

Cooperative Learning Strategy on Senior Secondary School Students' Interest in Physics

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ABSTRACT

The study investigated the effects of cooperative learning strategy on students' interest in physics in senior secondary schools in Ebonyi State. Three research questions and three null hypotheses guided the study. The research design was quasi-experimental. The population of the study comprised 1887 senior secondary two students in Abakaliki Education Zone. Simple random sampling technique was used to sample 121 students for the study. The instrument for the study was Physics Interest Inventory (PII) which was adopted from Baggaley Interest Inventory by the researcher. The study was made up of two groups; the experimental and the control groups. The research questions were answered using Mean and Standard Deviation while Analysis of Co-variance was used to test the hypotheses at 0.05 level of significance. Findings of the study indicated that students of the experimental group had higher interest mean scores than those of the control group. Also, male of the experimental group and that of the control group displayed higher interest than their female counterparts. The researcher recommended that educational authorities should ensure that physics teachers employ appropriate learning strategy that could arouse students' interest towards physics while teaching. This could be achieved through regular supervision and inspection of schools. The researcher equally advocated that educators of physics should plan for a review of curriculum that would be gender friendly and allow for student's active involvement on task rather than making them passive learners.

Keywords: Cooperative Learning, Physics, Interest, and Gender.

INTRODUCTION

Learning is a continuous process that starts from birth to death. Learning is defined as the acquisition of knowledge or skills through study, experience or being taught. It is a process of gaining knowledge or skills by studying, practicing, being taught or experiencing something. According to Omebe in Oka (2021), learning is a permanent mental change that makes it possible for an individual to exhibit observable change in behavior. Ambrose in Queensu (2020) viewed learning as the process that leads to change, which occur as a result of experience and increases the potential for improved performance and future learning. Learning may take the form of cooperative or individualize. It is said to be cooperative learning if the task to be learnt is carried in group and individualize learning if the instruction is taken individually.

Learning of Science involves the acquisition of science content and the systematic process through which the learner maximizes knowledge of the world around them, as well as helping them to develop skills on how to manipulate the world to better their lives and those around them. Science being a body of knowledge or systematic process of investigating and a way of thinking in pursuit of an understanding of nature requires tentative skills in learning it. Omiko in Oka (2021) maintained that learning of science is fundamental to human survival and must be seen as the right of every individual in a society. Learning of science in Nigeria secondary schools cut across the core science subjects such as physics, biology, chemistry and other science related subjects. Physics is the focus of this study.

Physics remains one of the science subjects taught in senior secondary school in Nigeria. Like other subjects, it plays vital role in socio-economic, technological and national development. Physics deals with the study of

properties in relation to space and its interactions, time, matter and energy. It also deals with the basic principles and understanding of the laws governing the universe. The study of physics has been an age long affair, since man's continuous search to better his life through science and technology. Physics as one of the science subjects taught at senior secondary school level offers the learner an opportunities to critically think, reason logically and acquire the spirit of enquiry by asking questions. Omosewo and Ogunlade (2012) opined that physics education is designed to train the students to acquire proper understanding of the basic principle as well as their applications. Physics is an important science subject that makes enormous academic demands on students in its learning as well as its teaching. Anyakoha (2016) defined physics as a natural science that involves the study of matter and energy and their interactions. It is not only concerned with the forces that exist between matter and energy but also take holistic study of matter and energy. Physics is also defined as the science that is concerned with the study of physical objects, substances and of natural forces such as light, heat and motion (Okeke, 2012). It is the basic science subject that deals with those fundamental questions on the structure of matter and interaction of elementary constituents of nature that are susceptible to experimental investigation and theoretical inquiry.

The need for technological development in Nigeria demands to encourage students to choose careers in science especially engineering and medicine which a student cannot offer without the knowledge of physics. Meanwhile, courses like Quantum physics, Geophysics, Computational physics, Material physics, Environmental physics, Industrial physics, Education physics to list but a few are career courses in institutions of higher learning which cannot be undertaken without the knowledge of physics at the senior secondary school level. In fact, physics can be seen as a subject that provides room for all technological development in the world. Think about all of the technological devices that one uses on a regular basis. Computers, wireless internet, smart phones, tablets, global positioning system (GPS), MP3 players, and satellite radio might readily come to mind. Similarly, when one think about the most exciting modern technologies that one has heard about in the news, such as trains that levitate above their tracks, invisibility cloaks that bend light rays around them, and microscopic robots that fight diseased cells in our bodies. All of these groundbreaking advancements rely on the principles of physics.

Despite all these roles played by physicist in the field of civilization, students' interest in physics is still low at all levels (Wenno, 2015). For many decades, students' interest towards the study of science has become an important topic of research for many science educators (Kapanadze, et al, 2023). Past studies have identified different factors, such as gender, age, learning environment, which may affect students' interest in science subject (Slovinsky, et al, 2021). As the present study investigates students' interest in physics, some researchers has examined the relationship between motivation and attitudes of students towards physics subject (Jufrida, et al, 2019); other educators argued that students become more interested in learning physics, if they see the connection between physics and the real world (Perkins, et al, 2006) while many teachers believed that their students have difficulty studying physics, and they advocated the need for co-curricular activities and laboratory work to enhance the interest of their students in learning physics (Oon & Subramaniam, 2011).

Students' interest in physics at secondary school and institution of higher learning has not been encouraging. In Nigeria, there has been a recurring unacceptable attainment of students in physics. Record of students' performance at Senior Secondary Certificate Examination (SSCE) in physics conducted by West African Examination Council (WAEC) according to Adolphous 2018 shows that between 2001 and 2009 (except in 2006), less than 50% of the students who enrolled for physics obtained credit level pass and above to secure admission into university in order to pursue courses that require physics. The researcher maintained that the failure rate continued from 2007 to 2009 (42.9%, 47.1% and 46.2%) and in 2013 (46%) with an improved achievement in 2010, 2011 and 2012 (50.2%, 62.6% and 67.2% respectively). According to Onah and Achufusi (2022), the failure rate continued in 2015, 2017 and 2020 with percentage scores of 47.83%, 41%, and 36% and improved in 2016, 2018 and 2019 with 71%, 87% and 80% respectively. In general, this cannot be considered an acceptable achievement as many have lamented that achievement of Nigeria students in physics at the Senior School Certificate Examination (SSCE) were generally poor (Adaramola & Obomanu, 2011). Even the WEAC chief examiner's report in physics specifies areas of students' weakness and the way forward to better achievement in the subject. They stated that many students cannot properly draw physics diagram, give correct definitions of some concept or solve some problems, using mnemonic to master some physics equations. It shows that what the national education authority has done to improve the education sector has not yielded any desired fruit.

Several strategies of learning like spacing, retrieval practice, concrete example, elaboration, dual coding (Sumeracki, 2020) have been tried out but having little or no effect on student's achievement (Adewale, Nzewuihe and Ogunshola, 2016). The researcher therefore sought for an innovative learning strategy that will improve students' achievement and help them develop interest in physics. The study therefore suggested the use of cooperative learning.

Cooperative learning is the use of small instructional group so that students work together to maximize their own and each other's learning (Patesan, Balgiu and Zechia, 2016). It is a learning strategy with small teams, each with students of different ability, uses a variety of learning activities to improve their understanding of a particular subject. Each member of the group is responsible for not only learning the concept but also helping team mates learn. According to Adegoke (2011) cooperative learning is defined as a division of labour undertaken to solve a problem for any given task, students divide the work and come together to present their findings. Each student makes an individual contribution. Yar'adua (2008) opined that cooperative learning is grounded in the belief that learning is most effective when students are actively involved in sharing ideas. Abdulazeez (2011) asserted that cooperative learning is a pedagogical technique that makes students work together in small and mixed groups on a structured learning task with the aim of maximizing each other's' learning. Cooperative learning strategy engages every member of the classroom into small groups performing specific task together. Students are forced to develop social relationship skill that creates a room for innovation and problem solving. It is well known fact that science related subjects especially physics are occupied with problem solving tasks, cooperative learning strategy helps students to solve problems collectively which may lead to efficient academic achievement. Most students are faced with challenges of inability to confront problems individually because they may believe they do not possess the required skill, but when working together as a group, the teacher will notice the positive contribution of such students. By this, they gain confidence to solve similar problems independently.

Cooperative learning makes use of various techniques which are learning together and alone, constructive controversy group, Team-Game Tournament (TGT), jigsaw procedure, Students' Team Achievement Division (STAD), complex instruction, cooperative learning structures and cooperative integrated reading and composition. Cooperative learning is one of the recent remarkable and productive areas of research; theory and practices in learning. It involves students working together to attain the stated objectives and the instructional events that organize the students' joint effort. Cooperative learning strategy is not only verbal communication to deliver instructions but also sharing ideas and practical demonstration in the classroom. However, the researcher chooses to use one of the cooperative learning techniques, Students' Team Achievement Division (STAD), to engage secondary school students on some selected topics in physics.

Furthermore, a pertinent question may arise as to know whether cooperative learning has differential effect on male and female students in physics. This is sequel to the fact that some research study (Kapandze, Javakhishvili and Dzagania, 2023) result shows that there are gender inequalities in physics achievement and interest in secondary school. Though, researchers and psychologist who study gender and its' effect on academic interest and achievement have had a mixed opinion. Some believed that gender has no effect on academic interest and achievement while others believed that gender has significant effect in favour of either male or female. The third group argued that any difference which may exist in academic achievement of male and female cannot be directly attributed to gender differences. The association between gender and response to physical science especially physics has been a research issue for years. The controversy of gender and performance in science has attracted the attention of many researchers. Igwe (2006) opined that general performance of boys and girls in physical sciences were in favour of boys except in chemistry and geological studies. Busolo (2014) also revealed that gender was strongly associated with physics achievement as boys significantly demonstrated better than girls did. Meanwhile, the extent to which gender levels are affected are determined in this present study on the effect of cooperative learning on secondary school students' interest in physics.

Statement of the Problem

Physics stands as the foundation upon which many science-related disciplines are based. However, it has been noted that there are unimpressive interest and achievement of secondary school students in physics, especially in external examinations like the West African Senior School Certificate Examination (WASSCE) and the National Examination Council (NECO) in physics. Onah and Achufusi (2022), revealed the failure rate of students in 2015,

2017 and 2020 Senior Secondary Certificate Examination (SSCE) in Abakaliki Education Zone. Over the years students' poor achievement in Physics continues to drop and if this is not checked may jeopardize the placement chances of students in tertiary institution, not only in Physics education but also in other science related subjects. This has serious implications for national development, security, economy, and manpower of a nation with a vision of becoming professionals in science and technology (Okorie,2011). The increasing level of poor academic interest of students in physics calls for further investigation. It is perceived that some factors could be responsible for this poor interest. For instance, WAEC 2015, 2017, 2020 and 2023 reported the declining performance of students in ordinary level physics. Physics being an essential science area that has many applications in real life situations regrettably turns out to be the area where students show poor improvement. Many researchers are of the opinion that the students' poor interest in physics may be due to strategies or methods employed by physics teachers. If the poor interest of students in physics remains unsolved, it could adversely affect the anticipated goal of physics education in Nigeria. It is against this backdrop that the study, verifies whether there would be differences in the academic interest of students who received instructions using cooperative learning strategy and those who received instructions using individualized learning method.

Research Questions

1. What is the effect of cooperative learning strategy on the mean interest scores of secondary school students who learnt physics when compared to those in individualize learning?
2. What is the effect of cooperative learning strategy on the mean interest scores of male and female secondary school students who learnt physics?
3. What is the interaction effect of methods and gender on students' mean interest scores in physics?

Research Hypotheses

- 1 There is no significant difference on the mean interest scores of secondary school students who learnt physics under cooperative learning and those in individualize learning?
- 2 There is no significant difference on the mean interest scores of male and female secondary school students who learnt physics under cooperative learning method?
- 3 There is no significant interaction between methods and gender on student's mean interest scores in physics?

METHODOLOGY

The study employed quasi-experimental research design. This is because there was no randomization of the subject as intact classes were used (Nworgu, 2016). The study employed two groups: Experimental group and the control group. Experimental group learnt physics through cooperative learning strategy (CLS) while the control group class learnt physics through individualize learning Strategy (ILS). The study was conducted in Abakaliki Education Zone of Ebonyi State. Abakaliki Education Zone is one of the three Education Zones in Ebonyi State. The Zone is made up of four Local Government Areas, viz; Izzi, Abakaliki, Ebonyi and Ohaukwu L.G.A. The population of the study comprised 1,887 SSII physics students in Abakaliki Education Zone of Ebonyi State. The sample size of the study comprised 121 senior secondary two (SS2) students from four (4) secondary schools of Abakaliki Education Zone. The instrument for the data collection was Physics Interest Inventory (PII) which was adopted from Baggaley interest inventory by the researcher. It was a standardized instrument and does not pass through validation. Two instructional methods were used for the study. They are Cooperative learning strategy and individualize learning strategy. Cooperative learning approach was employed for the treatment group while individualize learning strategy was employed for the control group. During the study, the instrument PII was administered at the beginning as pre-test on both the experimental group and control group by the research assistant of the various groups. After four weeks of intensive learning, the same instruments were reshuffled and administered as post-test to both groups. The data collected were handed over to the researcher by the research assistants for scoring. The scores of the students in both Cooperative Learning Strategy and Individualize Learning Strategy from the pre-test and posttest were analyzed using both descriptive and

inferential statistics. Mean and standard deviation were used to answer the research questions, while ANCOVA was used to test the research hypotheses at 0.05 level of significance.

RESULTS

Table 1: Mean interest scores and standard deviation of students learnt physics in both experimental and control groups

Group	N	Adjusted Mean	Standard Deviation
Coop.	58	55.24	12.03
Indiv.	63	54.03	9.41

Table 1 showed the mean interest scores of 55.24 for the experimental group with a standard deviation of 12.03 while the control group had a mean interest score of 54.03 with a standard deviation of 9.41. Consequently, the table indicated that students of the cooperative learning group had a higher mean interest scores than those students who learnt physics individually. The standard deviation also indicated that there were differences between the mean deviation score on students' interest within the experimental groups.

Table 2: Mean interest scores and standard deviation of male and female students who learnt physics using cooperative learning strategy.

Gender	N	Adjusted Mean	Standard Deviation
Male	25	63.68	9.25
Female	33	48.85	9.80

Table 2 showed that male students obtained an adjusted mean score of 63.68 with a standard deviation score of 9.25 while their female counterpart had a mean achievement score of 48.85 with a standard deviation score of 9.80 both of the experimental group. The score indicated that male of cooperative learning strategy was highly interested than their female counterparts. The standard deviation also showed that the deviation scores within the male group was tight indicating stronger interest among students.

Table 3. Mean interest scores and Standard Deviation in the Experimental and Control Group Based on Interaction between Method and Gender.

Group	Gender	N	Adjusted Mean	Standard Deviation
Exp.	Male	25	63.68	9.24
	Female	33	48.84	9.80
Cont.	Male	28	55.07	9.74
	Female	35	53.20	9.18

Table 3 reveals the mean interest scores of male and female students in both the experimental and control group. The mean interest scores of the treatment group for male and female are 63.68 and 48.85 respectively. While the mean interest scores of males and females for the control group were noted to be 55.07 and 53.20 respectively. This revealed that cooperative learning strategy favoured male of the treatment group and also male of the control group were also very interested to learn physics individually alongside their female counterpart showing stronger interaction between method and gender.

Table 4: Summary of ANCOVA on the students' mean interest scores in physics for the experimental and control group at α : 0.05.

Dependent Variable; Posttest

Source	Type III sum of squares	DF	Mean Square	F	Sig
Corrected model	8796.304 ^a	4	2199.076	51.075	.000
Intercept	1323.083	1	1323.083	30.730	.000

Pretest	5568.700	1	5568.700	129.338	.000
Method	402.388	1	402.388	9.346	.003
Error	4994.440	116	43.056		
Total	374664.000	121			
Corrected total	13790.744	120			

For hypothesis 1, Table 4, the analysis showed that alpha level of significance (0.05) is greater than the significance. F value of .003. Based on the decision, the researcher therefore reject the null hypothesis that there is no significant difference between the mean interest scores of secondary school students learning physics using cooperative learning strategy and those using individualize learning method. This showed that mean interest scores of students in physics is significant in favour of the cooperative learning students.

Hypothesis two:

There is no significant difference between the mean interest scores of male and female students who learnt physics using cooperative learning strategy.

Table 5: Summary of ANCOVA for male and female students interest scores in physics for experimental group.

Dependent Variable Posttest

Source	Type iii sum of squares	Df	Mean Square	F	Sig
Corrected model	5025.772 ^a	2	2512.886	42.751	.000
Intercept	1722.553	1	1722.553	29.306	.000
Pretest	1896.834	1	1896.834	32.271	.000
Gender	664.157	1	664.157	11.299	.001
Error	3232.848	55	58.779		
Total	185252.000	58			
Corrected total	8258.621	57			

For hypothesis 2, Table 5, the analysis shows that alpha level of significance (0.05), is greater than the significance F. value of .001. since alpha level is greater than the corresponding significance F. value, the researcher therefore rejects the null hypothesis that there is no significant difference between the mean interest scores of male and female secondary school students learning physics using cooperative learning strategy. This showed that mean interest scores of students in physics in terms of gender is significant in favour of male students.

Table 6: Analysis of covariance for students' interaction between method and gender in physics interest scores.

Dependent Variable; Posttest

Source	Type III sum of squares	DF	Mean Square	F	Sig
Corrected model	8796.304 ^a	4	2199.08	51.075	.000
Intercept	1323.08	1	1323.08	30.73	.000
Pretest	5568.7	1	5568.7	129.338	.000
2-way interaction	296.33	1	296.33	6.883	0.010
Gender & Method	296.33	1	296.33	6.883	0.010
Method& Gender	211.248	1	211.248	4.906	0.029
Error	4994.44	116	43.056		
Total	374664	121			
Corrected total	13790.7	120			

The ANCOVA result of Table 6 showed the two-way interaction effect where the alpha level of significance (0.05) is greater than significance F. value (0.01) for gender and method, also the alpha level of significance

(0.05) is greater than significance F. value (0.029) for method and gender. The decision rule is to reject the null hypothesis when alpha level is greater than the significance F value. The observation indicated that the interaction effect between gender and method have both alpha level greater than their sig. f values. The researcher therefore rejects the null hypothesis that there is no significant interaction between gender and method on student's mean interest scores in physics. However, the researcher upheld the alternative hypothesis and concluded that there is significant interaction effect between students' interest in terms of gender and method.

DISCUSSION

Finding of the study showed that students of the experimental group had higher interest mean score than those of the control group. ANCOVA of the study equally buttressed that students' mean interest in physics was significant with the use of cooperative learning strategy. The findings of the study were in-line with the study of Yunusa, Abdulwahid and Adullahi (2014), Hossain (2013) and Oni (2018) whose studies revealed that significant difference exists between cooperative learning group and control group students in terms of interest towards learning of physics and other science subjects as cooperative group students displayed greater interest than control group students.

Findings of the study showed that male students obtained a higher mean interest score than their female counterpart for the experimental group. Further analysis of the study also showed that there is significant difference between the mean interest scores of male and female secondary school students learning physics using cooperative learning strategy. The findings of the study were not in agreement with the study of Oni (2018), Kapanadze, Javakhishvili and Dzaganian (2023) who works investigated the relationship between students' interest in physics and other science subjects and revealed that girls showed higher interest in physics than boys.

Findings of the study also showed that male students of the treatment group and that of the control group were very interested to learn physics alongside their female counterpart indicating strong interaction between method and gender. However, the ANCOVA observation indicated that the interaction effect between gender and method have both alpha level values greater than their sig. values. The researcher therefore maintained that there is significant interaction between gender and method on student's interest mean scores in physics. This result contradicted with the study of Oni (2018) but were in-line with the study of Sunday, Olaoye and Audu (2022) who maintained that cooperative learning strategy and competitive learning are gender friendly and interaction bound as both male and female performed equally.

CONCLUSION

The study also concluded that there is significant difference between the experimental and control group in terms of interest mean scores as the experimental group showed greater interest than the control group. Male and female students who received learning under cooperative learning strategy also displayed different level of interest in their scores. The finding therefore affirmed that significant mean interest exists between male and female students in favour of male. The study equally concluded that there is an interaction effect that existed between the experimental group and control group in their interest mean scores with respect to method and gender.

RECOMMENDATIONS

Based on the findings and implications of the study, the following recommendations were made: -

- Ministry of Education and other educational authorities should ensure that physics teachers employ appropriate learning strategy that can arouse students' interest towards physics while teaching. This could be achieved through regular supervision, inspection of schools.
- Physics teachers should re-examine and redesign their learning styles to allow for individualize learning strategies in most calculation concept in Physics instead of relying on innovation strategies for different topics. For instance, the researcher employed (STAD) only, one of the learning styles in cooperative learning strategy.
- Educators of physics should plan for a review of curriculum that would be gender friendly and allow for student's active involvement on task rather than making them passive learners.

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