

# **GENDER AND ACHIEVEMENTS IN SENIOR SECONDARY SCHOOL PHYSICS**

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## **Abstract**

This study set out to investigate the relationship between gender and achievement of SS III students in Physics. Correlation research design was used and stratified proportionate random sampling technique was employed. 494 subject used for the study were randomly selected from 25 secondary schools across the six education zones of Enugu State. Intact classes were used. One intact was selected by simple balloting for schools that have more than one stream studying Physics. Test of Understanding of Physics Concepts (TOUPC) was the instrument in the study while the school certificate physics examination was the achievement test for the SSCE. Results showed from the simple correlation and regression analysis a weak negative relationship between gender and TOUPC and no relationship between gender and SSCE results. Gender did not correlate significantly with students' achievement in SSCE. In conclusion, gender was significantly related to senior secondary school Physics students' understanding of physics concepts but not a significant predictor of their attainment in SSCE.

## **Introduction**

The knowledge of Physics has been found to be very essential in the understanding of modern technology and the myriads of the scientific developments useful to mankind. However, research findings on understanding of Physics concepts and achievement in Physics deduced from students' performances (whether interview or written) in solutions to problems in the Physics concepts generally show that the students do not appear to have a set of logically coherent ideas about Physics concepts. The students not only have poor knowledge of Physics concepts but also cannot relate their knowledge to practical situations in applying the principles learned. Nevertheless there are two major aspects to the difficulties that children have with learning Physics- things to be learned (Physics curriculum) and the learners (the group of children to whom the materials is to be taught). Educational psychology puts great emphasis on the anchoring ideas already established in the pupils' cognitive structure and suggested the ideas of structuring learning materials to be taught. Ausubel's famous idea to start from what the learner already knows is concerned about the processing skills the learner has available to cope with new materials.

Evidence however abound that many students approach Physics with concern about the difficulty of Physics, doubts about their own

abilities in Physics and uncertainty about its value and relevance to their lives (Orji 2000). According to him, there is the apprehension that Physics involves a lot of symbols and calculations. These feelings pose a significant challenge in their understanding of Physics concept. Thus Orji (2000) also identified learner factor to have considerable influence in understanding Physics. One of such factors is gender which may be the major factor contributing to the deplorable state of Physics education that manifests itself in low enrolment and poor achievement by Physics students.

Interest in gender and physics enrolment and achievement derives mainly from two concerns. Equality between the sexes that focuses on the need to avoid sexual discrimination in education. And for a wider interest and understanding in physics so as to eliminate the shortage of female representations in certain scientific and technical areas. Science and technology may equally change as a result of the wider participation of women. Thus if girls appear to shun choice of physics as observed in Nigeria secondary schools, female representation in scientific and technical areas will ultimately be low. Unless something is done in form of research and implementation of research findings, Nigeria would for a long time to come fit into Rivo's less developed group in which the percentage of female scientists and engineers in the country can be between 2.5% (as in Madagascar) and 9.3% (as in Togo) Ventura (1992). Again the achievement of Nigeria's Vision 20:2020 goals will be a mirage. Curriculum planners and implementers are faced with the problem of gender gap and enrolment in science education (Ukwungwu, 1999). Hence, the importance of consideration of gender as a factor in a study of this nature.

However, a comprehensive review of the literature on gender differences reveals that there has as yet not been any clear picture concerning this issue. Osisioma (1995), Johnson and Murphy, (1984), Zeltoun (1989). That gender has significant contribution on student's understanding of physics concepts and achievement has been reported by some researchers, Bomide (1986); Nworgu (1988) and Ezeife (1990), both reported in Osisioma (1995), while some research reports reveal no significant effect due to gender in students' achievement in Physics, Daramola (1983), Nkpa (1997), Lagoke, Jegede and Oyebanji (1997) and Iloputaife, (2001).

Some empirical studies have been conducted in Nigeria relevant to the present study. Most of these studies were done outside Nigeria. The available ones relevant to the present study were inconsistent because there were no general agreement among the findings. The present study further investigated the influence of gender on Physics

concept attainment in order to shed more light and help resolve the controversy.

### **Purpose**

A meta-analysis of empirical studies in gender-related differences in achievement showed that gender is related to Physics achievement, Ukwungwu (1999). It would appear that gender differences in achievement in Physics is hypothesized to give rise to the problem of gender gap in Physics. Investigations, directed at eliminating gender difference in achievement in Physics would hold immense promise for an improvement of the status of Physics education in Nigeria. In this study we are not concerned with issues of cause and effect but rather on how gender relates to senior secondary school Physics students' achievement in physics. Specifically, the study attempted to determine the relationship between gender and students' achievement in TOUPC and SSCE in Physics. The following research question guided the study.

**RQ1:** What relationship exists between gender and achievement of SS III Physics students in TOUPC and SSCE?

The following hypothesis were tested at 0.05 level of significance.

HO<sub>1</sub>: There is no significant relationship between gender and achievement of SS III physics students in TOUPC.

HO<sub>2</sub>: There is no significant relationship between gender and achievement of SS III physics students in SSCE in physics.

### **Procedure**

Correlational research design was employed in this study while stratified proportionate random sampling technique was the sampling design. 494 subject from 25 schools across the six education zones of Enugu State were selected with the help of Table of random numbers using the list of schools in the zones. Intact classes were used while simple balloting was used to select a class for schools that has more than one stream studying Physics. Test Of Understanding of Physics Concepts (TOUPC) designed by the research and school certificate Physics examination were the achievement tests for the study. TOUPC was a 36 multiple choice items with provisions for explanations of the choice of options based on the concepts of motion, force, electric current and electric circuits respectively. A scoring guide utilized a four point scale system of 0 (lowest quality answer) to 3 (highest quality answer). The face and content validation on TOUPC was validated by six experts. After the test, 48 scripts on TOUPC belonging to the subjects were drawn at random and marked differently by two experts. The inter-rater reliability was calculated using Kendall's coefficient of concordance and

it yielded a value of 0.52. The respective values for each concept were motion = 0.51, force = 0.56. Current = 0.41 and circuit = 0.40. After the SSCE results were released, the researcher visited WAEC office and collected the physics score grades of the subjects. Both correlation and simple regression analysis were employed on the data collected.

### **Results**

One research question was answered and two null hypotheses were tested in the study.

The research question is, what relationship exists between gender and achievement of SS III physics students in TOUPC and SSCE?

**Table 1:**  
**Strength of Relationship between Gender and Physics Students' Attainment in TOUPC and SSCE**

<b>Validation</b>	<b>R</b>	<b>Interpretation</b>
Gender and motion	-0.25	Weak negative relationship
Gender and force	-0.25	“
Gender and current	-0.24	“
Gender and circuit	-0.23	“
Gender and TOUPC	-0.31	“
Gender and SSCE	0.02	No relationship

Data in Table 1 above indicates that male and female SS III Physics students have weak negative relationship in their mean scores in TOUPC. The tendency is that where male students had high scores in TOUPC, female students had low scores. This indicates that increase in scores in TOUPC of male students tend to occur with decrease in scores of female students and decrease in scores of male students to occur with increase in scores of female students. This result is similar with each of the concepts examined.

Male and female SS III physics students have no relationship in their attainment in SSCE. There is therefore no consistent tendency for variation in scores in SSCE of male and female students to agree. This indicates that when male students increases in achievement, one cannot say whether the achievement of female students will decrease or increase in SSCE.

To null hypotheses were tested in the study. They are:

HO<sub>1</sub>: There is no significant relationship between gender and achievement of SS III physics students in TOUPC.

HO<sub>2</sub>: There is no significant relationship between gender and achievement of SS III physics students in SSCE in physics.

**Table 2: Regression of Students' Attainment in TOUPC and SSCE on Gender**

Variable	Multiple R	r <sup>2</sup>	Standard error	Tcal	Tcrit	Decision
Gender and motion	0.25	0.062	0.43	-5.73	1.96	S*
Gender and force	0.25	0.062	0.51	-5.79	1.96	S*
Gender and current	0.24	0.058	0.41	-5.36	1.96	S*
Gender and circuit	0.23	0.053	0.33	-5.21	1.96	S*
Gender and TOUPC	0.31	0.096	1.32	-7.17	1.96	S*
Gender and SSCE	0.02	0.00	10.52	0.41	1.96	NS*

NS\* = Not significant at P<0.05

S\* = Significant at P<0.05

Data in Table 2 indicate that the calculated t-value due to the relationship between gender and TOUPC is -7.17 while the t-critical value at 0.05 significant level(s) with 1 and 492 degrees of freedom is 1.96. since the calculated t-value is greater than t- critical, the null hypothesis of no significant relationship is rejected. Therefore, male and female SS III physics students are significantly related in their achievement in TOUPC at the 0.05 probability level. This means that the relationship between gender and TOUPC is not due to chance. The coefficient of determination  $r^2 = 0.096$  means that 9.6% is the proportion of the total variation in TOUPC that is explained by gender.

Furthermore, the calculated t-value due to the relationship between gender and attainment in SSCE is 0.41 while the t-critical value at 0.05 significant level(s) with 1 and 492 degrees of freedom is 1.96. since the calculate t-value is less than t-critical, the corresponding null hypothesis of no significant relationship was not rejected. Therefore, male and female SS III physics students were not significantly related in their achievement in SSCE at the 0.05 probability level. This means that any relationship that may be noticed is due to chance or error of research. This is evidenced by the coefficient of determination  $r^2 = 0.00$  meaning that 0% is the percentage of the variance due to the relationship.

### **Discussion**

This study sought to determine the relationship between gender and students' attainment in TOUPS and SSCE. The result of regression analysis indicate that gender had weak negative relationship with understanding of Physics concepts which was found to be significant at

0.05 probability level. The result confirms the findings of Zeltoun (1989), Bomide (1986) and Ukwungwu (1999) that gender had a role in predicting the achievement of Physics concepts. Some research findings which include Ivowi (1983), Inomiesa (1986), Nkpa (1997); Lagoke, Jegede and Oyebanji (1997), and Iloputaife (2001) showed no significant relationship due to gender. Ukwungwu (1999) in a meta-analysis of empirical studies of gender –related differences in achievement in science reported that while Ehindaro (1986), Ezeife (1990) and Momoh-Olle (1997) found that boys achieved better than girls in Physics, Atadoga (1997), Olarewaju (1997) and Ugwuanyi (1998) show that girls achieved better than boys in Physics. In the light of the anomalies, Ukwungwu resorted to integrating research results on gender differences in achievement in Physics. The gender difference effect for achievement in Physics was in favour of males. The magnitude of gender difference effect was significant.

However it can be reasoned from the weak negative relationship found in this study that boys and girls responded differently to the items in the Test Of Understanding of Physics Concepts (TOUPC). The items could be suspected to be stereotyped in gender for they might have been gender sensitive by appealing differently to different sexes. The weak negative relationship could also mean that gender influences is not just a simple phenomena always in favour of any sex but may have a complicated interaction with other factors such as understanding. This may need further investigation.

On the relationship between gender and students attainment in SSCE, the regression showed no correlation between gender and achievement of students in SSCE. Accordingly, gender of the students cannot be used to distinguish clearly the students who scored high in SSCE and those who scored low in SSCE. This finding is in agreement with Daramola (1983), Nkpa (1997), Iloputaife (2001), Harding (1992) and Okoli (1995). For instance Harding revealed that given the appropriate conditions, girls could achieve in science as well as if not better than boys while Okoli revealed that no clear evidence from research findings to show that males are more endowed intellectually than females. Stumpf and Stanley cited in Linn (1992) observed that the gender gap in science achievement is closing. The researcher observed that in Nigeria. Many parents are weak in expectation and parental support such that encouragement particularly for girl is minimal. This trend has a change to create equal favourable opportunities for both sexes to participate in Physics education for greater achievement, for science and technology may change as a result of wider participation of women who form a large bulk of our population.

### **Conclusion**

Gender was significantly related to senior secondary school Physics students' understanding of Physics concepts but not a significant predictor of their attainment in SSCE. The observed gender difference in understanding Physics concepts appears to explain gender gap in Physics education in Nigeria. Since the gender difference in attainment in physics is in favour of boys. Physics teachers should take this into consideration when teaching female students. Another implication is that being a male appears to have significantly promoted achievement in physics in school. Physics teachers should stimulate and motivate female students to compete favourably with male students. Since understanding of Physics concepts is gender related in terms, balance have to be maintained by Physics teachers so that one sex does not have undue advantage over the other especially in the mixed schools. It is recommended that to enhance participation of both sexes in Physics education for better performance, obstacles and impediments that deny girls access and hinder their participation in Physics education should be identified and removed. The requirements may be daunting; however this may hold the key to the relevant and viable physics education in the twenty first century.

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