ATTITUDE AND ACADEMIC PERFORMANCE OF SENIOR SECONDARY SCHOOL STUDENTS IN PHYSICS IN NIGERIA

Ballah Augustine Godwin[1*], Ugwumba Augustine Okoronka (Phd)[2]

[1,2]Department of Science Education, Adamawa State University, Mubi, Nigeria
*Corresponding author

Abstract

The study investigated the influence of attitude on senior secondary school students' academic performance in physics in Nigeria. Congruity theory was its theoretical framework and Expost-Facto and Co relational research designs were adopted for the study. The populations of the study were all senior secondary school three (SSSIII) students who had taken physics in the 2012/2013 academic session. Out of total population of 3271 SSSIII, 172 were randomly selected. Students' Physics Attitude Questionnaire (SPAQ) and Students' Physics Performance Test (SPPT) were administered on the selected students. Frequencies and percentages were used to determine students' attitude and their level of academic performance, the independent t-test was used to determine differences in attitude and academic performance between male and female students while the Pearson Product Moment Correlation Coefficient (r) was used to determine the relationship between attitude and academic performance. The result of these analyses showed that; students had low level academic performance; positive attitude towards physics; significant gender difference in academic performance in favour of the male students. There was no significant gender difference in attitude, and there was significant positive correlation between students' attitude and their academic performance in physics with value($r = 0.013$, $P < 0.05$). It is recommended among others that government, teachers, parents and guardians should ensure that boys and girls are given equal educational opportunities without discrimination including choose of subjects.

Keywords: 1. Attitude to Physics 2. Academic Performance in Physics, 3. Gender and attitude to Physics, 4. Gender and academic performance in Physics

INTRODUCTION

It is said that everything a man becomes in life, is a product of his attitude. Thus, the level of honesty, hard work, tolerance, team spirit, forbearance, humility, etc which he possesses and exhibits, sets the limits of success or failure of the man. This can be no less true in educational pursuits. Contrary to this view, experts in the field of education tend to place greater emphasis on the cognitive characteristics of the student when examining issues surrounding his academic attainment. This has often not produce the best results as there is not much that can be done in altering the cognitive components of an individual. On the other hand, the attitude of a person which belongs to the affective domain can be tinkered with to see if the cognitive component can produce optimal result.

Omosewo (1994) and Ikwa (2000) opined that the study of physics has been and will continue to be of tremendous importance to humanity for its ability to explain natural phenomena and everyday occurrence. However, despite the importance of physics to national development, as outlined in the National Policy of Education (FRN, 2006), it is clear from research findings that the subject has been suffering from low

ISBN: 978-605-64453-3-0

patronage and performance in both internal and external examination within and outside the country (Mankilik, 2005; Robert, 2000 and Kessel & Hannover, 2004). Additionally, Usman (2004) posited that there is gender bias in academic performance of students in science which could be attributed to poor attitude of students towards Mathematics and Science. So many reasons have been suggested as responsible for low performance in physics by different authors. For instance, Fenstermacher (1996) acknowledged that teachers and other external factors ranging from unprecedented expansion at all levels of education, lack of school facilities and equipment for effective teaching and learning of the subject contribute to poor academic performance of the students. Morakinwa (2003) believes that the poor academic performance of students in physics is attributed to teacher's attitude to their job which is reflected in their poor attendance to lessons, lateness to school, and unsavory comments about student's performance that could damage their ego as well as scarcity of physics teachers. Furthermore, Okoronka and Wada (2014) identified poor teaching methodology. In their research work on Effect of Analogy Instructional Strategy, Cognitive Style and Gender on Senior Secondary School Students Achievement in Physics in Nigeria, found the use of Instructional Strategy significantly effective on academic achievement in Physics.

On the other hand, Nzewi (2003) attributed low academic performance of students to gender bias in physics and mathematics. She posited that references were being made to some courses as 'hard' and 'soft'. For example, physical sciences and technical courses which are dominated by male were regarded as hard while and Biological sciences, Home Economics and Secretarial studies were regarded as soft and are dominated by female.

Academic achievement problems therefore have been the focal point for educators and researchers for quite some time now. This is because problems in the performance and achievement of students' school subjects are thought to be associated with their attitudes. The researcher was fascinated by this association as a result of his experience as a science student as well as a physics teacher for over a decade. The 6-3-3-4 system of education in Nigeria was fashioned in such a way that after the six years of primary education, students are allowed to sit for common entrance examination to enable them start the first phase of the next three years called the Junior Secondary School (JSS). After the first three years, students are subjected to placement and promotion examination (JSSE). The results of this examination are used by the school authorities to place students appropriately; either in arts, social sciences and or science classes at the next level (three years) called Senior Secondary School (SSS). It is observed by the researcher in some instances, where students performed below average in Integrated Science that they were cajoled into science classes because of the high demand by the government to have science students and teachers for the scientific and technological development of the society. This is not in harmony with the National Policy of Education (FRN, 2006) guidelines which stipulates that ''interest and ability should determine the individual's direction in education''.

In the researchers opinion therefore, attitude and ability must go together. This is because if a student is forced to take a course that he/she has negative attitude to; it might be very difficult for the student to perform well. In view of the fore going, the researcher is of the opinion that when students' attitude towards physics is positive, performance in the subject will be optimal.

Given this perspective, this study intends to determine among others, the gender difference in students' attitude to physics, gender difference in students' academic performance in physics as well as examine the relationship between students' attitude to and academic performance in physics.

The study is based on the Congruity theory which was developed by Osgood and Tannenbaum (1957). The theory posits that attitude is always directed towards some object which can be measured on a point scale. These objects may become linked in our mind, that is, form a bond; which may either be associative (positive link between objects) or disassociative (negative link between objects). Congruity exists when peoples evaluation of two objects (e.g. attitude and performance) that are associatively bonded are identical in magnitude and direction. For example; I love Physics and I would like to be a pilot; and I learn that students that do good in Physics are capable of becoming pilots in the future (associative bond). Similarly, congruity also exists when peoples' evaluation of two objects that are somewhat bonded, when the objects are identical in magnitude but opposite in direction, they are said to be dissociatively bonded. For example; I like Physics as a subject but I dislike Physics teachers, and I learnt that students that like Physics reject physics teachers because of poor methodology of teaching.

Congruity theory is aimed directly at situations in which a person (e.g. a student) makes an assertion about an attitude object (e.g. Physics). The theory is therefore relevant to this study in that two objects are considered to be measured (attitude and academic performance), which may either be associatively or dis-associatively bonded. If attitude and academic performance of students are associatively bonded, then the bond is said to be identical in magnitude and direction. On the other hand, if their attitude and academic performance are disassociatively bonded, then, the bond is said to be identical in magnitude but apposite in

ISBN: 978-605-64453-3-0

direction.

Three null hypotheses were stated to guide the study ($H0_1$, $H0_2$, and $H0_3$). These emanated from the Congruity theory. Congruity of individual students' attitude to physics with regard to gender as well as the individual students' academic performance in Physics with regard to gender will be tested; as in the case of hypotheses $H0_1$, $H0_2$. Depending on the type of bond formed by the male and female students; their attitude or academic performance may either be positively or negatively linked to physics.

The null hypothesis, HO_3 will also be tested to determine if the two variables are associatively bonded and are identical in magnitude and direction; which implies that there exist a significant positive relationship between attitude of students and their academic performance in physics or if the variables are disassociatively bonded; which implies that there exist a significant negative relationship between attitude of students and their corresponding academic performance in physics. This study will therefore guide the researcher in determining the attitude of students with regard to their academic performance in the subject.

Learning occurs in three domains; affective, cognitive and psychomotor domain. According to Craven and Martin (2000) affective characteristics are now being recognized for the significant interaction they have with academic performance. And so, attitude, one of the affective characteristics – is the general evaluation of people about themselves, others, other objects, events or problems. Studies on attitude generally explore how attitude influences success in school.

Attitude, therefore, affects learning in science and in particular physics (Sedlacek, 2004). In addition, Shunk and Hanson (1995) suggest that the attitude of students is likely to play a significant role in any satisfactory explanation of variable level of academic performance shown by students in their science subjects. Ogunleye (1993) in his finding reports that many students developed negative attitudes to science learning, probably due the fact that teachers are unable to satisfy their aspirations or goals. It is well known that negative attitude towards a certain subject makes learning or what to be learned in the future difficult. That is, if a student has a negative attitude towards say physics, it makes the learning of the subject difficult. Therefore developing students' positive attitudes towards science should be the most important purpose of science teaching.

Apart from the students, teachers' attitude towards science and science teaching are also important. This is because the role of the teacher as facilitator of learning and the contributions to students' achievements is enormous. For example, the classroom teacher is the one that is saddled with the responsibility of translating the learner's thoughts into action. In other words, teacher's experiences and behaviours towards the teaching – learning process in the classroom contributes greatly in shaping students attitude towards their teachers and the subject being taught. This in turn will have an effect on the students' academic performance.

Slavin (1987); Evans (1992); and Gibson (1997) were of the opinion that students taught by more experienced teachers tend to have favourable attitude towards the subject and perform at a higher level, because their teachers have mastered the content and acquired classroom management skills to deal with different types of classroom problems. Several research findings have confirmed the hypothesis that teachers' attitude either towards science or science teaching affect their students' academic performance in science (Philias, 2009).

Studies exploring the relationship between students' attitude to physics and their academic performance in physics have produced mixed results. Talton and Simpson (1985) sampled 350 physics students of 8^{th}, 9^{th}, and 10^{th} grade of Melbourne town; which comprised of 205 male and 145 female. They used Analysis of Variance (ANOVA) in the analysis of their result, which produced an F-ratio of 94.381 significant at 5% alpha-level. This showed that students' attitude towards physics has a significant predictor of students' academic performance in physics. Similarly, Anthony (1995) researched in to the relationship between senior secondary school 3 students' attitude towards the theory – backed (three – phase) technique of physics teaching and academic performance in physics. He sampled 375 subjects; 25 students each from 15 senior secondary schools in Port-Harcourt. The researcher used a 3 x 2 factorial design, and the double classification of analysis of variance as statistical tools. His result revealed a significant correlation between the students' attitude towards the technique and academic performance in physics.

In another related study, Yara (2009) examined the relationship between teachers attitude and students' academic performance in senior secondary school physics. His subjects were 60 physics teachers and 1020 senior SS2 physics students from two secondary schools each from the six senatorial districts in the south western part of Nigeria. Frequency count and simple percentages were used in the analysis of the data. The result revealed a statistically significant positive correlation between teachers' attitude towards the teaching of physics and students' academic performance in spite of the shortage of physics teachers. The finding of Okpala (1985) is in agreement with that of Yara (2009). Okpala reported that the effect of teachers' attitude towards assessment practices on students' achievement in physics correlate positively.

ISBN: 978-605-64453-3-0

On the contrary, other studies, e.g. Daniel (1995) and Osongy (1995) have not shown any significant relationship between attitude and academic performance of physics students. Daniel (1995) studied the relationship between students' attitude to physics and academic performance in West African Senior School certificate Examination (WASSCE) in physics. He used Test of Understanding Physics Concept (TOUP) as his instrument; which was administered randomly to 501 subjects from 54 SSS II students in Lagos. Analysis of Variance (ANOVA) and t-test were used to test his hypothesis. Result revealed that there was no significant correlation between students' attitude to physics and their academic performance in West African Senior School Certificate in Physics Examination. On the other hand, Osangy (1995) studied the relationship between attitude to and academic performance of physics students' of Holy Trinity Girls College Ibadan; using a sample of 59 female students. The result did not show significant relationship between the two factors; while 67% of the female students did not show positive attitude towards the subject, yet they outperformed the 33% that showed positive attitude in the subject.

Gardner's (1995) review of such research evidence offered little support for any strong relationship between attitude and academic performance in physics. Schibeci (1986) draws a strong link between the two variables, while Shrigley (1990) argues that attitude and academic performance in physics correlate only moderately. These conflicting results therefore make it difficult to generalize whether there is significant correlation between attitude to and academic performance in science and physics in particular.

PURPOSE OF THE STUDY

The purpose of the study was to determine the influence of attitude on the academic performance of SSSIII students' in physics. The study will also examine among others the level of academic performance of the students, if there is gender difference in student's attitude to physics, if there is gender difference in student's academic performance, if there is significant relationship between student's attitude and academic performance in physics and whether the relationship between student's attitude and academic performance in physics varies with gender.

Research Questions

The study answered the following research questions:
i. What is the attitude of Senior Secondary School Students towards physics?
ii. What is the level of academic performance of Senior Secondary School Students in Physics?

Hypotheses

The study tested three null hypotheses at 0.05 alpha level stated as follows:
$H0_1$: There is no significant difference between male and female students' attitude towards physics.
$H0_2$: There is no significant difference between male and female Students' academic performance in Physics.
$H\mathbf{0}_3$: There is no significant relationship between attitudes of students' towards physics and their academic performance in physics.

Methodology and Instrumentation

This study adopted an ex post facto research design in determining differences as well as correlation research design in determining relationship. Styles (2006) asserted that where it was not possible to randomly assign students to experimental treatment (i.e. having the pupils being manipulated by the researcher) and to the control treatment before administering the students' physics performance test (SPPT), an ex post facto research design is appropriate. Kerlinger (1970) defined ex post facto research as that design in which the independent variable (in this study, the students' attitude towards physics) had already occurred in the past; but a condition will be created again in order to generate the requisite data for analysis. The independent variable i.e. Students' attitude to physics was studied in retrospect to determine the possible relationship with the dependent variable i.e. students' academic performance in physics. In addition, attitude and academic performance between male and female students was compared. The population for this study consisted of all the SS III (3271) physics students' in Mubi Educational Zone of Adamawa State. The education zone comprises of 5 local government council areas which consists of 34 senior secondary schools that are offering physics.

Techniques

One school each from the five local government areas and SSS3 from each of the schools were purposively sampled. This is because these schools are located at the urban areas of the local government, and from

ISBN: 978-605-64453-3-0

experience most of the science teachers are posted to schools in the urban areas. On the other hand, SSS3 are considered to have undergone a reasonable coverage of the curriculum in physics towards the terminal SSSCE examinations. The schools selected are GSSS Madagali, GSSS Michika, GSTC Mubi/N, GSSS Mubi/S, and GSSS Maiha. The number of students per school that studied physics at the time of the study are: 410, 637, 956, 828, and 440 in the five selected respectively. Out of the Population 3271 physics students, 174 were sampled based on Robert, Morgan and Daryin (1970) sampling technique procedure table i.e. (range is 170 - 202 students). See table 1 below;

Table 1. Distribution of Population and Sample by Local Government Area, Schools and Gender

S/No	Local Government Area	Name of Schools	No. of (SS3) physics Students	No. of males Sampled	No. of females Sampled	Total No. in the Sample
1.	Madagali	Govt. Senior Sec. Sch. Madagali	220	24	10	34
2.	Michika	Govt. Senior Sec. Sch. Michika	320	15	20	35
3.	Mubi North	Govt. Science & Tech. College. Mubi	582	28	7	35
4.	Mubi South	Govt. Senior Sec. Sch. Gella	304	17	18	35
5.	Maiha	Govt. Senior Sec. Sch.Maiha	202	16	18	35
Total	5	5	1,628	100	74	174

Source: Academic Staff Records of the schools (Office of the Principal)

Students Physics Attitude Questionnaire (SPAQ) and Students Physics Performance Test (SPPT) are the two main instruments used for data collection. SPAQ is a likert scale which consists of 20 items on five rating scale responses. The responses; strongly agree (SA), agree (A), undecided (U), disagree (DA), strongly disagree (SD) were assigned value points of 5, 4, 3, 2, 1, respectively for positive statements and in reverse order for negative statements.

The SPPT covers five topics in mechanics, hydrostatics, heat energy, optics and waves in line with stipulation in the National physics curriculum. The topics were chosen because students were taught based on the curriculum content for the term under study. The test comprises of 30 physics objective questions having five options A to E within which students were expected to choose one correct alternative. Each correct answer is scored one totaling 30 marks for the 30 questions. It is converted to 100%

Validation and Reliability of the Instruments

The SPAQ has reliability index of 0.79 and was developed by Ballah (2009) whereas, the SPPT was adapted from past SSSCE (WASSCE, 2008 and 2009).

DATA ANALYSES AND RESULTS

Attitude of Students towards Physics

The research question raised was: what is the attitude of senior secondary school students towards physics? The result to this question is presented in table 2.

Table 2: Frequency Distribution of Attitude Scores of the Students in SPAQ

s/no	Attitude interval	Midpoint (x)	Frequency (f)	%	frequency		%	
					M*	F*	M*	F*
1	0 – 50	25	2	1.1	1	1	0.5	0.5
2	51 – 60	55.5	6	3.5	2	4	1.2	2.3
3	61 – 70	65.5	25	14.4	13	12	7.5	6.9
4	71 – 80	75.5	62	35.6	44	18	25.3	10.3
5	81 – 90	85.5	59	33.9	32	27	18.4	15.5
6	91 - 100	95.5	20	11.5	8	12	4.6	6.9
	Total		174		100	74		

From Table 2; Range = Highest attitude score – Lowest attitude score = 100 – 49 = 51

Note: M*=male and F* =female

ISBN: 978-605-64453-3-0

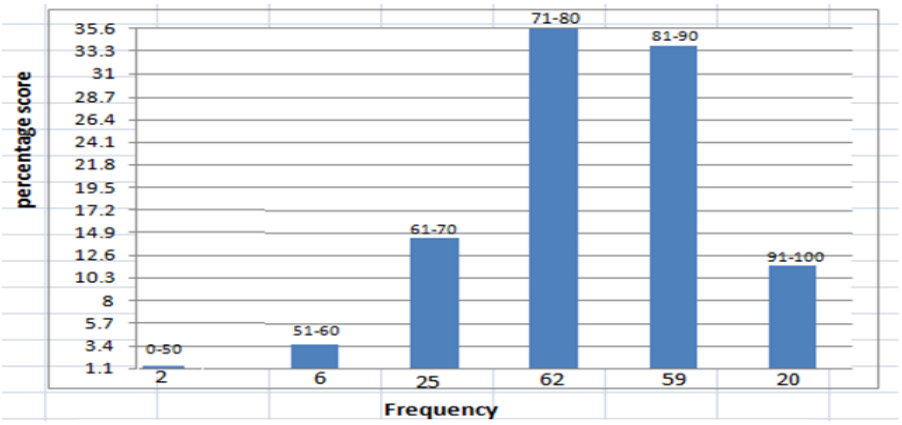

Figure 1: Frequency distribution of attitude score

Table 3: Summary of Mean, Standard Deviation and Range

N	$\dot{X}$	S.D	Range
174	67	22.8	51

The bar-chart in figure 4.1.1 is positively skewed indicating students have favourable attitude towards physics with 83.9% of the students having attitude of 61-90%. 1.1% of the students have attitude of 0-50% and 11.5% have a positively extreme attitude of 91% and above.
Table 3 further buttressed the fact that the students have favourable attitude towards physics with a mean of 67 and range of 51. This indicates a high mean score, and the difference between the least attitude score and the high attitude score is low.

Students Academic Performance in Physics

The research question raised was: what is the level of academic performance of students in physics.
The result to this question is presented in table 4

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Table 4: Frequency Distribution of Performance Scores of the Students in SPPT

s/no	performance interval	Midpoint (x)	Frequency (f)	%	frequency		%	
					M*	F*	M*	F*
1	0 – 39	19.5	57	32.8	24	33	13.8	19
2	40 – 49	44.5	60	34.4	36	24	20.7	13.7
3	50 – 59	54.5	42	24.1	26	16	14.9	9.2
4	60 – 69	64.5	10	5.8	09	01	5.2	0.6
5	70 – 79	74.5	04	2.3	04	-	2.3	-
6	80 - 89	84.5	01	0.6	01	-	0.6	-
	Total		174		100	74		

From Table 4; Range = Highest performance score – Lowest performance score = 87 – 23 = 64, therefore, 64 is the difference/distance between the highest/top scorer and the lowest/bottom scorer.
Note: M*=male and F* =female

ISBN: 978-605-64453-3-0

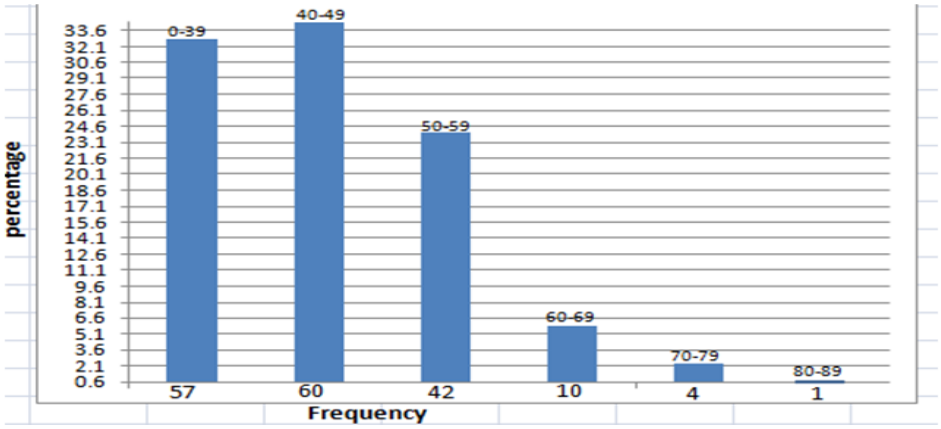

Figure 2: Frequency distribution of academic score

The bar-chart in figu performance in physics is very low with only 8.7% of the students scoring 60% and above. Also, 34.4% of the students have weak passes (40-49%) while 24.1% have strong passes and 32.8% of the students failed the test. Less than 1% (0.6%) of the students obtained excellent performance scoring between 80 and 89%.

Table 5. Summary of mean, variance and standard deviation

N	$\dot{X}$	S.D	Range
174	57	21.2	64

Table 5, further showed the fact that the students' academic performance in physics is very low with a mean of 57 and range of 64. This implies that, the mean is low and the difference between the least performance score and the highest performance score is high.

Differences in Attitude towards Physics

The null hypothesis (H_{01}) tested was: There is no significant difference between male and female students' attitude towards physics. The result of the analysis is presented in table 6

Table 6: Gender Difference in Attitude towards Physics.

Gender	N	Mean (x)	SD	df	t	p-level	remark
Male Female	100 74	78.4200 78.9189	8.90259 11.34847	172	-0.325	<.050	Significant

The result of the t-test in table 6 shows that the t-test (-0.325) is less that the alpha level (0.05) and so, the null hypothesis is not rejected indicating significant gender difference in attitude to physics in favour of the female students; with a mean and standard deviation of 78.42 and 8.90 for the male and 78.92 and 11.35 for the female; therefore the null hypothesis (H_{01}) is rejected.

Differences in Academic Performance in Physics

The null hypothesis ($H0_2$) tested was: There is no significant difference between male and female students' academic performance in physics. The result of the analysis is presented in table 7.

Table 7: Gender Difference in Academic Performance in Physics.

Gender	N	Mean (x)	SD	df	t	p-level	remark
Male Female	100 74	47.3200 40.6351	11.12998 9.14656	172	4.218	>.050	Not Significant

The result of the t-test in table 7 shows the mean (47.32) and standard deviation (11.13) of the male to be greater than that of the female with mean (40.64) and SD of (9.15). The t-test also clearly shows that there is no significant difference in academic performance between the male and the female students with t value (4.23) greater than alpha. Therefore, the null hypothesis (H_{02}) is not rejected.

Relationship between attitude to physics and academic performance in physics

The null hypothesis (H_{03}) tested was: There is no significant relationship between attitude of students' towards physics and academic performance in physics. The result of the analysis is presented in table 8

ISBN: 978-605-64453-3-0

Table 8: Correlation between Attitude and Academic Performance in Physics.

Variable	N	Mean (x)	SD	df	r	P- level	remark
Attitude	174	78.6322	9.98799	173	0.013	< 0.05	Significant
Performance	174	44.477	10.82478				

The result of the Pearson Product Moment Correlation Coefficient in Table 8 indicates that the value r= 0.013 is less than the p-level (0.05). Therefore, $H0_3$ is rejected. This implies that there is a positive and significant relationship between attitude to physics and academic performance in physics.

DISCUSSION AND RECOMMENDATIONS

For research question one which sort to determine the attitude of senior secondary school students towards physics; the results indicated that 172 (98.9%) students had strong positive attitude towards physics and only 2 (1.1%) of the students had a weak attitude towards physics. This result was in agreement with the findings of Pogge (1986) who found majority of students having positive attitude towards physics; but contrary to the findings of Angel (2004) whose result revealed that students had negative attitude towards physics pre-laboratory studies and that only 3% of the students preferred physics to other science subjects.

For research question two which sort to determine the level of academic performance of senior secondary school students in physics; the results indicated that 117 (67.2) students had a satisfactory performance; whereas, 57 (32.8%) of the students' performance was below average.

The results of hypothesis one which sort to test the gender difference in students attitude to physics indicated that a significant difference existed in attitude between male and female students' towards physics. This result was in agreement with the findings of Kost-Smith (2010); whose result also revealed a significant gender difference in attitude to physics in favour of boys. On the contrary, Hasan (2008) finding is not in congruence with this study.

The result of hypothesis two which sort to test the gender difference in academic performance of students in physics; indicated that there is significant difference in academic performance between male and female students in physics. This finding revealed that gender and ability of students failed to have any significant effect in the study of physics whereas gender and attitude to physics is significant. This study did not agree with the findings of Ikeoji (2008); Nathaniel (2006); Abdulhameed (2008) and Ajzen (2004) who all documented a significant difference in students' academic performance in physics.

The result of hypothesis three which sort to test whether there was the relationship between attitude of students towards physics and academic performance in physics; indicated that a significant relationship exists between students' attitude and their corresponding academic performance in physics. This result is in congruence with the findings of Talton and Simpson (1987); Yara (2009) ; Okpala and Onocha (1985), but contrary to the findings of Daniel (1995) and Osangy (1995) whose result did not reveal any significant relationship between students' attitude and academic performance in physics.

From the results of this study, it can be inferred that attitude alone has little or no effect on the academic performance in physics. This could probably be attributed to other factors that affect achievement such as abstract nature of the subject and the quantative nature of the concepts in physics. It is therefore recommended that students should not be cajoled to read course that is not their interest but be allowed to choose their subjects of interest. Government, teachers, parents and guardians should ensure that boys and girls are given equal educational opportunities without discrimination including the choice of subjects. Students' level of academic performance in physics could be enhanced through teacher's thorough knowledge of the subject matter and their making physics teaching and learning interesting. This can only be possible when qualified and experienced physics teachers are saddled with the responsibility of teaching the course.

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