

GENDER AND ACQUISITION OF SCIENCE PROCESS SKILLS AMONG JUNIOR SECONDARY SCHOOL STUDENTS IN CALABAR MUNICIPALITY: IMPLICATIONS FOR IMPLEMENTATION OF UNIVERSAL BASIC EDUCATION OBJECTIVES

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ABSTRACT

Science Process Skills acquisition is the foundation for the effective learning of science even at the primary or basic level of education. The acquisition of Science Process Skills helps the learner to perceive the relevance of science in everyday life. The purpose of the study therefore was to investigate Gender and Acquisition of science process skills among junior secondary school (JSS) 3 students in Calabar Municipality and the implication for implementation of Universal Basic Education objectives. One research question and two hypotheses were used for the study. Two hundred (200) JSS 3 students in three (3) co-educational schools participated in the study. A Science Process Skills acquisition (ASPA) test developed by the researchers was used for data collection. Descriptive statistics in terms of percentages was used to answer the research question, independent t-test and contingency chi-square were used to test the null hypotheses at ($p < 0.05$). The result of analysis showed that majority of the students acquired the basic Science Process Skills measured but at a very low and little above average, students who acquired Science Process Skills performed better than those who didn't acquire those skills measured and gender did not significantly influence the acquisition of Science Process Skills at the upper basic level of UBE. Based on the findings, it was recommended among others that students in the UBE scheme should be actively involved in classroom activities, and that activity-based methods of instruction be employed in teaching Basic sciences to enable a greater percentage of students to acquire Science Process Skills with higher scores for effective learning of Science subjects.

INTRODUCTION

Science Skill acquisition is the foundation for the effective learning of Science. Goldberg in Mandor (2002) defined Science as a way of explaining events and phenomena in nature and so it is a continuous search or attempts to finding more accurate description of things and events. This search leads to new discoveries or knowledge and requires skills for one to arrive at these new discoveries. Science as a body of knowledge is acquired through systematic

experimentations which involve the processes of doing sciences using the senses.

Through sense experience we learn many things about nature by asking questions and finding answers to these questions. This enables us to interact effectively with nature. Science in general helps us to have a control over the course of events in our daily lives. When we know the sequence and characteristics of an event, we are better placed to rechanneling that event for our betterment. Bajah (2000) is of the opinion that Science brings solutions to man's

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problems and improves his welfare. He further put it that science should therefore be presented as a way of finding solutions to common everyday problems or a way of understanding the physical environment in which we live.

Based on the importance of Science to human and National development, emphasis is now placed on science instruction at all levels of the Nigerian education system especially at the lower and upper levels of the Universal Basic Education (UBE). The Nigerian Educational Research and Development Council (NERDC) 2007 developed a curriculum on Basic Science for Lower Basic Education and stressed on the theme "Science and Development". This aspect was introduced into the recent Curriculum to expose UBE students to develop alongside skills that will enable them to face challenges, make decisions, develop survival strategies and live effectively within the global community.

The developments in Science and technology can only be done effectively by studying science through discovery method of instructions. (Nwosu, 1994). The most important aspect of studying Science is by developing in the learner the skills needed for acquiring scientific attitudes, which are the Science Process Skills.

Hill (2011) defines Science Process Skills as the underlying skills and premises which govern the scientific method. In other words, Science Process Skills are used to gather information about nature. Bajah (2000) sees these process skills as tools which scientists use to do science and that if children are properly introduced early to science through Process skills acquisition, will find the skills useful throughout life. He contends further that it is possible to easily forget science content(s) learnt but Process skills learnt tend to remain with individuals for a longer period. Mandor (2002) is of the opinion that Science Process skills have added quality of contributing to the students' abilities to explore their environment, answer questions and solving challenging problems.

Furthermore, Padilla (2011) defined Science Process Skills as a set of broadly transferable abilities appropriate to science discipline and reflective of what scientist do. He grouped Science Process Skills into two major types- basic and integrated. The integrated Science Process Skills are more complex, meant for solving problems in science subjects but basic skills provide a foundation for learning the

integrated skills. There are six (6) Basic Science Process Skills, namely:

- Observing,
- Communicating
- Classifying
- Measuring
- Inferring
- Predicting.

The Integrated Science Process Skills are six, namely:

- Controlling variables
- Defining operationally
- Formulating hypotheses
- Interpreting data
- Experimenting
- Formulating models.

Description of Basic Science Process Skills

- **Observing:** This involves using all the five senses to gather information about an object or event. This is the fundamental Science Process Skills in that the ability to make good observation is necessary to develop other Science Process Skills like communicating, classifying, measuring, inferring and predicting.
- **Communicating:** This involves using written and spoken words, graphs, tables, diagrams and other information presentations, including those that are technology based. Students need to have good communication skills in order to share their observations with one another in the class, so communication must be clear and effective using descriptive words for which both of them share a common understanding.
- **Classifying:** This skill involves grouping or ordering objects or events into categories based on properties or criteria. It can be binary where a set of objects is divided into two subsets or multistage system involves different layers or stages of classification.
- **Measuring:** This involves using both a standard and a non-standard measurement or estimates to describe the dimension of an object or event.
- **Inferring:** Drawing a conclusion about a specific event based on observations and data. This involves explanations or

interpretations that result from observation.

- **Predicting:** Stating the outcome of a future event based on a graph.

For the purpose of this write up, we intend to use four Basic Science Process Skills which are observing, communicating, inferring and predicting.

Gender plays a major role in achievement (Effiong, 2001) and it may be possible that gender disparities could affect the acquisition of Science Process Skills invariable achievement among students in Junior Secondary Schools. The US department of Education (1994) has observed that the type of schools (that is single or co-educational) could have some social implications and hence possible academic influence in students learning. Seymair in Mandor (2002) showed that female students preferred cooperative learning to competitive one. It is therefore possible that interaction between boys and girls in co-educational schools may enhance acquisition of Science Process Skills leading to science learning among the girls in co-educational schools than in single girls' schools. On the other hand, there is the underlying belief that boys and girls differ in their intellectual abilities and that boys, tend to be interested in task oriented subjects like the sciences than the girls (Akolonu, 2001). Viadero (1998) seems to be of the opinion that the nature of performance is the product of heredity and exposure to the environment and not of sex.

Research Question

1. To what extent have students acquired Science Process Skills at the end of the upper basic level of Universal Basic Education (UBE)?

Research Hypotheses

Ho₁: Acquisition of Science Process Skills does not significantly influence students' academic performance at the end of the upper basic level of Universal Basic Education (UBE).

Ho₂: Gender does not significantly influence the acquisition of Science Process Skills at the upper Basic level of UBE.

Methodology

The population for this study comprises all the JSS3 students in the 14 co-educational schools in Calabar Municipality, Cross River State and the sample size was made up of 200 JSS3 students drawn from three co-educational secondary schools in Calabar Municipality. Random sampling techniques were used for this study. Out of the fourteen (14) co-educational secondary schools in Calabar Municipality, three (3) schools were randomly selected. From the three schools, 70 students each were randomly sampled from two of the schools considered to be highly populated while 60 students were sampled from the remaining school with a smaller population. This gave a total population of 200 students sampled for the study. The instrument used for data collection was Science Process Skills Acquisition (SPSA). It consisted of three sections covering the UBE curriculum as follows:

- Section A:** Basic Science
Section B: Computer Education
Section C: Family life/HIV and AIDs Education

All the sections consisted of multiple choice test items. The test items were scored according to the predetermined marking scheme and the distribution of the test-items according to the skills were predetermined as well.

The research instrument received face and content validation from experts in the Faculty of Education, University of Calabar, Calabar and Faculty of Education, University of Nigeria, Nsukka. The scores obtained were analyzed using descriptive statistic (frequencies and percentage) to answer the only research question and independent t-test to analyze hypothesis 1 and contingency chi-square to analyze hypothesis 2.

RESULTS

Research Question I

To what extent have students acquired Science Process Skills at the end of the upper basic level of UBE?

This research question is answered using descriptive statistics (frequencies and percentages) as presented in Table 1.

Table 1
Acquisition of science process skills by students at the upper basic level of UBE

	Science Process Skills			
	OB	IN	CO	PR
No of students who acquired the skills	132 (66)	134 (67)	118 (59)	126 (63)
No of students who did not acquire the skills	68 (34)	66 (33)	82 (41)	74 (37)

Key: OB = Observing, IN = Inferring, CO = Communicating, PR = Predicting

Note: Numbers in parentheses are percentages

Results of findings in table I indicate that 132 (66%) students acquired the skill of observing while 68 (34%) did not. 134(67%) acquired the skill of inferring while 66(33%) did not. 118(59%) of the students acquired the skill of communicating, while 82(41) did not. 126(63%) of the students acquired the skill of predicting while 74(37%) did not.

From this result, it is observed that majority of the students acquired basic Science Process Skills.

Hypothesis I

Acquisition of science process skills does not significantly influence students' academic performance at the end of the upper Basic level of UBE

This hypothesis is tested using independent t-test analysis as presented in table 2

Table 2
Independent t-test Analysis of the influence of acquisition of Science Process Skills on Students' Academic Performance

Acquisition of Science Process Skills	Academic Performance			
	N	\bar{X}	SD	t
Students who acquired skills	134	57.51	5.68	10.1
Students who did not acquired skills	66	49.64	4.92	

Significant at .05, df = 198, critical t = 1.96

Results of analysis as presented in table 2 indicate that a calculated t-value of 10.1 was obtained. This value when compared to the critical t-value of 1.96 at 0.05 probability level and 198 degrees of freedom was found to be higher. By this result, the null hypothesis is rejected, meaning that acquisition of Science Process Skills significantly influenced students' academic

performance at the end of the upper Basic level of UBE.

In this case, students who acquired Science Process Skills performed better than those who did not acquire the skills. This is evident in their having higher mean scores and higher standard deviation than those who did not acquire the skills as indicated in Table 2.

Hypothesis 2

Gender does not significantly influence the acquisition of Science Process Skills at the upper Basic level of UBE.

This hypothesis is tested using contingency chi-square as presented in Table 3

Table 3

Chi-square analysis of the influence of gender on the acquisition of Science Process Skills

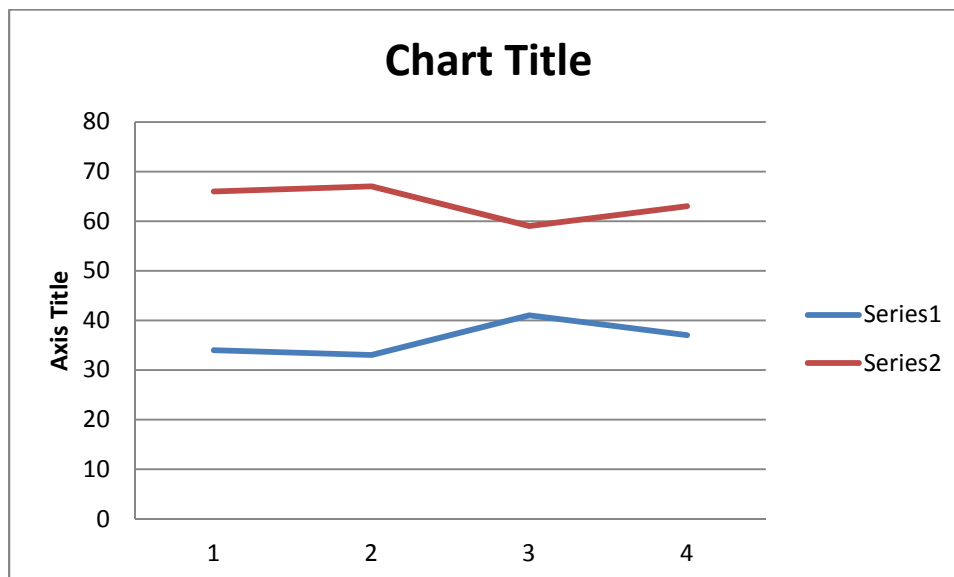
Gender	Science Process Skills					X ²
	OB	IN	CO	PR	Total	
Male	28 (25.7)	21 (20.8)	18 (19.6)	15 (15.9)	82	1.02
Female	14 (16.3)	13 (13.2)	14 (12.4)	11 (10.1)	52	
Total	42	34	32	26	134	

Key: OB = Observing, IN = Inferring, CO = Communicating, PR = Predicting
Not significant at 0.05, diff = 3, critical $x^2 = 7.81$

Results of analysis as presented in table 3 indicate that a calculated x^2 – value of 1.02 was obtained. This value when compared to the critical x^2 value of 7.81 at 0.05 probability level and 3 degrees of freedom was found to be lower, thus the hypothesis is accepted. This means that gender does not significantly influence the acquisition of Science Process Skills at the upper Basic level of UBE.

DISCUSSION**The Extent of acquisition of Science Process Skills among upper Basic level of UBE**

The findings revealed that not all the students acquired the basic Science Process Skills to help them in the learning of basic science in the UBE programme. It was observed that those who acquired the measured skills performed better than those who did not acquire the measured skills according to their percentage score in the test as seen in Table 1. This is best illustrated in the graph below



Series 1 = Percentage of students who did not acquire those measured skills

Series 2 = Percentage of students who acquired those measured skills

Acquisition of Science Process Skills on Students' Academic Performance

The finding in table 11 revealed that those students who acquired those measured skills had a mean performance score of 57.51 while those who did not acquire those skills had a mean performance score of 49.64. The result from the hypothesis revealed that acquisition of Science Process Skills significantly influenced students' academic performance at the end of the upper Basic level of UBE programme.

This finding is in line with the study conducted by Nwosu (1994) which revealed that the group who were taught using inquiry method of instruction improved on their level of acquisition of Science Process skills more than their counterparts who were taught using the conventional method. The inquiry method of instruction enables students to participate actively in the classroom; they also apply their five senses and other skills to their lessons more than when conventional approach is used in teaching. Mandor (2002) conducted a research on the Effects of Constructivist – based instructional model on acquisition of Science Process Skills among Junior Secondary Students and discovered that the experimental grouped students who were taught using Constructivist –

based method of instruction acquired Science Process Skills more than their counterparts who were taught using the conventional method of instruction. It was discovered that the students in experimental group applied their five senses to their lessons; they were actively involved in the classroom activities and were able to construct their knowledge personally based on their experiences and develop a better understanding of scientific concepts. This invariably influenced their academic performance as compared to the other group who hadn't the opportunity.

The Influence of Gender on the Acquisition of Science Process Skills

The finding in Table 3 revealed that gender does not significantly influence the acquisition of Science Process Skills at the upper Basic level of UBE.

The findings of this study appears to support the views of American Association of University Women cited in Okeke (1997) that gender difference in science achievements are small and declining.

Implications of the Study

Teachers in the Universal Basic Education Scheme need to involve their students in the classroom activities. This will enable the

students obtained first-hand information about events around them and will help them to acquire the necessary skills in solving daily lives problems. The acquisition of these skills will help them understand science concepts better than the rote learning presently practiced by most teachers in our schools system. Effective teaching arising from the use of activity – based methods of instruction will certainly affect students' acquisition of Science Process Skills and would lead to excellent performance.

A learner who is taught using activity based instructional methods, at the end of the 9 year basic education programme should be able to choose tools for his/her investigations, make appropriate observations and design ways of solving problems. Such a student would not only pass terminal examinations but would be able to acquire job skills, generate skills and be productive citizen. Such a student would be a reliably autonomous and self-reliant in the society at the end of 9 year Basic Education Programme if such a child will not proceed to senior secondary school (SSS).

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