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# EFFECTS OF PEER INSTRUCTIONAL STRATEGY ONSTUDENTS'ACHIEVEMENT AND ATTITUDES TOWARDS BASIC SCIENCE ANDTECHNOLOGY IN MANGU, PLATEAU STATE, NIGERIA

**[1]Ayuba, B. Kabang Ph.D, [2]Saurayi, I. Dadughun Ph.D, [3]Prof. Jerry, E. Omenka and [4]Prof. Joel O. Eriba**
**[1&2]Department of Science and Technology Education, Department of Educational Foundation, University of Jos, [3&4]Department of Science and Mathematics Education, Benue State University, Makurdi, Nigeria**

*Email: kabangayuba@gmail.com,joeleriba@yahoo.com*

## ABSTRACT

*This study examined the effects of Peer instructional strategy on students' achievement and attitude towards Basic Science and Technology in Plateau State, Nigeria. Five research questions guided the study and four hypotheses were formulated and tested at 0.05 level of significant. The study employed the non- equivalent group pre-test- post-test quasi experimental design. The population of the study was all the 2,195 Upper Basic 2 students in the 21 public schools. The sample for the study was 164 students from two co-educational secondary schools in Mangu Local Government Area of Plateau State. The instruments used for data collection were Basic Science Achievement Test (BSAT) and Basic Science Attitude Inventory (BSAI). Kuder Richardson (K-R, 20) formula was used to determine the reliability coefficient of BSAT which yielded 0.799 while for the BSAI, Cronbach alpha coefficient was used and it yielded 0.764. Descriptive statistics of mean and standard deviation were used to answer all the research questions and inferential statistics of Analysis of Covariance (ANCOVA) was used to test all the hypotheses at 0.05 significant level. The results of the study showed that peer instructional strategy enhanced students' achievement in Basic Science and Technology more than lecture method. There is a significant difference between the mean achievement scores of students taught Basic Science using peer instructional strategy and those taught using lecture method (p = .000 < 0.05) Peer instructional strategy did not influence students' attitude towards Basic Science and Technology (P = .920> 0.05). Hence, there is no significant difference between the mean rating attitude of female and male students taught Basic Science and Technology using peer instructional strategy (P = .678>0.05). There is no significant interaction effect of gender and the peer instructional strategy on students mean rating attitude in Basic Science and Technology (P = .065> 0.05). Based on the findings it was recommended that Basic Science and Technology teachers should not only guide the students on the subject matter but allow them to interact with one another to learn through discovery. This can foster confidence in the students and enhance their achievement in Basic Science and Technology.*

***Keywords: Peer Instructional strategy, Achievement, Attitude, Basic Science, Technology***

## INTRODUCTION

The survival of any country largely depends on acquisition and application of science and technology education to harness her human and material resources. This will make life more meaningful and productive to the people. According to Adejoh and Ekele (2014) the hope to progress to a higher understanding of people and our relationship with nature is raised by science. Science and technology change and increase the life expectancy and material well-being of people. These are seen in the area of our agricultural system, transportation, health care and social outlook. These rapid changes in science have affected the teaching of science. Thus, naturally, the sciences including Basic science and Technology are affected by these innovations.

Basic science and Technology occupy a special position in the junior secondary school curriculum. Basic Science and Technology is the foundation stone to science courses for the senior secondary and tertiary levels of education in Nigeria. Duru (2013) defines Basic science and Technology as a core subject and a stepping stone to all the sciences at the senior secondary school and at all science related occupations. It is also seen as an approach to science teaching in which concepts, principles and methods of science are presented to express the fundamental unity of scientific thought. This means that basic science is a unified course planned or drawn to show the unity, wholeness and inter-relationships of different disciplines that make up science. Basic science is taught in the Nigerian Junior secondary schools as a unified subject. Science Teachers Association of Nigeria STAN (2011) classified basic science contents into four major units as; you and environment, living and non-living things, science and development and you and energy with their respective subthemes.

The contribution of science and technology to national development is contained in the aims and objectives of the National Curriculum Review of 2011 in which the Basic science formed an integral part. The objectives consist of value orientation, poverty eradication, job creation, wealth generation and economic empowerment among others that are directed factors in national growth and development (NERDC, 2014).

Essentially, through science and technology, a nation develops her citizenry in science-based professions and technologies to meet the daily needs of man in the area of agriculture, medicine, architecture, engineering, science teachers at all levels of education and other professions in science with background in the basic science and Technology. Basic Science and Technology also has the following teaching objectives, to; develop interest in science and technology, acquire basic knowledge and skills in science and technology, apply scientific and technological knowledge and skills to meet societal and personal needs, become aware of numerous career opportunities provided by science and technology (in the world of work), avoid drug abuse and related vices and be safety or security conscious (NERDC, 2012).

In order to realize these, the Science Teachers Association of Nigeria and the Nigerian Educational Research and Development Council have been conducting series of researches, seminars and workshops for teachers, aimed at improving the teaching and learning of Basic Science and other Sciences in Nigerian schools without success. The Federal Government of Nigeria had through its new national policy on education (NPE) established in all states of the Federation, Teachers Resource Centres, Education Resource Centres, Audio-visual Centres, Science and Mathematics Centers among others to cater for the human and material needs of teachers across the country in order to address falling standards and mass failure of students in internal and public examinations without total success. Particularly, there have been research attempts in the areas of constraints to Basic Science students' attitude and science and teaching methods as exemplified by Akpan (2006), Gany and Joshua (2011) respectively towards addressing the problems of students' failure in Basic science and Technology.

The Federal Government in her effort to promote the teaching and learning of science in schools stressed the need for the 9-3-4 system of education curriculum, making a deliberate policy on admission into tertiary institutions by placing admission ratio of 60:40 in favour of science as against the Arts (FRN, 2009). The introduction of remedial courses in tertiary institutions aims at continuing with science courses in various disciplines, science fairs, clubs, trade fairs arise from application of new technologies, junior engineers' technicians' scientist (JETS) in schools for both primary and post primaries. membership is open and is made compulsory to all students of science (mathematics, physics, chemistry, Biology, Basic science and Technology, Agricultural science, Introductory Technology and computer science) in secondary schools including Technical colleges and pupils who have the ability for primary science in the primary schools (Enems, 2003). Scholarships for studying students are some attempts made by government to encourage the learning and teaching of science and technology in schools.

In spite of government effort to popularize the teaching and learning of basic science and technology with innovative strategies in schools because of its relevance, researches revealed that students' achievement in the subject is still below 50% (Ozoji 2011 &Adejoh, 2012). This could be why Omoregic in Ekandayo (2010) laments that, 'the products of today's secondary school system can neither usefully live in the society nor move into higher institution without forgery'. This problem is experienced in most secondary schools. Agbo, Ahmed, Ibrahim and Auta (2016) say that the achievement of students in sciences in Nigeria has remained consistently poor. Analysis of the Junior Secondary Certificate Examination (JSCE) for the past five years (2016-2020)by the researcher reveals that students' achievement in Basic Science and Technology at credit level in the study area is consistently poor. The level of distinction and credit pass and fail indicate 1.87%, 27.47%, 52.03% and 18.59% respectively for the five years especially for five out of the seventeen Local Government Areas as reported by the Ministry of Education, Plateau State from the year 2016-2020 in the study area. The results show that the average students' achievement in Basic Science and Technology at credit level in the Junior Secondary Certificate Examination (JSCE) in the Area is 27.47%. The average percentage pass at distinction level from the five years is 1.87% with percentage pass at credit level at 29.34% with a percentage passes of 52.03% and 18.59% fail. Ayua and Eriba (2015),blame the nature of the Nigerian system of education that tends to produce 'Job seekers' instead of 'Job creators' for lack of skills and creativity in graduates. This could be the reason of seeing many Nigerian graduates roaming the streets seeking for white color job. This poor achievement in Basic Science and Technology being the foundation for all sciences remain a source of concern to science educators.

The contribution of any laudable achievements in Basic Science and Technology cannot be possible unless teachers are committed to the teaching of science in Nigeria. The teachers have however been fixated with frontal teaching methods such as lecture and discussion which are teacher – centred. Lecture method on the other hand, is a way of presenting a lesson in which the teacher assumes the role of a knowledge giver by standing in front of the class to recite information relevant to the objectives of the lesson. It is a teacher centred-approach because it involves largely a one-way form of communication from the teacher to the students. The method is also termed didactic approach because most of the talking is carried out by the teacher while the students remain passive listeners. At secondary school level, there is strong objection to the exclusive use of the method in teaching science. This is against the principles of active methods that are geared towards student-centredness such as process approach, activity-based approach, inquiry and problem solving approach, cooperative learning and peer instructional strategy.

Researchers have shown that poor instructional strategies, lack of qualified teachers, abstract nature of science concepts, poor infrastructure and inadequate laboratory facilities, teacher-centred instruction, non-availability and utilization of instructional materials among several other factors were identified as the causes of students' poor achievement in science subjects (Duru, 2013). These findings made a number of science educators to believe that science subjects are poorly taught in our schools (Olorukooba, 2007). However, literature search showed that little or no effort had been made in the area of peer instructional strategy in Basic science and Technology in Nigeria. This strategy is not common in Nigerian science classrooms. This is the motivation for this study.

Peer instruction (PI) involves students in their own learning during lessons and focuses their attention on underlying concepts. Akay (2011) explains peer instruction as a method in which students study as a group of four or five rather than alone, sharing knowledge in the class with the roles of tutor and tutee. Here instead of presenting the level of details covered in the textbook or lecture notes, it consists of a number of brief presentations on key points. Each followed by related conceptual questions, called concept test, which probe students' understanding of the ideas just presented. The students are first given time to think about the situation on their own. They formulate their individual answers, and report their answers to the teacher. Then they are asked to discuss their answers with their team. During this step, a student reflects on his/her ideas,

discusses and compares them with his or her team. When the team has reached an agreed answer they report it to the teacher through a flash card. At the end the teacher explains the answer and moves onto the next topic. These processes encourage students' active participation in class activities and it is student-centred rather than teacher-centred as against lecture method. Lasry, Mazur and Watkins (2008) sees peer instruction as a method of teaching which consists of short presentations on key points followed by a concept test, which students formulate answers for and discuss with each other.

Empirical search on the use of peer learning and teaching elsewhere revealed that the method is effective for a wide range of goals, content, and students of different levels, personalities, advantages and high achievement (Gok, 2012; Amaka, 2013 & Okoroma, 2013;).The difference in academic achievement may be as a result of students' attitudes towards the subject. Researches have revealed that students who have positive attitude towards a subject perform better than those who have negative attitude or no interest at all in the subject (Adesoji, 2008; Ayanniyi, 2009; &Kara 2009:). Attitudes are simply expressions of what we like, dislike or neutral to a particular thing or situation. Churchill (2010) sees attitude as an enduring predisposition or readiness to react or behave in a particular manner to a given object or situation, idea, material or person. Landu (2007) in a research conducted reveals that attitude change positively towards learning that involves active participation of learners. This shows that meaningful learning could only take place in a scenario where learners are themselves deeply involved. In a related development Orunaboka (2011) affirms reveals that attitudes are formed by learners as a result of the kinds of learning experiences. If the experience is favourable to them a positive attitude is found or vice versa and if none of the two is neutral. It can represent our evaluations, preferences or rejections based on the information we receive. Adeyemo and Babajide (2014), say attitude is an internal state that influences personal actions of an individual and serves as a major factor in subject choice. The attitude of students is likely to play a significant role in any satisfactory explanation of variable level of achievement shown in their school subjects. Majority of students in secondary schools in Nigeria perceive science as a difficult subject. This impression cuts across gender. The cause of students' negative attitude towards science include among others; poor method of teaching, students' un-readiness to study, fear of mathematical calculation. Studies also revealed that students under training in the teaching profession have negative attitude towards the teaching profession (Maliki, 2013, Babu & Raju, 2013).If this happens to be a subject rejected by students and teachers, their academic achievement may be poor in such a discipline. Thus, understanding of students' perception will help the science teachers that have positive attitude towards the teaching profession in shaping their students' class perception and relatively their achievement in science (Akinbobola, 2009; Adeyemo, 2011 & Jegede & Adedayo, 2013:).

Academic achievement as a product of understanding of learned materials varies among learners on the basis of different factors as socio-economic background, gender difference, intelligence quotient and class size. The relationship between gender and intelligence quotient has particularly been a subject of controversy among scholars. While some scholars reported similarity in an average test score of boys and girls, others as discovered by Witty and Grotberg (2012) indicate differences between median scores of boys and girls. This indicates that there is no absolute agreement about the equality of gender intelligence and similarly in terms of their test score.

It is against this backdrop that the researchers intend to investigate on the effects of Peer Instructional Strategy on students' achievement and their attitude towards Basic Science and Technology in Mangu Local Government Area, Plateau State. The study will determine whether it is Peer Instructional Strategy that may be the more effective method that can improve better achievement in Basic Science and Technology in the study area.

## Statement of the Problem

In spite of the laudable efforts of government, organizations and parents in enhancing students' achievement in basic science, the level of students' achievement in the subject is still low. This is evidenced from the students' performance of the Plateau State results of basic science and technology2016-2020 examination. The attitude of Nigerian students is negative towards learning the subject. The use of ineffective method by teachers could be responsible to this negative attitude and low achievement in students. This poor achievement in Basic science and Technology could also be the reason for students 'low enrollment in the science courses at the senior level of our education in the study area due to poor foundation in the science subject. The few that enrolled in the science courses in the area of study find it difficult to copedue to their low achievement in the sciences. This is evidenced in the poor achievement of students in the 2016-2019 senior secondary certificate examination (SSCE) and NECO especially in physics and chemistry in the study area. Some researchers also blame this decline in students' achievement to none use of effective methodology for teaching Sciences including Basic Science and Technology in secondary schools for skills acquisition in the learners (Cirfat, 2011 &Daramola & Odigiri, 2016).In a related study, some researchers blame the poor achievement in science among secondary school students apart from the ineffective teaching methodology used by teachers, to students' negative attitude towards the sciences and the teachers' negative attitude towards the teaching profession (Onuh & Ugwu, 2010; Maliki, 2013; Babu& Raju, 2013).

This situation is unhealthy for an ambitious country like Nigeria that is aspiring to develop her technology in the new millennium. The scenario should no longer be shone over as carelessness on the part of the students. This poordecline in students achievement may be as a result of lack of innovative method, lack of teacher dedication in the job and the right attitude towards learning Basic science that could promote students' interaction in a classroom setting.

Peer Instructional Strategy involves learner active participation during teaching and learning process. This explains why peer instructional strategy is considered for trial in Basic Science and Technology in this study. There is no evidence to show that studies of this kind were carried out in Plateau State Education especially in Mangu Local Government Area. The problem in question form therefore is; what is the effect of peer instructional strategy on students' achievement and their attitude towards Basic Science and Technology in Mangu Local Government Area of Plateau State?

## Purpose of the Study

The purpose of this study is to determine the effect of peer instruction on students' achievement and their attitude towards Basic Science and Technology in Mangu Local Government Area, Plateau state. Specifically, the objectives are to:

1. determine the effect of peer instructional strategy on students' achievement in Basic Science and Technology when compared with lecture method
2. determine the effect of peer instructional strategy on students' attitude towards Basic Science and Technology when compared with lecture method
3. determine the effect of peer instructional strategy on students' attitude towards basic science and Technology based on gender
4. determine the combine effect of gender and peer instructional strategy on students' attitude towards Basic Science and Technology.

## Research Questions

The following research question will guide the study:

1. What is the effect of peer instructional strategy on students' achievement in Basic science and Technology when compared with lecture method?
2. What is the effect of peer instructional strategy on students' attitude towards Basic science and Technology when compared with lecture method?

3. What is the effect of peer instructional strategy on students' attitude towards Basic science and Technology based on gender?
4. What is the combine effect of gender and method on students' attitude in Basic Science and Technology?
5. What is the interactive effect of gender and method on students' attitude in basic science and Technology?

**Hypotheses**

1. There is no significant difference in the mean achievement scores between students taught Basic Science and Technology using peer instructional strategy and those with lecture method.
2. There is no significant difference in the mean attitude ratings between students taught with peer instructional strategy and those with lecture method.
3. There is no significant effect of peer instructional strategy on students' attitude towards Basic Science and Technology based on gender.
4. There is no significance different between the interactive effect of gender and method on students' attitude.

## Method and Procedure

The study adopted the quasi-experimental design, particularly the non- randomized pretest-posttest control group design. The design involved two groups (experimental and control) which members were not randomly assigned to the groups by the researchers, but pre-existed as intact classes. The population of the study was all the 2,195 upper Basic Science and Technology students of public secondary schools in the study area. The population consisted of 1085 male and 1110 female students making a total of 2,195 in the public schools. A sample of 164 upper Basic 2 students of two intact classes each from the study area that were coeducational schools were used to ensure gender variable. The sample consisted of 96 male and 68 female students from the two schools for the study.

The random sampling technique was used to obtain Mangu Local Government Area for the study out of the seventeen Local Government in Plateau State. The purposive sampling technique was further used to select the sample schools that had first degree (B. Sc. Ed) in Integrated Science Education to serve as research assistants.

Basic Science Achievement Test (BSAT) contained items adopted from the Basic Education Certificate Examination (BECE) questions for the past 10 years which were standardized examination with 40 objective items and Basic Science Attitudes Inventory (BSAI) with 30 items using the 5 likert scale were used for data collection. The BSAT and BSAI were validated by three experts, one from the University of Jos in the area of Measurement and Evaluation, one in Benue State University, Makurdi, in Science Education and the other one in Nasarawa State University, Keffi, a specialist in Curriculum and Instruction. The reliability of BSAT was determined with Kuder-Richardson 20 formula (KR-20) to obtain 0.799 while the BSAI was determined with Cronbach alpha Coefficient to obtain 0.764.

The descriptive statistics of mean and standard deviation were used to answer the five research questions. The inferential statistics of analysis of covariance (ANCOVA) to test all the hypotheses at 0.05 level of significance.

Results

The five research questions and four hypotheses were answered and tested as follows;

**Research Question 1:** What is the difference in the mean achievement scores of students taught basic science and technology using peer instructional strategy and those taught using the conventional method?

***Table 1:*** *Mean and Standard Deviation of Students' Scores in Peer Instructional Strategy and Conventional Method*

| Teaching Approach | Number of Students | pretest $(\bar{x})$ | SD | posttest $(\bar{x})$ | SD | Mean Gain |
|---|---|---|---|---|---|---|
| Peer instructional strategy | 84 | 26.93 | 8.14 | 55.43 | 8.14 | 28.50 |
| Conventional method | 76 | 25.58 | 8.96 | 38.55 | 8.96 | 12.97 |
| **Mean difference** | 1.35 | 0.82 | 16.88 | 0.82 | 15.53 | |

Table 1 shows the mean and standard deviation scores on the difference in the mean achievement scores of students taught Basic Science and Technology using peer instructional strategy and conventional method. The table reveals that students taught using peer instructional strategy had a mean gain of 28.50. While those that were taught with conventional method had a mean gain of 12.97 with a mean gain difference of 15.53 in favour of those taught using peer instructional strategy. This difference may not be statistically significant when tested at 0.05 levels of significance.

**Research Question 2** What is the difference in the mean attitude rating of students taught Basic Science and Technology using peer instructional strategy and those taught using the conventional method?

***Table2****: Mean and Standard Deviation of Students' Attitude Rating in Basic Science and Technology using Peer Instructional Strategy and Conventional Method.*

| Teaching Approach | Number of Students | Pretest $(\bar{x})$ | SD | Posttest $(\bar{x})$ | SD | Mean Gain |
|---|---|---|---|---|---|---|
| Peer Instructional Strategy | 88 | 102.64 | 15.50 | 103.18 | 15.50 | 0.54 |
| Conventional Method | 76 | 104.95 | 13.37 | 103.67 | 13.37 | 1.48 |
| Mean Difference | 2.31 | 2.13 | 0.29 | 2. 13 | 0.94 | |

Table 2shows a pretest mean rating of102.64 and a posttest mean rating of 103.18 giving a mean gain of 0.54 in peer instructional strategy class, while the conventional classhas a mean gain of 1.48. Thus there is a mean difference of 0.94 in favour of the conventional method class. The mean gain of those taught using conventional method is higher compared to those in the peer instructional strategy class. This difference may not be statistically significant when tested at 0.05 level of significant.

**Research Question 3**
What is the difference in the mean attitude rating between male and female students taught Basic Science and Technology using conventional method?

***Table 3:****Mean and Standard Deviation of the Mean Attitude Rating between Male and Female Students inConventionalGroup.*

| Gender | Number of Students | Pretest $(\bar{x})$ | SD | Posttest $(\bar{x})$ | SD | Mean Gain |
|---|---|---|---|---|---|---|
| Male | 48 | 110.29 | 10.93 | 104.92 | 10.93 | -5.37 |
| Female | 28 | 97.21 | 12.37 | 101.00 | 12.37 | 3.79 |
| Mean difference | | 13.08 | 1.53 | 3.92 | 1.44 | 1.58 |

The data in Table 3 show male pretest attitudes mean ratingof 110.29 and posttest attitude mean rating of 104.92 giving a mean negative of -5.37 for male students. The female had a pretest attitude mean rating of 97.21 and a posttest attitude mean rating of 101.00 with a mean gain of 3.79 in favour of female students. Thus a mean gain differenceof 1.58 is obtained in favour of female students. This implies that female students received instruction and had a more positive attitude towards Basic Science compared to the male students in the same class who had a negative attitude towards basic science. This difference may not be statistically significant if tested at 0.05 level of significant.

**Research Question 4** What is the difference in the mean attitude rating between male and female students taught basic science and technology using peer instructional strategy?

***Table4:****Mean and Standard Deviation of the Mean Attitude Rating between Male and Female Students in Peer Instructional strategy*

| Gender | Number ofMean Attitude Rating Students Pretest X | SD | Posttest X | SD | Gain | Mean |
|---|---|---|---|---|---|---|
| Male | 48 | 106.17 | 13.97 | 104.00 | 13.97 | 2.17 |
| Female | 40 | 98.25 | 16.85 | 102.20 | 16.85 | 3.95 |
| Mean difference | | 7.92 | 2.98 | 1.80 | 2.88 | 1.78 |

The data in Table 4 showa mean attitude rating gain differenceof 1.78 in favour of female students. This implies that female students received peer instruction and had a more positive attitude towards Basic Science compared to the male students in the same class of Basic Science. This difference may not be statistically significant when tested at 0.05 level of significant. Hence, one will not conclude that peer instructional strategy of instruction enhance female students' attitude towards Basic Science than the male students of the same group.

**Research Question 5** What is the interactive effect of gender and method on students' attitude in basic science and technology?

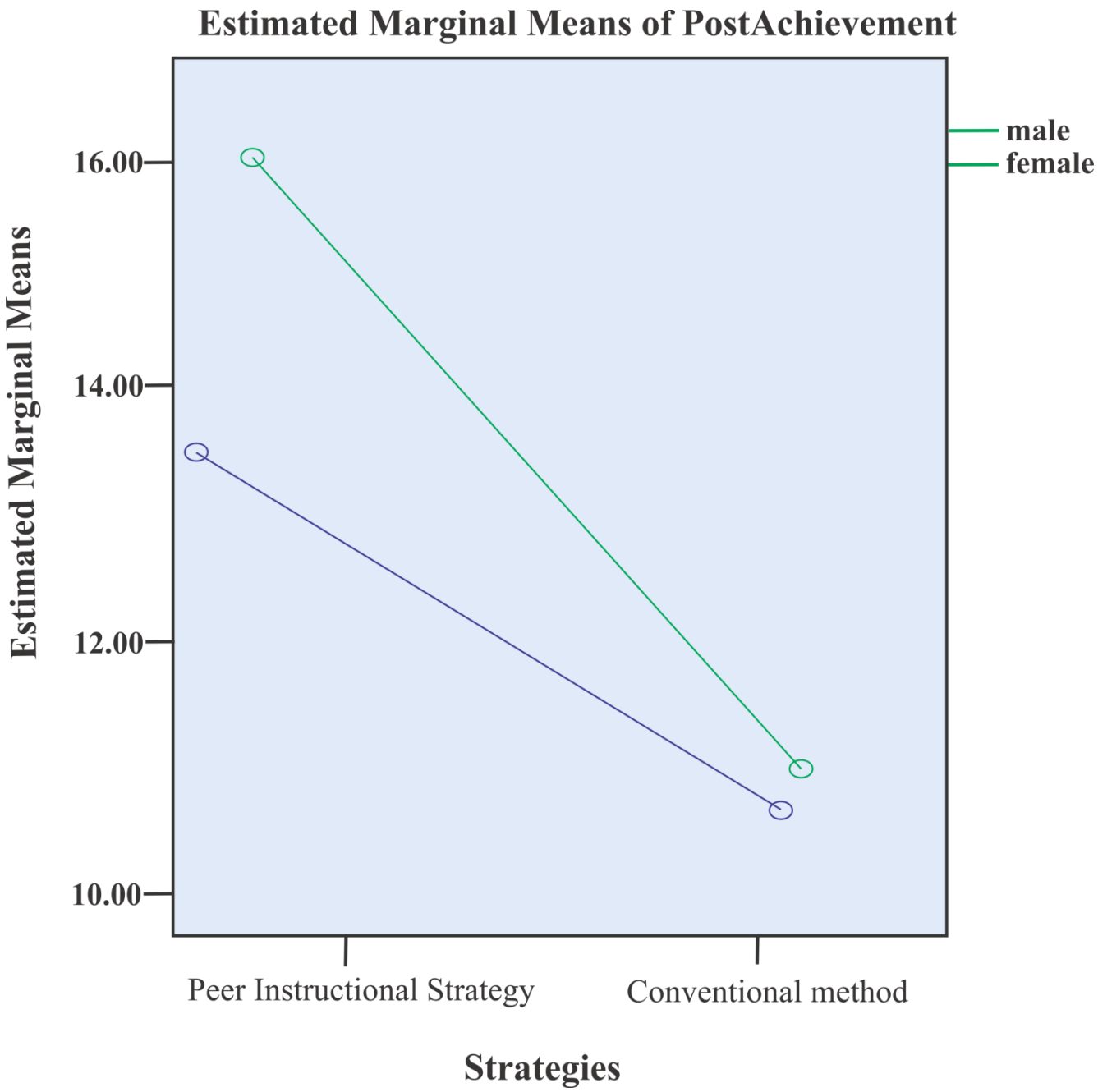


**Figure 1:** Interactive Effect of Gender and Method on Students' Attitude in Basic Science and technology.

In Figure 1, the profile graph shows the interaction effect of strategies and gender on students' attitude in Basic Science. The interaction pattern shows that the plots for males and females do not intersect. This indicates that there is likelihood of an interaction effect between strategies and gender when the plot is extrapolated the intersection could only be at infinity, which means that the interaction effect between strategies and gender may be tenable in this case.

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**Hypothesis 1** There is no significant difference in the mean achievement scores of students taught basic science and technology using peer instructional strategy and those taught using the conventional method.

***Table 5:Summary of ANCOVA Result of Significant Difference in the Mean Achievement Scores of Experimental and Control Groups***

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta squared |
|---|---|---|---|---|---|---|
| Corrected Model | 15698.356[a] | 2 | 7849.178 | 53.587 | .000 | .400 |
| Intercept | 10425.748 | 1 | 10425.748 | 71.178 | .000 | .307 |
| PREBSA | 6669.956 | 1 | 6669.956 | 45.537 | .000 | .220 |
| GROUBSAT | 7778.064 | 1 | 7778.064 | 53.102 | .000 | .248 |
| Error | 23582.426 | 161 | 146.475 | | | |
| Total | 394448.000 | 164 | | | | |
| Corrected Total | 39280.780 | 163 | | | | |

a. R Squared = .400 (Adjusted R Squared = .392)

Table 5 reveals that F (1, 161) = 53.10, p = .000 < 0.05.Since the P-value (.000) is less than 0.05 levels of significance, therefore, the null hypothesis is rejected. It is concluded that there is a significant difference between the mean achievements scores in favour of students taught Basic Science using peer instructional strategy. It shows that peer instructional strategy has significant effect on the mean scores of students. The partial eta square was to look at the effect sign that is the magnitude of the differences between groups.

**Hypothesis2** There is no significant difference in the mean attitude rating of students taught basic science and Technology using peer instructional strategy and those taught using the conventional method.

***Table 6: Summary of ANCOVA Result of Significant Difference in the Mean Attitude Rating between Experimental and Control Groups***

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 3.497[a] | 2 | 1.748 | .005 | .995 |
| Intercept | 3.2507.175 | 1 | 32507.175 | 98.038 | .000 |
| PRETEST | .023 | 1 | .023 | .000 | .993 |
| GROUP | 3.382 | 1 | 3.382 | .010 | .920 |
| Error | 53384.015 | 161 | 331.578 | | |
| Total | 1803992.000 | 164 | | | |
| Corrected Total | 53387.512 | 163 | | | |

a. R Squared = .000 (Adjusted R Squared = -.012)

The experimental and control groups were subjected to Analysis of Covariance (ANCOVA) to determine if a significant difference exists in the mean attitude rating between students taught Basic Science using peer instructional strategy and those taught with conventional method. Table 6 shows that mean attitude rating between students taught using peer instructional strategy have no significant effect on the mean attitude ratingof students taught with conventional method after controlling for the effect of pre-test mean attitude rating, F (1, 161) = .005, p = .920> 0.05, since the p value is greater than 0.05 level of significance, the null hypothesis is not rejected.It is concluded that the difference between experimental group and control group is insignificant, this shows that peer instructional strategyand conventional method does not increase students' attitude towards Basic science. Table 7 reveals that peer instructional strategy and conventional

method did not affect students' attitude even though it greatly affected their achievement in Basic science. It also shows that achievement in Basic science is independent of students' attitude.
**Hypothesis 3**There is no significant difference between male and female students' attitude in Basic Science and Technology using lecture method.

***Table 7:Summary of ANCOVA Result of Significant Difference in the Mean Attitude Rating between Male and Female on Effect of Conventional Method***

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|
| Corrected Model | 2377.020[a] | 2 | 1188.510 | 4.078 | .021 | .100 |
| Intercept | 3536.138 | 1 | 3536.138 | 12.133 | .001 | .143 |
| Pre-attitude control | 681.515 | 1 | 681.515 | 2.338 | .131 | .031 |
| Attit. gender control | 2370.897 | 1 | 2370.897 | 8.135 | .06 | .100 |
| Error | 21275.402 | 73 | 291.444 | | | |
| Total | 643580.000 | 76 | | | | |
| Corrected Total | 23652.421 | 75 | | | | |

a. R Squared = .024 (Adjusted R Squared = -.032)

The control group was subjected to Analysis of Covariance (ANCOVA) to determine if a significant difference exists in the mean attitude rating between male and female students taught Basic Science using lecture method. Table 6 shows that mean attitude rating between male and female students taught basic science using lecture method have no significant effect after controlling for the effect of pre-test mean attitude rating, $F(2,73) = 8.135$, $p = 0.06 > 0.05$. The mean difference recorded was statistically insignificant that is, the null hypothesis is not rejected. This shows that lecture method does not increase male or female students' attitude towards Basic science. Table 7 reveals that lecture method did not make a difference on male or female students' attitude in Basic science. It also shows that students' attitude in Basic science is independent of gender. The partial eta square indicates the magnitude of the differences between groups.

**Hypothesis4:**There is no significant difference between male and female students' attitude using peer instructional strategy

***Table 7: Summary of ANCOVA Result of Significant Difference in the Mean Attitude Rating between Male and Female Students on Effect of Peer Instructional Strategy***

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 403.256[a] | 2 | 201.628 | .631 | .534 |
| Intercept | 26303.030 | 1 | 26303.030 | 82.361 | .000 |
| Pre-attitude experimental | 386.232 | 1 | 386.232 | 1.209 | .275 |
| Attitude experimental | 55.402 | 1 | 55.402 | .173 | .678 |
| Error | 27145.835 | 85 | 319.363 | | |
| Total | 964440.000 | 88 | | | |
| Corrected Total | 27549.091 | 87 | | | |

a. R Squared = .015 (Adjusted R Squared = -.009)

The experimental group was subjected to Analysis of Covariance (ANCOVA) to determine if a significant difference exists in the mean attitude rating between male and female students taught Basic Science using peer instructional strategy. Table 10 shows that difference in mean attitude rating between male and female students taught basic science using peer instructional strategy is not significant after controlling for the effect of pre-test mean attitude rating, F (2, 85) = .173, p = .678> 0.05. The mean difference recorded was statistically insignificant that is, the null hypothesis is not rejected. This shows that peer instructional strategy does not increase male or female students' attitude towards Basic science. Table 7 reveals that peer instructional strategy did not make a difference on male or female students' attitude in Basic science. It also shows that students' attitude in Basic science is independent of gender.

**Hypothesis 5**There is no significance different between the interactive effect of gender and method on students' attitude.

***Table 8Summary of ANCOVA Result on Significant Interaction Effect of Gender and Method on Students' Attitude***

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 8465.602[a] | 4 | 2116.401 | 6.800 | .060 |
| Intercept | 26807.549 | 1 | 26807.549 | 86.133 | .000 |
| PREATTTOTAL | 2.488 | 1 | 2.488 | .008 | .929 |
| POSTATTIGROUP | 5175.255 | 1 | 5175.255 | 16.628 | .000 |
| POSTATTIGENDER | 671.861 | 1 | 671.861 | 2.159 | .144 |
| POSTATTIGROUP * POSTATTIGENDER | 1077.462 | 1 | 1077.462 | 3.462 | .065 |
| Error | 49486.495 | 159 | 311.236 | | |
| Total | 1608020.000 | 164 | | | |
| Corrected Total | 57952.098 | 163 | | | |

a. R Squared = .146 (Adjusted R Squared = .125)

The experimental and control groups were subjected to Analysis of Covariance (ANCOVA) to determine if a significant interaction effect of gender and method on students attitude to basic science using peer instructional strategy and lecture method. Table 16 reveals that F (1, 159) = 3.462, p =.065> 0.05, since the P-value (.065) is greater than 0.05 level of significance, the null hypothesis was not rejected.It was concluded that there is no significant interaction effect of male

and female students on attitude of students on basic science using peer instructional strategy and conventional method.It indicates that the mean attitude score of male did not significantly differ from that of female. This shows that the interaction effect of gender was statistically insignificant.

Table 8 shows that for the main effect of method, F (1, 159) = 6.800, p = .060> 0.05.This shows that the attitude mean score of students in peer instructional strategy class were not statistically significantly different from those in conventional class. It indicates that the attitude mean score of students was statistically insignificant after their exposure to peer instructional strategy and conventional method.This reveals that the interacting effect of method was statistically insignificant.

**Discussion of Findings**

The findingsof the study indicated that peer instructional strategy enhanced students' achievement in Basic Science and Technology better than the conventional method. There was a significant difference between the mean achievement scores of students taught Basic Science and Technology using peer instructional strategy and those taught using conventional method. This finding does not agree with that of Igboko and Ibeneme (2011) who investigated the effect of collaborative/cooperative work skills on students' achievement and retention in Introductory Technology in Nigeria.The results found that there was no significant difference between the peer collaborative/cooperative learning instruction method and the lecture method as regard retention. The difference in the findings could be attributed to certain factors such as the use of unqualified teachers in the study, lack of motivation to learners and teachers or lack of it from teachers of other subjects and unconducive learning environment in the previous studies of which were controlled to some extend in this study. The teachers used in this study were qualified teachers of Basic Science who indicated interest for this study.

However, the present finding agrees with that of Gok (2012), Ezenwosu and Nworgu (2013) and Yurtand Aktas (2016). Gok investigated the effect of peer instruction on students' conceptual learning and motivation in Technical Vocational School University of Higher Education Izmir, Turkey. Peer instruction was found to be more effective than using the lecture method. Ezenwosu and Nworgu investigated the efficacy of peer tutoring and gender on students' achievement in Biology in Aguata of Anambra State Nigeria. Peer tutoring was found to be more effective in promoting students' achievement than those taught Biology using the conventional method. The finding from Mcknight (2015) is also in tandem with the present study.Mcknight carried out a study on the effect of using peer instructions on State College students' achievement in an introductory Biology unit in genetics in Palm Bay, Florida of Brevard County. The focus of the study was to examine the effect of peer instruction in a State College classroom and achievement in Biology unit in genetics. Findings of the study revealed that, with respect to effect of peer instruction strategy resulted in students' achievement in Biology unit in genetics was better than when compared to the conventional teaching method.

Peer Instructional Strategy improved students' achievement in Basic Science and Technology better than the Conventional method. There is a significant difference between the mean achievement scores of students taught Basic Science and Technology using peer Instructional Strategy and those taught using Conventional method. This result was expected as a qualified teacher carefully planned the lesson, provided adequate time for interaction among peers and structured the task that was given.This is because peer instructional strategy was an interactive strategy in which students were opportune to be active participants and learners and teachers were interested or willing to be used in the study, while the control group depended on the teacher.

The second finding revealed that the conventional method has slight effect on students' attitude towards basic science than the peer instructional strategy. The slight difference could be attributed to students who are shy in class to contribute among their peers group as peer instructional strategy required individual active participation in the learning process. However,

there is no significant difference in the mean scores rating attitude of students using peer instructional strategy and those using conventional method. Hence, it was concluded that the meanattitude rating scores difference between the experimental group and the control group was insignificant. This is because Peer Instructional Strategy and Conventional method did not show any significant effect on students' attitude towards learning Basic Science and Technology. This finding corroborates with that of Foley and Mcphere (2008) who investigated on students' attitude towards science in classes using hands-on or textbook based curriculum and found that students in the hands-on classes were generally more favourable to science and had a better understanding of the nature of science than students in the textbook classes but their differences in attitude do not correlate significantly with test scores. However, the study is contrary to that of Maliki (2013) whose finding indicated significant sex differences in the attitude rate of students towards the teaching profession.The study also supports that of James and Awe (2014) who found that students' gender had no effect on students' achievement and attitude towards science.Hence, peer instructional strategy is an innovative learning strategy that is gender- friendly for both sexes.

The third finding reveals that, the conventional method has positive effect on female students' attitude towards basic science and Technology more than the male students in the same class. However, there is no significant difference exist in the mean rate scores of students' attitude towards basic science using conventional method.This finding is in disagreement with that of Ozdemir (2012) who research on high school students' attitude towards geography courses in Turkey and found that students had negative attitude towards learning the subject due to non-use of innovative methods by teachers. In the same manner, in a study by Mohammed and Waheed (2011) on secondary students'attitude towards mathematics in a selected school of Malaysia found that students have positive attitude towards mathematics at a medium level. This difference in the findings could be attributed to students' lack of knowledge in differentiating methods of teaching of their teachers due to their age different, individual interest, perception different and the different environment in which the learning take place.

Furthermore, the fourth finding of the study reveals that, peer instructional strategy has effect on female students' attitude towards basic science and Technology than the male students in the same class. However, there exist no significant difference between the male and female students mean rate attitude after controlling the effect of pre-test mean attitude rating.This finding disagrees with that of Ozdemir (2012) who researched on High school students' attitude towards Geography courses in Turkey and found that students have negative attitude towards learning the subject due to lack of using innovative methods by teachers. In the same manner, in a study by Mohammed and Waheed (2011) on secondary students' attitude towards Mathematics in a selected school of Malaysia found that students have positive attitude towards Mathematics at a medium level. This difference in finding could be attributed to students' lack of knowledge in differentiating methods of teaching of their teachers due to their age difference, individual interest, perception difference and the different in environment in which learning take place.

The last of this finding of the study also found that there is no significant interaction effect of methods of interaction and gender on students' attitude in basic science. The fact that male and female students were exposed to two different strategies could have produced a resultant effect on the final attitude of all students,when two independent variables are involved in a research design (in this case two), there is more to consider than simply the 'main effect' of each of the independent variables or factors. That is, the effect of one independent variable on the dependent variable of interest may not be the same at all levels of the other independent variable.Another way to put this is that the effect of one independent variable (method) may depend on the level of the other independent variable (gender). In order to find an interaction, a factorial design was involved in which the two independent variables (method and gender) are 'crossed' with one another so that there are observations at every combination of levels of the two independent variables. In the present study they never crossed and this is indicated by the fact that there was no interaction effect of method and gender on students' attitude in Basic Science and Technology.

## RECOMMENDATIONS

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

1. The students were taught using Peer Instructional Strategy; hence Basic Science and Technology teachers should not only guide the students on the subject matter but allow them to interact with one another, so that the students can take charge on how they can learn. This can foster confidence in the students and enhance their achievement in Basic Science and sciences in general.
2. The school administrators should provide adequately for Basic Science and Technology teachers to take refresher courses in novel instructional strategies such as peer instructional strategy.
3. Federal and State Ministries of Education, professional bodies such as Science Teachers Association of Nigeria (STAN) should organize workshops and seminars on the use of peer instructional strategy for Basic Science and Technology teachers, so that they can master the principals involved in this strategy.
4. Teachers should always employ teaching strategies like the peer instructional strategy to allow both male and female students to be actively engaged in the learning processes for meaningful learning to occur.
5. Faculties of Education should organise seminars and in-service courses based on peer instructional strategy for serving teachers so that they can have adequate knowledge about the strategy. Teachers who attended the programme should be certificated to enhance their profession.

## REFERENCES

Adejoh, M.J. (2012). Improving the quality of Integrated Science and Introductory Technology curricular in secondary schools. *Nigerian Journal of Teachers Education and Teaching,4* (1), 304-311.

Adejoh, M.J.,& Ekele, G.E. (2014).*Contemporaryissuesinscience*, *technologyand Agriculturaleducation*:*Micro-teacherandAssociates*. Makurdi, Nigeria: Onimsi Press.

Adeniyi, E. O. (2012). *The 9-year basic education curriculum: Basic science and technology* Jos: Nigeria Educational Research Development Council (NERDC).

Adesoji, C.H. (2008). Effects of three models of graphic organizers on senior secondary Schoolsstudents' comprehension and attitudes to expository and narrative texts. Unpublished Doctoral Thesis, University of Ibadan, Nigeria.

Adeyemo, S. A.,&Babajide, V.F.T (2014). Effects of mastery learning approach on students' achievement in Physics. *International Journal of Scientific and Engineering Research,5* (2), 910-920.

Adeyemo, S. A. (2011). The effect of teachers' perception of Physics classroom learning environment on students' academic achievement in senior secondary school Physics. *International Journal of Educational Research and Technology, 2* (1), 74 81.

Agbo, F. O. Ahmed, U., Ibrahim, M.A., & Auta, A. (2016). *Assessing the relevance of Practical activities in the teaching and learning of basic science in upper basic*

*Schools in Gombe metropolis of Gombe State*. Jos, Fab Anieh Nigeria Limited.

Ajibola, M. A. (2008). Innovation and curriculum development of basic education in Nigeria: Policy priorities and challenges of practice and implementation. *Journal of International Studies, 2*(3), 12-14.

Akpan, E.U.U. (2006).Attitudinalinfluence, tochemistryandsciencestudiesinNigeria: *Amajorproblem Innationaldevelopment*: *InauguralLecturedeliveredat University of Jos,September 6th.*

Akinbobola, A. O. (2009). Enhancingstudents'attitudetowardsNigeriansenior secondary Physics through the use of cooperative, competitive and individualistic learning strategy. *Australia Journal of Teacher Education,34* (1), 29-38.

Akay, G. A. (2011).The effect of peer instruction method on the 8th grade students' Mathematics achievement in transformation geometry and attitude towards Mathematics. Thesis, Master Degree Middle East Technical University.

Arunaboka, A. (2011).Attitude of Nigerian secondary school students towards physical education and predictor of achievement in the subject.*Journal of Education Practice,2*(6), 71-78.

Ayanniyi, M.A. (2009). Effects of three modes of advance organizers on secondary students'achievement and attitude to Chemistry in Ibadan Metropolis. Unpublished Doctoral Thesis, University ofIbadan, Nigeria.

Ayua, G. A & Eriba, J. O. (2015). Influence of teachers' creative behaviours on development of entrepreneurial skills among pupils in Benue State. *JournalofResearchin CurriculumandTeaching,9* (1), 40-54.

Babajide, V. F. (2010). Rethinking students' learning outcomes in senior secondary schools Physics for sustainable development. *EducationalandScienceJournal of Policy Review and Curriculum Development, 3*(1), 1-10.

Babu, B. P. &Raju, T.J.M.S. (2013). Attitude of student teachers towards their profession. *International Journal of Social Science and Interdisciplinary Research,2* (1),2277-3630.

Churchill, W. (2010). Retrieved 17 August, 2016 from http://www.buzzle.com/articles/type-of-attitudes.html

Cirfat, A.B. (2011).Effective strategies for the teaching of STME concepts in schools in Nigeria. *APublicationofJournalScience Teachers Association of Nigeria.Vol.11-27*.

Daramola, I. S.,&Odigiri, M. (2016).*Challengesintechnical skills acquisitionand development inenhancingmanpower development inNigeria*:*Abookofreadings*.JosFabAnieh Nigeria Limited.

Duru, V. N. (2013). An investigation of perceived students study problems and study

strategies: Towards improved achievement in Basic Science. *International Journal of Research in Science Technology and Mathematics Education,1* (1), 112-123.

Enems, F.O. (2003), *JETShandbook*: *Scopeandorganization*.Enugu: Castro & Sons Publishers (Nid).

Ezenwosu, S.U.,&Nworgu, L. N (2013) Efficacy of peer tutoring and gender on students' achievement in Biology. *International Journal of Scientific and Engineering Research,4*(12), 944-950.

Federal Republic of Nigeria (2009).*NationalPolicyonEducation*. Lagos: NERDC Press,

Federal Republic of Nigeria(2009).*National policy on science and technology*. Lagos: NERDC Press.

Federal Republic of Nigeria (2012).*Nationalpolicyon*e*ducation*Abuja: NERDC Press.

Federal Republic of Nigeria (2014).*Nationalpolicyon*e*ducation* (6th edition)Abuja: NERDC Press.

Foley, B. J.,&McPhee, C. (2008). Students' attitude towards science in classes using hands-on or textbook based curriculum. *JournalofResearchinScienceTeaching*, *47* (7),1-12.

Gang, E. Y.,& Joshua, I. (2011). The teacher effectiveness in improving the attitude of students towards science technology and Mathematics education: One of the problems in National Development.*PSTAN,* 1, 85-94.

Gok, T. (2012).The effect of peer instruction on students' conceptual learning and motivation.*Asia-pacific Forum on Science Learning and Teaching,13* (1), 10 – 17.

Igboko, K. O.,&Ibeneme, O. T. (2011).Effect of collaborative/cooperative work on students' achievement and retention in Introductory Technology.*Journal of Education Federal University of Science and Technology Owerri*,*2* (3), 70-79.

James, T., & Awe, O.A. (2014).Impact of school location, gender and class size on the academic performance of Basic Science students in Lagos State.*International Journal of Research in Science, Technology and Mathematics Education*,*2* (2), *77* 85.

Jegede, S. A.,&Adedayo, J. O (2013). Enriching Physics education in Nigeria: Towards enhancing sustainable technological development. *Greener Journal of Educational Research*, *3* (2), 80-84.

Kara, A. (2009). The effect of learning theories on students' attitudes in Chemistry. *Australian Journal of Teacher Education 34(3),100-113.*

Landu, B.V. (2007). Using experiential learning strategy to teach refuse management. *STAN Integrated Science Education Series,5*, 52-54.

Lasry, N., Mazur, E.,& Watkins, J. (2008). Peer instruction: From Harvard to the two

year college. *AM. J. Phys*,*76* (11), 1066-1069.

Maliki, A. E. (2013). Attitude towards the teaching profession of students from the faculty of education Niger-Delta University. *International Journal of Social Science Research*, *1* (1), 11-18.

Mcknight, H. N. (2015). The effect of using peer instruction on state college students' *achievement in Biology unit in genetics.Doctorate dissertation.*Florida Institute of Technology, Melbovrne, Florida.

Mohamed, L.,&Waheed, H. (2011). Secondary students' attitude towards Mathematics in a selected school of Maldives in Malaysia. *International Journal of Humanities and Social Science,1* (15), 277-281.

Olorukooba, S.B. (2007). Science, technology and mathematics (STM) education is for all students: Promoting effective teaching of STM subjects in our schools through teacher preparation*. Proceedings of the 50th Anniversary conference of Science Teachers Association of Nigeria, 3-6. Lagos.*

Onah, D. U.,&Ugwu, E. L. (2010). Factors which predict performance in secondary school physics in Ebonyi north education zone of Ebonyi State in Nigeria. *Advanced in Applied Science Research,1* (3), 255-258.

Orunaboka, A. (2011).Attitude of Nigeria secondary school students towards physical education as predictor of achievement in the subject. *Journal of Education Practice,2*(6), 71-78.

Ozdemir, U. (2012). High school students' attitude towards Geography courses in Turkey.*Journal of World Applied Sciences,17* (3), 340-346.

Ozoji, B. E. (2010). Effects of concept mapping strategy and gender on students' performance in Integrated Science.A first book of readings on effective strategies for the teaching of STME Concepts in Nigeria schools. *Plateau Science Teacher Association of Nigeria 1151-168*.

Science Teachers Association Nigeria (2011).*Nigerian basic science project: Pupils' textbook one*. Lagos: Pacific Printers Nigeria Ltd.

Witty, P.,&Grotberg, E. (2012).Discovering the child's potentialities: Intelligence and attitudes*.* In C.E. Skinner (ed) *EducationalPsychology* (4th ed.) (pp. 648-678). New Delhi: PHI Learning.

Yang, J.C.,& Chen, S. Y. (2010).Effect of gender differences and spatial abilities: digital pentominoes game: *Computer in Education,* 55(3), 1220-1233.

Yurt, S. U.,&Aktas, E. (2016).The effects of peer tutoring on university students' success, speaking skills and speech self-efficacy in the effective and good speech course. *Academic Journals,* 10(11), 1035-1042.