

Commitment to Science and Gender as Determinants of Students Achievement and Practical Skills in Physics

Bamikole Oludare Ogunleye

Related papers

[Download a PDF Pack](#) of the best related papers 



[AYODELE Ph.D WORK JULY 22ND 2016 CURRENT ONE NOW](#)

Fasanya Ayodele

[Impact of physical fitness activities on students' Basic Science achievement in selected Nigerian se...](#)

Bamikole Oludare Ogunleye, Oluwasogo R. Ojo

[Students' Variables as Predictor of Secondary School Students' Academic Achievement in Science S...](#)

ABBEYTECH GLOBAL CONCEPT

Ogunleye, B. O. and Babajide, V. F. T. (2011). Commitment to science and gender as determinants of students achievement and practical skills in physics. *Journal of the Science Teachers Association of Nigeria*, 46 (1), 125-135.

Commitment to Science and Gender as Determinants of Students Achievement and Practical Skills in Physics

By

B. O. Ogunleye, Ph.D
Department of Teacher Education
University of Ibadan, Ibadan, Nigeria.
+234-8034072263
banklad2001@yahoo.com

&

V. F. T. Babajide, Ph.D
Emmanuel Alayande College of Education
Oyo, Oyo State, Nigeria
+234-8033837789
babajidevero2009@yahoo.com

Abstract

This study is premised upon the conception that students are less committed to science as well as the yet to be resolved issue of gender difference in science education. The study therefore investigated the effect of students' commitment to science and gender on their achievement and practical skills in Physics. Findings showed a significant effect of commitment to science on both students' achievement ($t=2.19$; $df=328$; $p<.05$) and practical skills ($t=2.54$; $df=328$; $p<.05$). In each case, students with high commitment to science performed better than those with low commitment to science. However, there was no significant effect of gender on both dependent variables ($p>.05$). Concerted efforts by Physics teachers, School guidance counselors and the students themselves were advocated towards improved students' commitment to science and consequent high achievement and improved practical skills in physics.

Introduction and Background

The role of science in this modern era of technology is wide and profound. In line with this reasoning, Olagunju, Adesoji, Iroegbu and Ige (2003) emphasized the importance of scientific knowledge in boosting national prestige, military might, national income and international rating of the country. According to them, science gives birth to the production of micro computers and their innovative applications which earned the developed countries such as the United States of America and Japan unparalleled national wealth, military potential and enviable national prestige.

There is no doubt that a good part of the scientific knowledge is derived from the principles of Physics. Indeed, the knowledge of Physics has led to so many inventions such as the production, application and utilization of integrated circuits, production and use of machines

and other contrivances. It also accounts for the discovery and production of hydroelectric power, gas turbine and thermonuclear power plant, telephones, refrigerators, heaters and cookers. The invention of modern technologies such as Information and Communication Technology (ICT) which has made the world a global village is also part of the benefits of Physics. Other benefits that are derivable from the knowledge of Physics include the construction of modern vehicles, rockets, nuclear bombs, missiles, diodes, computers and other electronic systems (Okoronka, 2004). The principles of radiation used in modern medicine for diagnosis and treatment, the production and use of so many appliances such as electronic gadgets and computers, surgical and astronomical instruments are all traceable to the study of Physics. The effective learning of the subject in schools is therefore desirable.

Central to any successful endeavour in life is one's commitment (Babajide, 2010). Commitment to Science is a state in which learners are willing, and desire to devote more time, energy, work, interest, affection and values to science. Commitment to science, according to Agoro (2002), includes learners' interest, attitudes, values and other affective behaviours of learners to science. Commitment to science is not merely defined in terms of students' desire to major in science courses but defined in terms of students' desire to take more courses in science, to continue reading about science, to explore new scientific topics and to be involved in science-related social issues. It is a life-long learning urge associated with science in the broadest sense. Agoro (2002) observed that all along, emphasis has only been placed on teachers' pedagogy at the expense of learners' learning. This situation has labelled the Nigerian science teacher as professionally incompetent and has resulted in poor academic performance on the part of learners. Based on this, better instructional strategies and high level of commitment on the part of learners to science subject are advocated. This is also paramount for improving learners' understanding and learning outcomes. For meaningful learning to be achieved in science therefore, learners' commitment is of great importance. If learners devote greater percentage of their time to scientific activities as well as involving themselves in science-related social issues, their achievement and practical skills would possibly improve. This can be achieved if science lessons are full of learner activities and fun that would encourage them to make self-contributions to lessons.

Similarly, Okeke (1986) and Babajide (2010) identified learners' commitment to science as part of other factors in the learning process that determine achievement in science. They argued that learners' commitment to the learning materials coupled with their deep drive or motivation to learn among other factors determine achievement which has been analysed to encapsulate knowledge, skills and attitudes (Ogunleye, 2002). These are essential ingredients for any learner to function as a competent citizen in the contemporary technology-based society. Agoro (2002) corroborated this while submitting that successful learning is related to the intrinsic motivation of learners. Hence learners can learn effectively when it originates from their own mind.

Gender has also continued to be an issue of concern to educators and researchers. This is also evident from the reports of Okebukola (2002), Longe and Adedeji (2003), Yoloye (2004) and Ezirim (2006) and a host of others. They noted that gender has impact on science education. Male supremacy and gender stereotyping are factors among others that were identified to influence occupational choice. Hence, Longe and Adedeji (2003) are of the opinion that science and technology is a male-dominated subject and that females tend to shy away from scientific and technological fields. Boys, therefore, appear to have a natural positive attitude to technical and science subjects while girls show negative attitude. This negative attitude appears to be due to the acceptance of the myth that boys are better in science subjects than girls. Babajide (2010)

further admitted that science subjects such as Physics and Chemistry are given masculine outlook by education practitioners.

Studies conducted across African countries, including Nigeria, have reported disparity in the education of girls and women in science and technology (Iyang and Ekpeyong, 2000). Also, studies by Grant (1998) and Ogunneye and Lasisi (2008) reported that more ladies are found in Biology and Chemistry than in Physics Departments of higher learning. This accounted for females' low contribution in the areas of Engineering, Medicine, Technology and by extension the development of nations. To this end, Okebukola (2002), Ogunneye and Lasisi (2008) proposed some instructional strategies to promote gender equity. The American Physical Society suggested that one of the ways of addressing women under-representation in Physics is by improving the environment in which women learn Physics.

The fact that boys recorded higher percentage of credit passes than girls in Physics in the West African Examinations Council O'Level examinations between 2002 and 2009 as a test period, is an evidence of gender inequality in Physics. For instance, in 2002, 29.20% of boys passed Physics at credit level and above as against 17.66% of girls in the same year. Also, in 2006, 34.39% of boys and 23.90% of girls passed Physics at credit level and above respectively. In line with this, Ogunleye (2002), Ogunneye (2003), Ezirim (2006) and Okwo and Otubar (2007) observed that gender has significant influence on science achievement while Agommuoh and Nzewi (2003) and Babajide (2010) found that gender has no significant influence on achievement in science. The influence of gender on achievement is therefore still a controversial one among science researchers. It is therefore imperative for more studies into the role of gender in students' achievement in science.

Raimi (2002) reported that the effect of gender on students' performance in Chemistry Practical skills acquisition was not significant. He also found that there was no significant interaction effect of treatment and gender on students' acquisition of practical skills in Chemistry. The female students were also reported to have performed better than their male counterparts in computational skills. Akale and Usman (1993) and Iroegbu (1998) also found no significant gender difference among students who were exposed to practical activities. These findings are at variance with the findings of Nwosu and Okeke (1995), Alexo Ponlou (1997), Okpala and Onocha (1998) and Adeoye (2000) who found that there was gender difference in favour of boys in relation to practical skills in science. Njoku (2002) in a study investigated the enhancement of girls' acquisition of Chemistry practical skills in co-educational schools. The study revealed that scores in practical skills depend on sex, as boys in mixed schools dominated girls in the skills of apparatus manipulation, conduct of experiment, control of variables as well as in mathematical and computational skills. Girls in single sex schools performed better than their male counterparts in mixed schools.

Shaibu and Mari's (1997) study on gender difference in acquisition of science practical skills among Junior Secondary School students in Nigeria showed that there was a significant difference in the practical skills of boys and girls but no significant difference was observed in the performance of boys and girls in the application of practical skills acquired. The students were reported to possess low understanding of science process skills while female students were significantly better in their understanding of science process skills than their male counterparts. There was also a significant difference between male and female students in the ability to solve problems requiring their understanding of the process skills.

Further, Njoku (2002) found that girls in single sex laboratory working group scored the highest mean in all the selected practical skills except in measurement skills. This means that girls in single sex group acquire more and better practical skills than their counterparts in mixed-

sex schools. It could therefore be inferred that scores in practical skills depend on sex. This implies that sex has effects on practical skills. However, with the contradictions and lack of a clear trend in gender influence in students' practical skills, more investigation has become necessary.

Objectives of the Study

The main objective of the study was to investigate the effects of commitment to science and gender on students' achievement and practical skills in Physics. The specific objectives are:

1. To find out the differences in the achievement and practical skills of Physics students who are highly committed to science and those who are poorly committed.
2. To investigate the gender differences in students' achievement and practical skills in Physics.

Based on these, the following research questions were raised;

1. Is there any significant effect of students' commitment to science on their achievement mean scores in Physics?
2. Is there any significant effect of students' commitment to science on their practical skill mean scores in Physics?
3. Is there any significant effect of gender on students' achievement mean scores in Physics?
4. Is there any significant effect of gender on students' practical skills mean scores in Physics?

Hypotheses

1. There is no significant difference in the Physics achievement mean score of students with low and high levels of commitment to science.
2. There is no significant difference in the Physics practical skills mean score of students with low and high levels of commitment to science.
3. There is no significant difference in the Physics achievement mean score of male and female students.
4. There is no significant difference in the Physics practical skills mean score of male and female students.

Method

This study is an *expost-facto* research which is causal-comparative. 330 SSII science students from twelve senior secondary schools were purposively selected for the study. The schools were selected from Oyo Township in Oyo State, Nigeria. One intact class of SSII students offering science subjects was then randomly selected from each of the selected schools. All students in the selected classes participated in the study. The distribution of students according to the twelve intact classes selected is presented on Table 1.

Table 1: Distribution of Students across the Selected Twelve Intact Classes

Intact Class	1	2	3	4	5	6	7	8	9	10	11	12	Total
No. of Students	32	21	43	38	27	14	19	28	36	30	22	20	330

Three instruments were developed and used for the study. They are:

1. Students Commitment to Science Questionnaire (SCOSQ)
2. Physics Achievement Test (PAT) and
3. Practical Skills Test (PST)

SCOSQ was used to categorise Physics students into low and high levels of commitment to science. It consists of two sections, A and B. Section A contains gender as the only demographic variable while Section B contains twenty-four items. These cover the desire and urge to pursue science endeavors, involvement in scientific activities, acquisition and development of basic practical skills, scientific methods and attitudes. The 4-point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D) to Strongly Disagree (SD) was used in presenting the items.

PAT was designed to measure achievement of students in Physics at the knowledge, comprehension and thinking levels of cognitive development. It consists of 30 multiple-choice objective questions drawn from the concepts of temperature, heat energy and humidity and their measurement which are concepts in the SSS Physics curriculum.

The PST was used to test students' abilities to follow some procedural steps in performing experiments correctly and accurately. It also tests students' skills of reporting correctly the experiment they have performed and abilities to make some deductions on the experiment performed. Two experiments based on the determination of the specific heat capacity of a metal block and melting point of naphthalene by plotting a cooling curve was used. Some procedural steps to carry out the experiments were provided after which ten questions follow each experiment making a total of twenty questions in all.

The three instruments were subjected to face and construct validity procedures in which two science educators critiqued the items and statements. This ensured that the various items actually tested what they intended to test. The three instruments were also administered to 30 SSII Physics students in a school that was not part of the study. The reliability coefficient of 0.88 for SCOSQ using Cronbach method, KR-20 value of 0.86 for PAT and a split half reliability index of 0.87 for PST were obtained.

Data collection was carried out by administering the three instruments across the twelve schools with the assistance of twelve research assistants who are secondary school science teachers. Data were analysed using the inferential statistic of independent samples t-test.

Findings and Discussion

H₀₁: There is no significant difference in the Physics achievement mean score of students with low and high levels of commitment to science.

Table 2: T-test of Physics Achievement scores of Students with Low and High Commitment to Science.

COMMITMENT TO SCIENCE	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig.
High	165	30.48	7.79	.61	2.19	328	.03*
Low	165	28.64	7.42	.58			

*significant of $p < .05$

Table 2 shows that students with high levels of commitment to science obtained higher mean achievement score (Mean = 24.64; SD=7.42). This difference is found to be significant ($t=2.19$; $df=328$; $p<.05$). This implies that Physics students' level of commitment to science has a significant effect on their achievement in Physics, hence, hypothesis 1 is rejected.

H₀₂: There is no significant difference in the Physics practical skills mean score of students with low and high levels of commitment to science.

Table 3: T-test of Practical Skills Scores of Students with Low and High Commitment to Science

COMMITMENT TO SCIENCE	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig.
High	165	27.29	9.29	.72	2.54	328	.01*
Low	165	24.65	9.63	.75			

*significant of $p<.05$

From Table 3, students with high commitment to science obtained a mean practical skill score which is higher (Mean = 24.65; SD=9.63). The difference is also to a significant extent ($t=2.54$; $df=328$; $p<.05$). Hence, students' level of commitment to science has a significant effect on their Physics Practical Skills. Hypothesis 2 is therefore rejected.

H₀₃: There is no significant difference in the Physics achievement mean score of male and female students.

Table 4: T-test of Male and Female Students' Achievement in Physics

GENDER	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig.
male	188	29.62	8.21	.59	.15	328	.88
female	142	29.49	6.88	.58			

Table 4 shows that the male students obtained higher mean achievement score in Physics (Mean = 29.62; SD=8.21) than their female counterparts (Mean = 29.49; SD=6.88). However, this difference is not significant ($t=.15$; $df=328$; $p>.05$). Hence, it is concluded that there is no significant effect of gender on students' achievement in Physics. Thus Hypothesis 3 is not rejected.

H₀₄: There is no significant difference in the Physics practical skills mean score of male and female students.

Table 5: T-test of Male and Female Students' Practical Skills in Physics

GENDER	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig.
male	188	25.86	9.33	.68	.25	328	.79
female	142	26.13	9.84	.83			

From Table 5, female students' mean practical skills score is slightly higher (Mean = 26.13; SD=9.84) than that for the males (Mean = 25.86; SD=9.33). This difference however is not significant ($t=.25$; $df=328$; $p>.05$). Hence, Hypothesis 4 is not rejected and it is concluded that gender has no significant effect on students' practical skills in Physics.

It was found that students with high commitment to science performed better than their counterparts with low commitment to science in both achievement and practical skills in Physics. This has far reaching implications for science teaching generally and Physics in particular. For achievement, the factor, when improved upon, could lead to greater urge and zeal towards the learning of Physics. Indeed, students' level of commitment as an important factor towards improved cognitive achievement in Physics poses great challenge to both teachers and learners for boosting students' commitment. Learners themselves must be willing and ready to learn. Also, science students should devote more time to scientific activities, discourse and take optimal advantage of the teaching-learning situation.

More importantly, laboratory activities, experiments and problem-solving opportunities should form the greatest part of science education in the schools as this would further help students to practice more, handle apparatus, manipulate equipments and attempt the use of science-process skills. The more students practice, the more they sharpen their process skills, the more they would become more committed to science endeavours and the more they would acquire and improve upon their practical skills. Above all, efforts should be made to motivate students to become more committed to science while students who possess science aptitude should be identified and placed in the science class at the point of entry into the Senior Secondary School. These students definitely would require little prodding as they are intrinsically motivated to learn science.

On gender, this study has shown that the era of male dominance and supremacy in science learning is fast winding up. With scores of male and female students not significantly different both in achievement and practical skills, gender stereotyping as well as the view of science careers being for male students are fast disappearing. The trend of boys having greater natural aptitude than girls has been proved not to be a truism by the finding of this study.

Based on these, teachers and school counselors should explore avenues, strategies and best practices in science education towards improving students' commitment to science. Also, the role of this factor in promoting students' effective learning and acquisition of practical skills in Physics should be made known to the male and female students alike in order to generate in them the much desired motivation in science learning and thereby increase their aptitude, interest, attitude and ultimately achievement and practical skills in the subject.

References

- Adeoye, F. A. 2000. Assessment procedure cognitive style and gender as determinants of students' performance in hierarchical cognitive tasks in Physics. Unpublished Ph.D Thesis, University of Ibadan, Ibadan.
- Agommuoh, P. C. and Nzewi, U. M. 2003. Effects of videotaped instruction on secondary school students achievement in Physics. *Journal of the Science Teachers Association of Nigeria* 38 (1&2) 88-93.
- Agoro, A. A. 2002. Relative effects of instruction, level of commitment and gender on student learning outcome in integrated science. Unpublished M.Ed Thesis, University of Ibadan, Nigeria.
- Akale, M. A. G. and Usman, A. 1993. Effects of practical activities on students' achievement in integrated science among junior secondary schools in Kaduna State. *Journal of Science Teachers Association of Nigeria* 28 (1&2) 102-108.
- Alexopoulou, E. 1997. Gender differences in small group discussion in Physics. *International Journal of Science Education* 19 (4) 393-406.
- Babajide, V. F. T. 2010. Generative and Predict-Observe-Explain Instructional Strategies as Determinants of Senior Secondary School Students' Achievement and Practical Skills in Physics. Unpublished Ph.D Thesis, University of Ibadan, Nigeria.
- Ezirim, M. U. 2006. Scaling up girls participation in science education: towards a score card on quality education. E. Okeke and M. Opara (Eds) *Science Teachers Association of Nigeria. Gender and STM Education Series* (1).
- Iroegbu, T. O. 1998. Problem-based learning, numerical ability and gender as determinants of achievement in line graphing skills in senior secondary Physics. Unpublished Ph.D. Thesis, University of Ibadan, Nigeria.
- Iyang, N. E. U and Ekpeyong, H. E. 2000. Influence of ability and gender grouping on senior secondary school Chemistry students' achievement on the concept of redox reactions. *Journal of Science Teachers Association of Nigeria*. 35 (1) 36-42.
- Longe, R. S and Adedeji, S. O. 2003. Increasing girls access to technical and vocational education in Nigeria. O. Ayodele-Bamisaiye, I. A. Nwazuke and A. Okediran (Eds) *Education This Millennium-Innovations in Theory and Practice*. Ibadan: Macmillan publisher Nigeria.
- Njoku, Z. C. 2002. Enhancing girls acquisition of science process skills in co-educational schools. An experience with sex grouping for practical chemistry. *Journal of the Science Teacher Association of Nigeria* 37 (1 & 2).
- Nwosu, A. A. and Okeke, E. A. C. 1995. The effects of teachers sensitization of students' acquisition of science process skills. *Journal of the Science Teachers' Association of Nigeria*. 30 (1 & 2) 39-45.
- Ogunleye, B. O. 2002. Evaluation of the Environmental Aspect of the Senior Secondary School Chemistry Curriculum in Ibadan, Nigeria. Unpublished Ph.D Thesis, University of Ibadan, Nigeria.
- Ogunneye, W. 2003. Students understanding of the concept of gradient in Physics. A case study of Physics student from Tai Solarin College of Education Ijebu Ode. *Journal of the Science Teachers Association of Nigeria* 38 (1&2) 100-106.
- Ogunneye, W. and Lasisi, I. 2008. Increasing women enrolment in Physics education: The way forward *Journal of Science Teacher Association of Nigeria* 43 (1&2) 35-43.

- Okebukola, P. A. O. 1997. And the barriers of the meaningful learning of science cause tumbling down. *Seventh inaugural lecture*, Lagos State University, December 1997.
- Okebukola, P. A. O. 2002. *Beyond the stereotype to New Trajectories in science teaching*. Published by the Science Teachers' Association of Nigeria. Printed by Taste and styles RH 13. Cultural complex Abuja.
- Okeke, E. A. C. 1986. Remedies for students' poor performance in science. Proceedings the 27th Annual Conference of the Science Teachers' Association of Nigeria 118-129.
- Okoronka, A. U. 2004. Model based instructional strategies as determinants of students learning outcomes in secondary Physics in Lagos State. Unpublished Ph.D Thesis. University of Ibadan, Nigeria.
- Okpala, N. P. and Onocha, C. O. 1998. Student factors as correlates of achievement in Physics educational. *A Journal of the British Institute of Physics* 6, 361-365.
- Okwo, F. A and Otubar, S. 2007. Influence of gender and cognitive styles on students' achievement in Physics essay test. *Journal of Science Teachers association of Nigeria* 42 (1 & 2).
- Olagunju, A. M., Adesoji, F. A., Iroegbu, T. O. and Ige, T. A. 2003. Innovations in science teaching for the new millennium. O. Ayodele-Bamisiaye, I. A. Nwazuoike and A. Okediran (Eds) *Education This Millennium-Innovations in Theory and Practice*. Ibadan: Macmillan publisher Nigeria.
- Onwioduokit, F. A. 1989. Development of students' laboratory skills using three problem-solving models in practical Physics. Unpublished Ph.D. Thesis, University of Ibadan, Nigeria.
- Raimi, S. M. 2002. Problem solving technique and laboratory skills as supplements to laboratory teaching in senior secondary school learning of volumetric analysis. Unpublished Ph.D Thesis, University of Ibadan, Nigeria.
- Shaibu, A. A. M. and Mari, J. S. 1997. Gender-related difference in understanding of science process skills amongst junior secondary schools. *Journal of Science Teachers Association of Nigeria* 32 (1&2) 21-27.
- Simpson, R. D and Troost, K. M. 1982. Influence on commitment to and learning of science among adolescent students. *Science Education* 66 (5) 763-781.
- Yoloye, T. W. 2004. *Increasing female participation in science*: Mimeograph, University of Ibadan, Nigeria.