

Relationship between Students' Science Process Skills Acquisition Scores And Academic Achievement In Biology In Anambra State

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Abstract: *The study determined the relationship between students' level of science process skill acquisition and their academic achievement in biology in Onitsha Education Zone of Anambra State. Three research questions and three null hypotheses guided the study. The design adopted for the study was correlational research design. The population of the study comprised 6,400 senior secondary school year two biology students out of which a sample of 640SS2 were obtained using a multi-stage sampling procedure. The instruments used for data collection were Test of Science Process Skills Acquisition (TSPSA) and Biology Achievement Test (BAT) validated by experts. The reliability of BAT and TSPS was established using Kuder-Richardson 20 (KR-20) to be 0.87 and 0.82 respectively. Data obtained were analyzed using Pearson correlation to answer the research questions and hypotheses were tested at 0.05 level of significance. The finding from the study was that there exists a significant positive relationship between science process skills acquisition and achievement in biology. Also, male students' science process skills correlated significantly with their biology achievement. The researcher recommended among other things that biology teachers should conduct practical exercise to demonstration and verify concepts for students as a way of modeling the requisite science process skills students must acquire for effective study of biology.*

Keywords: *Science process skills, biology, achievement*

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I. Introduction

Science is the foundation of all technological break-through and the basis for the development of a nation. Science has occupied almost all sphere of human life. The wonderful achievements of science have glorified the modern world and transformed the modern culture into scientific one. Scientists worldwide have skills with which they conduct experimental investigations that have led to the advancement of science and betterment of life. For any country to attain a meaningful level of advancement in science, priority must be placed on the promotion of scientific knowledge and skills at all levels of the education.

Science process skills have profound influence on students' academic achievement including such subject as biology. Science process skills acquisitions are needed to understand the content of science subjects including biology. Acquisition of science process skills should be a major goal of biology instruction. If these skills are not well developed, for example, relevant evidence is not collected, or conclusions are based selectively on those findings which confirm initial preconceptions and ignore contrary evidence, then the emerging concepts will not help the understanding of the world around. Science process skills facilitate learning in science, teach students research methods, help students to be active, develop students' responsibility to take part in their own learning, and increase their permanent learning. Science process skills are categorised into two types as basic and integrated process skills by (Padilla 2011). Basic process skills provide a foundation for learning the more complex integrated skills. Basic and integrated skills are grouped in the following ways according to Padilla: Basic process skills are as follows: observing, classifying, communicating, measuring, using space/time, using numbers, inferring and predicting. Integrated process skills are as follows: posing questions, controlling variables, interpreting data, formulating hypothesis, defining operationally and experimenting.

Acquisition of appropriate science process skills is necessary to cope with the academic challenges in learning science related subjects like biology, challenges present in the modern work place and the growing non-formal sectors. There would also be self-employment of the unemployed, which reduces poverty and unemployment amongst youth. To acquire such process skills and meet the varied needs of the learners therefore, teacher should conduct practical activities in biology to relate what students learn to real life. However, the extent or level of acquisition of science process skills by secondary school biology students are not widely known amongst teachers neither is the role of their levels of science process skills acquisition and their academic achievements in biology.

Biology is one of the science subjects that deal with the study of life and structure of living things. It is the study of living things and concerns itself with the study of the structure, behaviour, distribution, origin of plants and animals and their relationship with their environments. Biology is one of the science subjects in senior secondary school education that deals with the study of life (Nzewi, 2008).

A sound knowledge of biology is a prerequisite for entrance into such professions like Medicine, Forestry, Agriculture, Biotechnology and Nursing. The Importance of biology, according to Nzewi (2008) can be grouped into two namely: for individual gains and for societal gains and development. Biology helps the individual to; understand himself, the parts of a body and their functions, understand the need to maintain good health and prepare for vocational selection such as medicine, teaching, and dentistry. For societal gain and development, the study of biology involves among others many current social issues such as human overpopulation, food production, disease control, environmental conservations and human genetics. If biology is crucial to this extent, therefore, teaching of biology should be practical oriented (hand-on activities) such that students as active participants will have experience in the subject.

The study of biology in senior secondary schools using science process skills acquisition which correlates with their academic achievement thereby making students to have good knowledge of concepts and principles that will enable them face the challenges before and after graduation. According to Ibe (2004), the American Association for the Advancement of Science (AAAS) developed a programme known as "Science: A process approach (SAPA)". This programme sees science processes as true essence of science. The programme was designed to improve children's skills in the process of science. Ajunwa (2002) reported that science educators and curriculum experts modified them by either expanding or narrowing them to suit their special needs or expectations. The Nigerian Educational Research Council (NERC) in 1990 therefore, modified "Science: A process approach" and came up with fifteen science process skills. They are; observing, measuring, classifying, communicating, predicting, interfering, using number, using space and time relationship, questioning, controlling variables, defining operationally, formulating models, hypothesizing, designing experiment and interpreting data.

There is need therefore to investigate the level of science process skills acquired or possessed by secondary school biology students and how it relates to their academic achievement in biology. The necessity of the investigation is made clear by researchers like (Adeyemi, 1998; Ige, 2000) who found science process skills to be central to the teaching of science in secondary schools. Science process skills have been found to be a skill devised by the teacher to enhance a meaningful learning of science concepts and theories. Science process skills acquisition have also been found to be a primary vehicle for promoting formal reasoning skills and students understanding, thereby enhancing desired learning outcomes in students.

The necessities of science process skills notwithstanding, researchers have found shortages in the number of laboratories in Nigerian schools. They argued that many schools do not have required science facilities. Hence, students often fail to acquire science process skills because their teachers were unable to conduct biology practical as they would like to and this always had inevitable consequences for students learning (Onipede, 2003). The lack of acquisition of appropriate process skills could lead to students' low achievement in biology.

According to Nwagbo (2008), a number of factors have been identified as contributing to the non-acquisition of science process skills by secondary school students which invariably lead to poor performance. Those factors include: teacher method of teaching, poor equipped science, lack of interest by the students and many more. Nwagbo further observed that teacher-centred approach like lecture method, which places the teacher as the sole possessor of knowledge and the students as passive recipients of knowledge may not enhance achievement or promote positive attitude of students in biology. Ezeani (2004) pointed out that lecture method does not promote much achievement because it appeals mainly to the sense of hearing which encourages rote learning and regurgitation of information without necessarily aiding the learners to construct their own meaning that are consistent with their prior ideas. This method of teaching does not promote much achievement in biology since it does not immerse the students into problem solving situation thereby, leading to low achievement in biology.

Other factors have been identified to cause students' low achievement in biology. They include teachers' attitude, time constraint for conduction of practical, non-coverage of syllabus (Edomwoni-Otu & Abraham, 2011). Other factors are those of Korau (2006) and Saage (2009) who reported that such factor as the students' factor, teacher factor, societal factor, the governmental infrastructural problem, language problem, examination body related variables, curriculum related variable and home related variable have been the cause of low achievements in biology.

Academic achievement depicts students' performance on a standard of measurement such as performance test, skill test and analytical thinking test (Uwaleke & Offiah, 2013). Agboola and Oyemide (2007) described academic achievement as the gain in knowledge of students as a result of taking part in a learning programme. This implies that academic achievement is a result oriented construct that encapsulates the extent of

performance of a desired task. In Nigeria, external examination bodies like West African Examination Council (WAEC), National Examination Council (NECO) and many others were established as standard bodies to measure students' academic achievement in different subjects including biology. The picture emerging from West African Examination Council (WAEC) Chief Examiner's report 2015 has it that there is a steady decline in the performance of students in biology over the years.

It is pertinent to note that only passes at credit level is an acceptable grade in biology to qualify for admission into the university, for science and science related courses. Students' performance in Senior Secondary School Certificate Examination (SSCE) in biology from 2011-2015 shows that the average percentage failure was 40.48 while the average percentage passes at credit level was 25.76 and 33.76 for non-credit. Students are often not exposed to activities that could improve their science process skills, thus, achievement in biology continues to remain poor.

Achievement in biology could also be influenced by other learners' characteristics such as gender (Offiah & Egolum, 2007). Gender is an important variable in educational research and it has continued to be an issue of concern to educators and researchers. Longe and Adedeji (2003), Yoloye (2004) and Ezirim (2006) have noted in their studies that gender has impact on science education. Gender can be considered to be sexual classification into male and female (Ezirim, 2006). It could also mean the society-constructed roles, responsibilities ascribed to male and female by different societies. Some studies revealed that female students performed significantly higher than male students in science-related subjects (Uwaleke & Offiah, 2013). Contrary to this, Ifeakor (2004) and Offiah and Egolum (2007), in their studies, revealed that male students are academically superior to their female counterparts in science. Some studies revealed that there is no significant difference in the performance of boys and girls when taught biology and other related science subjects. The contradictory evidence in academic achievement due to gender has resulted in the need to verify how male and female students' science process skills relate to their achievement.

PURPOSE OF THE STUDY

The purpose of this study is to investigate the relationship between students' level of science process skills acquisition scores and academic achievement in biology in Onitsha Education Zone of Anambra State. Specifically, the study determined the;

1. Relationship between science process skills acquisition scores and academic achievement scores of SSII students in biology.
2. Relationship between science process skills acquisition scores and academic achievement scores of male students in biology.
3. Relationship between science process skills acquisition scores and academic achievement scores of female students in biology.

RESEARCH QUESTIONS

The following research questions guided the study.

1. What is the relationship between Science Process Skills Acquisition Scores of SS II biology students and their Achievement Scores in biology?
2. What is the relationship between Science Process Skills Acquisition Scores of SS II male biology students and their Achievement Scores in biology?
3. What is the relationship between Science Process Skills Acquisition Scores of SS II female biology students and their Achievement Scores in biology?

HYPOTHESES

The following hypotheses were tested at 0.05 level of significance:

1. There is no significant relationship between science Process Skills Acquisition scores of SS II biology students and their achievement scores in biology.
2. There is no significant relationship between Science Process Skills Acquisition Scores of SS II male biology students and their achievement scores in biology.
3. There is no significant relationship between Process Skills Acquisition Scores of SS II female biology students and their Achievement Scores in biology.

II. Method

The research design adopted for this study was correlation research design. The area of study was Onitsha Education Zone. The population of the study comprised 6,400 (2, 993 males & 3,407 females) senior secondary two (SS II) biology students in Onitsha Education Zone that enrolled for 2018/2019 academic session. The sample for the study is 640 which are 10% of 6400 of SSII biology students. Sampling was done using a multi-stage procedure. The researcher stratified the schools according to the local government areas in

which they are situated. The 15 coeducational secondary schools in the three local government areas in Onitsha Education zone were listed out. Eight out of the 15 coeducational secondary schools were selected purposive. The reason behind the selection of the schools is because they are coeducational secondary schools from the onset and not like some schools which were made coeducational at certain time and may not have adequate or proportionate number of male and female students. Secondly, the schools were selected because they have the required laboratory apparatus for the study which are functional and may not require the acquisition of new ones. In each of the schools, 80 SS2 Biology students were selected at random for the study.

The instruments used for data collection were Biology Achievement Test (BAT) and Test of Science Process Skills Acquisition (TSPSA) developed by the researcher. The BAT was used to collect data on students' achievement in biology. BAT is a fifty-item, multiple choice objective tests with four options lettered A-D developed by the researcher. BAT was developed based on the following SS2 topics: Vertebral Columns, Variation, Ecology, Food Test, Habitat, Nutrient Cycling and Bones which are part of the SS2 scheme of work. In the BAT, each correct answer is 2 marks. The total marks were 100%.

The Test of Science Process Skills Acquisition (TSPSA) was used to determine students' Science process skills acquisition. Two experiments TSPSA part I and TSPSA part II was carried out by the students. TSPSA part I was based on food tests while TSPSA part II was based on Habitats and Bones of the Vertebral Column which were part of the contents of the Achievement Test. Some procedural steps to carry out the experiments were provided. TSPSA consist of seven main questions drawn from the selected topics. TSPSA part I is 12 marks while TSPSA part II was 16 marks each for correct answer. The total marks were 100%. The scores were based on Observation, Classification, Inference, Measurement, Prediction, Counting and Using Numbers, Interpretation of Data, Experimenting, Controlling and Manipulating Variables, Communication and Hypothesizing and Knowledge of Biology.

BAT and TSPSA were validated by three experts: one from Science Education Department, the other from Department of Educational Foundations both in Nnamdi Azikiwe University, Awka, Anambra state of Nigeria and an experienced biology school teacher from Ideke Girls Secondary School, Ideke, Ogbaru Local Government Area. The reliability of the instruments (BAT and TSPSA) was established using Kuder-Richardson formula 20 (KR-20). The instruments were administered once to 45 SS 2 biology students from a school in Ihiala Local Government Area in Nnewi Education Zone of Anambra State which is outside the research area. The instruments were administered to the students and the scores obtained were subjected to reliability computation using the formula. The coefficient of internal consistency obtained for the BAT was 0.87 while the coefficient of internal consistency obtained for the TSPSA was 0.82.

The instruments were administered with the aid of the five research assistants. The research assistants who were the regular biology teachers in each school were acquainted with the purpose of the study and how to administer and collect the instrument. They were instructed to assist the students in matters confusing them when responding to the instruments. The research assistants read the instruction to the students and gave hints to ensure they complete the entire instrument. The BAT and TSPSA were administered and collected on the spot but students who were not be able to return the instruments immediately were allowed to return them to the biology teacher within two days. Data collected were analyzed using correlation coefficient and Pearson correlation. The interpretation of the correlation coefficient was according to Nwana (2007) who provided a rough guide for interpreting correlation coefficient values when a large number of pairs of scores have been correlated. They are as follows: $r = .00$, no relationship, $r = \pm .01$ to ± 0.20 , low relationship; $r = \pm .20$ to ± 0.50 , slight to fair relationship; $r = \pm .50$ to ± 0.70 , substantial relationship; $r = \pm .70$ to ± 0.99 , high relationship and $r = \pm 1.00$, perfect relationship. The null hypotheses were tested at 0.05 level of significance using the following decision rule; reject a null hypothesis if probability value (P-value) is less than 0.05 ($P < 0.05$) otherwise, do not reject the null hypothesis.

III. Results

Research Question 1: What is the relationship between Science Process Skills Acquisition (SPSA) scores of SS II biology students and their Achievement Scores in Biology?

Table 1: Pearson r on Students' Scores in SPSA and Academic Achievement Scores in Biology

Source of Variation	N	SPSA r	Achievements r	Remark
SPSA	640	1.00	0.08	Low positive relationship
Achievements	640	0.08	1.00	

Table 1 shows that there is low positive relationship of 0.08 existing between the students' science process skills acquisition scores and academic achievement scores in biology.

Research Question 2: What is the relationship between Science Process Skills Acquisition (SPSA) scores of SS II male biology students and their achievement scores in biology?

Table 2: Pearson r on Male Students' Scores in SPSA and Academic Achievement Scores in Biology

Source of Variation	N	SPSA r	Achievements r	Remark
SPSA	297	1.00	0.10	Low positive relationship
Achievements	297	0.10	1.00	

Table 2 shows that there is low positive relationship of 0.10 existing between the male students' science process skills acquisition scores and academic achievement scores in biology.

Research Question 3: What is the relationship between Science Process Skills Acquisition (SPSA) scores of SS II female biology students and their achievement scores in biology?

Table 3: Pearson r on Female Students' Scores in SPSA and Academic Achievement Scores in Biology

Source of Variation	N	SPSA r	Achievements r	Remark
SPSA	343	1.00	0.06	Low positive relationship
Achievements	343	0.06	1.00	

Table 3 shows that there is low positive relationship of 0.06 existing between the female students' science process skills acquisition scores and academic achievement scores in biology.

Hypothesis 1: There is no significant relationship between Science Process Skills Acquisition Scores of SS II biology students and their Achievement Scores in biology.

Table 4: Test of Significance of Relationship between SPSA Scores and Achievement in Biology

Source of Variation	N	SPSA r	Achievements r	P-value	Remark
SPSA	640	1.00	0.080	0.043*	Significant
Achievements	640	0.08	1.00		

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4 shows that correlation coefficient of 0.080 which exist between SPSA scores and achievement in biology is significant since the Pvalue (0.043) is less than 0.05. We reject the null hypothesis. The conclusion is that there is significant relationship between science process skills acquisition scores of SS II biology students and their achievement scores in biology.

Hypothesis 2: There is no significant relationship between Science Process Skills Acquisition Scores of SS II male biology students and their achievement scores in biology.

Table 5: Test of Significance of Relationship between SPSA Scores of Male Students and their Achievement in Biology

Source of Variation	N	SPSA r	Achievements r	P-value	Remark
SPSA	297	1.00	0.100	0.035*	Significant
Achievements	297	0.100	1.00		

*. Correlation is significant at the 0.05 level (2-tailed).

Table 5 shows that correlation coefficient of 0.100 which exist between SPSA scores of male students and their achievement in biology is significant since P value (0.035) is less than 0.05. We reject the null hypothesis. The conclusion is that there is significant relationship between science process skills acquisition scores of SS II male biology students and their achievement scores in biology.

Hypothesis 3: There is no significant relationship between Process Skills Acquisition Scores of SS II Female Biology Students and their Achievement Scores in Biology.

Table 6: Test of Significance of Relationship between SPSA Scores of Female Students and their Achievement in Biology

Source of Variation	N	SPSA r	Achievements r	P-value	Remark
SPSA	343	1.00	0.06	0.224	Significant
Achievements	343	0.06	1.00		

Table 6 shows that correlation coefficient of 0.06 which exist between SPSA scores of female students and their achievement in biology is not significant since P value (0.224) is greater than 0.05. We do not reject the null hypothesis. The conclusion is that there is no significant relationship between process skills acquisition scores of SS II female biology students and their achievement scores in biology.

IV. Discussion

The study revealed that the students' level of science process skills acquisition is positively and significantly correlated with achievement in biology. The finding of the study could be related to the fact that as students acquire science process skills, they understand the concepts in biology much better. This is because science process skills help the students to carry out experimental investigation and verification of biology concepts. Also, the acquisition of such skills as critical thinking and inferring helps the student to accurately hypothesize and conceptualize certain observations within their surroundings, thereby making biology learning more interesting. With all these skills, the students come into the position of becoming true scientists who are able to verify and concretize knowledge. The findings of the study are in line with the findings of Amaefuna (2013) who reported that students taught using science process skills methods performed better than their peers. The findings of the study differs from that of Fredrick (2008) that gender has no much influence on the science process skills acquisition on the students.

The findings of the study showed that there is significant relationship between the science process skills acquisition scores of male students and their achievement in biology. However, no significant relationship was observed between the science process skills acquisition scores of female students and their achievement in biology. The reason for the observation could be attributed to the fact that male students were more active in the practical lessons. Thus, they tend to acquire more skills than their female counterpart. Such acquisition of science process skills help to improve their achievement. The findings of the study are however, in line with that of Abungu, Okereke and Wachangu (2014) that science process skills acquisition fosters students' academic achievements more favourably for males than for females.

Riffat, Ghazala and Anjum (2011) conducted the study of relationship among Science Process Skills Acquisition, Achievement Motivation and Academic Achievement in English and Mathematics in Secondary school level. The purpose of the study was examining the relationship among Science Process Skills Acquisition, Achievement Motivation and Academic Achievement of students at the secondary schools in the district of Sargodha. Two research questions guided the study. Findings revealed that Science Process Skills Acquisition, Achievement Motivation and Academic Achievement are significantly related to the academic achievement. Again, the findings reviewed that significant gender difference were discovered which were in favour of girls. It was recommended among others that teachers must appreciate students for their achievements whether inconsequential or important as children who perceived that their teachers said positive things to them tends to achieve higher in academics.

V. Conclusion

The study establishes that academic achievement in biology improves as the level of science process skills acquired appreciates from low to moderate and high levels. The study concludes that the level of science process skills students possess positively influences academic achievement in biology especially for male students.

VI. Recommendations

The following recommendations are made in the light of the findings of the study:

1. Studies on the different science process skills, basic and integrated should be carried out and investigate on how the skills co-predict achievement in biology should be done.
2. Effect of science process skills teaching approach on students' academic achievement in biology should be carried out.
3. Studies should be conducted on the effect of laboratory teaching approach on secondary school students' acquisition of science process skills.

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