.** The above table showed that t – calculated is greater than t – critical, hence the null hypothesis is rejected at 0.05 level of significance. This implies that, there is a significant difference between the mean achievements of physics students in pre = test score of control and experimental groups in favor of the control group (individualistic learning strategy).

Research Question 2: What is the difference in achievement between the post-test of control and experimental groups.

Table 2: T-test analysis of post – test score of control and experimental groups

Source of Variation	N	m	sd	Df	tcal	tcrit	Result
Control group	80	63.9	12.35	79	7.91	1.96	significant
Experimental Group	80	78.3	10.69				

Hypothesis 2: There is no significant difference between the mean achievement of physics students in post – test score of control and experimental groups. The table above showed that the t – calculated is greater than the t – critical, hence the null hypothesis is rejected at 0.05 level significance. This means that, there is a significant difference between the mean achievement of physics students in post – test score of control and experimental groups, in favour of the experimental group (cooperative learning strategy).

Research Question 3: What is the difference in achievement between the male and female physics students in the control group (competitive learning strategy).

Table 3: T-Test analysis of male and female physics students in the control group

Source of Variation	N	m	sd	Df	tcal	tcrit	Result
Control group	80	63.9	12.35	79	7.91	1.96	significant
Experimental Group	80	78.3	10.69				

Hypothesis 3: There is no significant difference between the mean achievement of male and female physics students in the control group. The result from the table above showed that t – calculated (2.66) is greater than t–critical (1.96), hence the null hypothesis is rejected at 0.05 level significance. This implies that, there is a significant

difference between the mean score of male and female students in the control group, in favour of the male physics students.

Research Question 4: What is the difference in achievement between the male and female physics students in the experimental group (cooperative learning strategy).

Table 4: T-Test analysis of male and female physics students in the experimental group

Source of Variation	N	x	sd	Df	tcal	tcrit	Result
Males	40	80.3	26.26	39	3.08	1.96	Significant
Females	40	61.3	8.90				

Hypothesis 4: There is no significant difference between the mean achievement of male and female physics students in the experimental group. The result from the table above showed that t – calculated (3.08) is greater than t – critical (1.96), hence the null hypothesis is rejected at 0.05 level significance. This implies that, there is a significant difference between the mean score of male and female students in the experimental group, in favour of the male physics students.

Table 5: T-Test analysis of male and female students' pre-test of control group and experimental group

Source of Variation	N	x	sd	df	tcal	tcrit	Result
Males	80	46.8	15.3	79	3.78	1.96	Significant
Females	80	36.4	16.89				

The table above showed that t-calculated (3.78) is greater than the t-critical (1.96), and this implies that there is a significant difference between the males and females' achievement on the pre-test of both control and experimental groups, in favors of male physics students.

Table 6: T-Test analysis of male and female physics students' post-test of control and experimental groups

Source of Variation	N	x	sd	Df	tcal	tcrit	Result
Males	80	79.9	25.97	79	4.24	1.96	Significant
Females	80	62.1	29.02				

The table above showed that t-calculated (4.24) is greater than the t-critical (1.96), and this also implied that there is a significant difference between male and female physics students 'achievement on the post-test of both control and experimental groups in favor of the male physics students.

Discussion

This study investigated whether cooperative learning strategy (students – Team Achievement Division) to be precise, would increase students' achievements in physics, especially the female students, in secondary school level. Results obtained from table 1 showed that students using competitive learning strategy (control group) performed better (with mean score of 50.6 while that of the experimental group mean score is 33.1) than those in the experimental group, in the pre – test administered before instructions were given. This result can be attributed to the fact that every student was struggling for position, recognition, higher grades etc., and placing more emphasis on doing better than everyone else. In this case, students perceive or believe that they can only obtain or achieve their goals only when the other students fail to achieve theirs; students engage in a win – lose struggle in an effort to determine who is the best; this type of learning can, in one way or the other, influence students' knowledge, attitude and interactions with other students. This result was in line with Akinbobola (2006) [2] who stated that our current educational system is based upon competition among students for grades, social recognition, scholarships and admission into top schools. He also stated that in our society and current educational framework, competition is valued over cooperation, and in a traditional competitive classroom, students are concerned with their individual grades and where they fit into grade curve. This approach leads to a performance goal as the desired outcome of the educational experience (Kolawole, 2007) [24].

On the difference in achievements between the post – test of control and experimental groups (where the mean score of the control group is 63.9 and that of the experimental group is 78.3), the result showed that students who used cooperative learning strategy (experimental group) performed better in their post – test physics achievement test than those students who used competitive learning strategy (control group). This result could be attributed to the fact that students worked together for one purpose or goal (i.e., everyone must pass). This type of learning help students to develop positive interdependence face – to – face promotive interaction, individual and group accountability, interpersonal and small skills, and group processing. This provided opportunities for students to develop skills in group interactions and in working with others, which are needed in the world today; it also promoted more positive attitude towards the instructional experiences; it also promoted students achievement, understanding of concepts, and retention of information in a positive way. This result is in line with Kolawole (2007) [24] who stated that cooperative learning strategy is more effective than competitive learning strategy in teaching of mathematics at secondary school level.

Ho and Boo (2007) [9] in their study on cooperative learning; exploring its effectiveness in physics classroom found that cooperative learning strategy contribute to higher students' academic achievement in relation to physic This finding is also in agreement with the earlier researcher, Zephaniah (2006) [39], who carried out an investigation on the effectiveness of cooperative instructional strategy in physics on students' academic performance in senior secondary school. He found that student taught physics with cooperative instructional strategy have a mean score greater than that of their colleague that are taught physics using conventional lecture method. Omeodu and Utuh (2018) [27], also stated that there is a statistically significant difference between the understanding of students taught with cooperative learning strategy and those taught with lecture method. But this finding is not in agreement with Sahin (2010) [32] who found cooperative instructional strategy to be ineffective in improving student's academic performance. He researched on the effect of cooperative learning method on student's academic performance in vocational studies. The results he found had no statistical difference or relationship between the mean scores of students in both lecture method and cooperative learning group.

On the difference in achievement between the male and female physics students in the control group, the result

showed that there is a significant difference between the mean score (45.6) of male physics students and the mean score (35.9) of female physics students. This means that male students performed better than their female counterpart in the control group (Competitive learning strategy). This could be attributed to the fact that male physics students used their time and read, it could also mean that they have more time to read their books at home than female physics students who use their time for other things like helping their parents at home, they also use more of their time painting their faces, nails and other parts of their body, as well as gossiping, most of the students are lazy too. This is in line with Erinosho (1994) [6] who pointed out that boys perform better than girls in sciences like physics, and that girls are said to lack qualities that will make them to excel in the field because of lack of interest, inappropriate use of their time and laziness.

On the difference in achievement between the male and the female physics students in the experimental group, the result showed a significant difference between the mean score (80.3) of male physics students and the mean score (61.3) of the female physics student in the experimental group (cooperative learning strategy). This could also mean that most of the female students within their groups were not listening or that they refused to listen, it could also mean that they were not understanding or refused to understand while the explanations were going on in their groups, it could also mean that they were using their time to do other things while explanations were going on within their groups. In the pre-test and post-test, male physics students still performed better than their female counterpart, with male mean scores being 46.8 and 79.9 respectively and the female mean scores being 36.4 and 62.1 respectively.

With all the followings, even though female physics students who were involved in the cooperative learning strategy performed significantly better than those who were involved in the "learn on your own" (competitive learning strategy), and generally too, students involved in cooperative learning strategy performed extremely better than the students involved in the competitive learning strategy. This means that there is positive effect of cooperative learning strategy on students' achievement in physics in secondary schools, and there is gender difference in the academic achievements of the physics students in secondary schools, since every student was given equal rights and opportunities and still, male students performed much better in the cooperative learning strategy. Study by Christian and Pepple (2012) [3] investigated the effects of cooperative and individualized learning strategies on students' achievement in chemistry, the results show statistically significant effect of learning strategies on students' achievement in chemistry. The result also revealed that cooperative learning strategies with learning strategies and gender having significant relative effect on students' achievement.

The likely influence of gender factors on students' academic achievement in physics when they are taught using cooperative learning strategy and competitive was examines by Kolawole, (2007) [24], he found that male students performed better than female students in cognitive, affective and psychomotor skill achievement. This finding is not in agreement with the following researchers: Oludipe (2012) [29] investigated the influence of gender on Junior Secondary students' academic achievement in basic science using cooperative learning teaching strategy. Findings of the study revealed that there was no significant difference in academic achievement of male and female students at the pre-test, post-test, levels respectively. Viann (2002) investigated gender differences and the effects of cooperative learning in mathematics classroom setting. The results revealed no significant gender-related differences, but females achieved slightly higher grades than males. Pandian (2004) [30] investigated the effects of cooperative computer-assisted learning method on male and female students' achievement in biology. The students were randomly grouped into cooperative computer assisted learning and traditional method groups. The analysis of results indicated that gender did not express any significant influence on biology achievement. However, male and female students in the cooperative computer assisted instruction group showed remarkable post-test mean differences over their respective counterparts who learned the same biology concepts through traditional method.

In conclusion, It is an obvious fact that no Nation can survive technologically if her future generations are performing poorly in science and science related subjects. Physics being one of the core science subjects is the bedrock of science and technology and if neglected, the related courses will suffer. Therefore, any effort to improve the teaching and learning of physics should be encouraged and adopted. The findings of this study lead to the following conclusions: competitive learning strategy is good but cooperative learning strategy is more effective in the teaching and learning of physics at secondary school levels, because cooperative learning increases students' academic achievement; help students to achieve better understanding of physics concepts and increase students' motivation to learn.

Cooperative learning strategy is more effective than competitive learning strategy in the learning of physics because it even helped female students were able to learn, understand and also perform better. It provides a better understanding of the concepts, and on the process of writing both the pre – test and the post – test, it was also discovered that students actually love sitting for a pre – test as this gave them an idea and insight of what to expect from the topics and in some ways, made the topics easier to understand. The findings of this study also revealed that there is a gender difference on the effect of cooperative learning strategy among the physics students in secondary schools. And there is a significant difference between the male students' achievement and the female students' achievement in physics, both in the pre-test and the post-test physics achievement tests. Based on the findings and conclusions reached in this study, the following recommendations were made.

- Curriculum planners and school Administrators should try and incorporate cooperative learning strategy into school curriculum as a way of helping students to develop positive attitude towards learning and understanding of physics.
- Government as well as school managements should give group rewards to students in order to motivate them to work and learn in groups based on cooperative learning.
- Physics teachers as well as other science teachers should adopt cooperative learning strategy as an effective teaching and learning method in order to

improve students' performance, achievements and social interaction among students.
- Students that are good academically should adopt cooperative learning strategy as a means of carrying those that are doll academically along with them.
- Female students should always cooperate with their male counterparts, especially during cooperative learning so as to increase their understanding and performance in physics as well as other science subjects.

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