The Effect of Reasoning Skills on Students Achievement in Biology in Anambra State

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Abstract– The study sought to find out the effect of Reasoning Skills on Students Achievement in Biology in Onitsha Education Zone of Anambra State, Nigeria. A descriptive survey research design was adopted for the study. Two research questions guided the study. A sample of 400 biology students were randomly selected from 10 Secondary Schools in Onitsha Education Zone of Anambra State using stratified random sampling. Two instruments were used for the study: A questionnaire titled Test of Logical Thinking (TLT) developed by the researcher and Biology Achievement Test (BAT). Two experts in Biology, and two experts in measurement and evaluation validated the instrument. The coefficient reliability of this instrument was established using Cronbach Alpha and the value was 0.88 which was considered adequate. The TLT & BAT were administered to the 400 biology students and collected on the spots. Mean and Standard Deviation were used to analyse the data. The result showed that students with high reasoning skills performed better in biology than the students who have low reasoning skills, also that gender does not have any effect on reasoning skills of student on biology achievement. Based on the findings some recommendations were made.

Keywords: Achievement, Biology, Reasoning, Skills.

INTRODUCTION

In Nigeria today, the quest for scientific and technological knowledge has led to increased emphasis in the study of science subjects. In the secondary schools, the number of students that seat for sciences in West Africa School Certificate Examination (WASCE) is in the increase. Of these science subjects, biology attracts the largest number of the candidates (Ibegbunam and Ngini, 2011).

One of the cardinal objectives of biology syllabus as derived from National Policy on Education (FME, 2004) is to prepare students to acquire reasoning and functional scientific altitudes. The syllabus also placed an emphasis on field study; guided discovering; laboratory techniques and skills coupled with conceptual thinking. Therefore, the effective learning and need for developing the reasoning or thinking ability of the students is of great importance.

Studies have shown that helping students to develop reasoning skills is a frequently cited goal of science educators (Lawson, 2009; Ibegbuna and Ngini 2011). The National Science Teachers Association (NSTA) (1985) advocated the science teachers to help students learn and think logically, specifying that high school laboratory and field activities should emphasize not only the acquisition of knowledge but also problem solving and decision making. Infact, science process skills taught in elementary grades such as observing, classifying and collecting data act as pre-requisites for integrated process usually taught in secondary school grade like hypothesizing, controlling variables and defining operationally (Tobin & Capie 2009), such processes require high level of reasoning ability. Thus, there is direct link between formal reasoning and integrated processes such as identifying and controlling variables and hypothesizing. It is reported that formal reasoning ability was the strongest predictor of process skill achieving and retention (Tobin and Capie, 2005).

Reasoning according to Hornby (2000) is the process of thinking about things in a logical way: opinions and ideas that are base on logical thinking. Therefore reasoning is the cognitive process of looking for reasons, beliefs, conclusion, actions or feelings. Skills on the other hand is the ability to do something well (Hornby, 2000). Hence, reasoning skills are acquired in order to improve the mental ability of an individual. There are four categories of basic reasoning skills: storage skills, retrieving skills, matching skills and execution skills (Ikegbue & Ngini, 2011). The purpose of education is not merely to enable students to accumulate facts. A major goal is that by the time students graduate from school, they should be able to solve problems that are facing their societies, to achieve this goal successfully, there is need to develop higher order thinking skills e.g. strategic teaching, cognitive skills instruction, process skill instruction and Scaffold instruction. Each of these terms focus for teaching students to think more productively. Teachers need to be laying more emphasis on these terms while instructing the students .

Lawson (1982) noted that student who can reason sensibly perform perfectly well in science courses because science

does not involve guess work. The learner must reason out solution to the problem himself. These strategies motivate students, to carry our perfect experiment and draw concrete conclusions concerning a particular experiment.

Also Valanides (1996) indicated substantive differences in development of students reasoning abilities and only ninth-graders has significantly better performance than seventh graders which was related to proportional reasoning problems. Also researchers has indicated that there is no gender differences when it comes to reasoning (Valanides, 2003; Ibegbunam & Ngini, 2011). While some researchers reported significantly positive relationship between students reasoning skills and performance in science (Herron, 2008; Lawson, 2009; Bill, 2003 & Wheller and Kass 2008). Therefore, there is need to find out the effect of reasoning skills on students achievement in biology in Anambra State.

Statement of the Problem

The persistent poor performance of students in science has called for divergent investigations into the factors responsible for the problems. Many researchers have reported that the reasoning abilities of the science students have great effect on their performance. Also, very scanty literature is available on the relationship between secondary school biology students reasoning skills and their academic performance in Nigeria. Therefore the main purpose of this study is to find out: the effects of reasoning skills on students achievement in biology in Anambra State, Nigeria.

Specifically, the study will also examine:

- If there is any difference among students with high reasoning skills and those with low reasoning skills in biology achievement.
- Whether gender has any effects on students reasoning skills and biology achievement.

Research Questions

The following research questions guided the study:

- To what extent do the mean scores of students who have high reasoning skills differ from those who have low reasoning skills in Biology achievement?
- To what extent do the mean scores of boys differ from those of girls based on reasoning skills and their biology achievement?

Method

A descriptive survey research design was adopted for the study. The study was carried out in Onitsha Education Zone of Anambra State, Nigeria. Onitsha Education Zone is made up of Onitsha North, Onitsha South and Ogbaru Local Government Area. It is located in the Southern Part of Anambra North Senatorial Zone.

The population of the study comprised of all the 7,611 biology students in 29 Senior Secondary Schools in Onitsha Education Zone of Anambra State. A sample of 400 biology students were randomly selected from 10 schools in the Education zone using stratified random sampling.

Two instruments were used for the study. (i) 20 items questionnaire Titled Test of Logical Thinking (TLT) structured by the researcher to determine the formal reasoning ability of biology students. The skills tested were storage skills, retrieval skills, matching skills and execution skills; also 20 items Biology Achievement Test (BAT) was used, the BAT was drawn from general biology. The instrument was validated by two biology educators and two experts in measurement and evaluation.

Cronbach Alpha was used to establish a reliability coefficient of 0.88, this was considered adequate. Copies of the questionnaire (TLT) were distributed to the 400 biology students in their schools with the assistance of the biology teachers, students were instructed to indicate whether male or female. The TLT was collected after 30 minutes on the spot. Also, after 30 mins, the 20 items BAT were distributed and collected 30 mins on the spot. The data was analyzed using mean and Standard Deviation.

Results

Table 1: Mean scores of Biology students achievement on test of reasoning skills

Ability level	Mean $\bar{X}$	Standard deviation (SD)
High reasoning	68.26	9.25
Low reasoning	48.44	10.38

From the table 1 result, the mean score of students with high reasoning skills is 68.26 while the mean score of students with low reasoning skills is 48.44. Therefore, the result showed that students with high reasoning skills perform better in biology than the students who have low reasoning skills.

Table 2: Means score of boys and girls in Biology Achievement Test

Gender	N	Mean $\bar{X}$	Standard deviation (SD)
Boys	198	55.18	14.56
Girls	202	55.16	15.08

From table 2 results, the mean score of boys is 55.18 while the mean scores girls in 55.16. The difference in the mean scores of boys and girls is very low therefore gender does not have any effect on reasoning skills on biology students achievement.

Discussions

The finding of the study reveals that students with high reasoning skills perform better than those with low reasoning skills in Biology test. This result is in line with Lawson (1982), Herron (2005) & Ibegbunam and Ngini (2011) who noted that students who reason sensibly perform perfectly well in science courses because science does not involve guess work. Also, Herron (2005) claims that students who use concrete reasoning skills perform better than those who use low reasoning skills.

Furthermore, the study revealed that gender does not have any effect on reasoning skills and thinking achievement in biology. This result is in line with Valanides (2009) who revealed that there are no gender difference when it comes to the issue of reasoning.

Conclusion

The study which is on the effect of reasoning skills on students achievement in Biology in Onitsha Education Zone of Anambra State can be concluded that no difference exist in the reasoning skill across gender; female students used in this study made use of the reasoning skills which they have acquired almost at equal measure with the male students. Also, high reasoning students perform much higher than low reasoning students whether boys or girls. The implication is that, there is need for the classroom teacher to monitor the biology students to understand skills of need in their reasoning abilities. This has become necessary since the adequate use of reasoning skills foster academic achievement of biology students.

Recommendations

The following recommendations were made:

- Curriculum planners should include in their scheme of work teaching of basic reasoning skills to be used by students especially biology students for better performance
- The classroom teacher should monitor the use of different reasoning skills among the students
- Students should also learn how to use these reasoning skills to improve their learning which will result in high academic performance.

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