Assessing the Interpreting Skills of Biology Students in Selected Senior High Schools in Ghana

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Abstract: *The study is on assessing the interpreting skills of biology students in selected senior high schools in Ghana. The sample consisted of 114 students from both single sex and mixed Senior High Schools (SHS) offering elective biology for the West African Secondary School Certificate Examinations (WASSCE). Simple random sampling was used to select the schools which participated in the study. One single-sex girls' school, one single-sex boys' school and one mixed school were selected. The research question was answered using Kruskal-Wallis test. The results indicated that the type of school a student attends (single-sex girls, single-sex boys and mixed) school was found not to be significantly related to the performance of the students at interpreting skills. However, greater proportion of students in single-sex girls school scored higher in interpreting than their counterparts in single-sex boys and mixed schools.*

Keywords: Assessment, Performance Assessment, Dichotomous Scoring, Basic Skills Assessment Approach

1. Introduction

Assessment in education generally refers to a process for obtaining information that is used for making decisions about students, curricula, programmes and educational policy. Joshua (2005) refers to assessment as the "global process of synthesizing information about individuals so as to describe, understand and perhaps help them better" (p.7). He argues that "assessment is a process and involves the collection of meaningful information to understand and help people cope with a problem" (p.7).

Performance assessment has long been part of science education (Anthony-Krueger, 2001). According to Haertel (1992) those to be assessed in performance assessment are to "demonstrate their capabilities directly, by creating some product or engaging in some activity" (p. 984). Ossei-Anto (1996) states that "performance assessment is of many forms and shapes depending on such factors as the subject matter, the class of grade level of the students, students' previous experiences in science and the time available for the period of the assessment" (p. 9).

The keystone of performance assessment is the use of graded, authentic task. An authentic task is one in which students are required to address problems grounded in real-life contexts. In the context of science laboratory, students are graded on the performance of manipulating variables, using scientific apparatus, identifying hypotheses, making measurements and calculations, organising and managing data, and the communication of results (Slater & Ryan, 1993). Graded laboratory performances go far beyond grading a final field report – this strategy considers the processes that become the laboratory report as well. In the evaluation of a performance task, the process of performing the task is emphasised more than the final product itself.

In assessing any science process skills, one could develop assessment instrument that is valid, reliable and usable. Such instrument should also be independent, complete and unique

(ICU). According to Anthony-Krueger (2001) "to validate the construct and content of an instrument, the instrument needs to be subjected to the judgement of experts" (p. 19). Ossei-Anto (1996) was of the view that "a valid assessment instrument does not automatically make other assessment instruments valid, even if they are correlated to each other" (p. 12). It is of these reasons that the researchers decided to develop an assessment tool to assess the interpreting skills of biology students.

Interpreting as a science process skills refers to the process of organising data and drawing conclusions from it. Students can analyse and share their results by interpreting data, inferring and communicating. Recording data in a chart and making a graph helps students to look for patterns in the data and draw conclusions about what the data mean. For example, students can investigate chemical weathering by placing pieces of limestone in water and vinegar and charting the change in mass of each piece over time. Students use the chart to interpret the data and conclude that vinegar weathers more of the limestone than water. Then students can use this conclusion to infer that acid rain causes chemical weathering of limestone. Students can communicate their findings by making a line graph and writing a summary or laboratory report.

Scientific inquiry is empirical in nature. Through observation and experiments, data are gathered. Once collected, the data need interpretation so that meaning and sense can be related to the data. Interpreting and inferring are critically determinant activities of science. Information gathered from scientific investigation usually is not readily useful and meaningful to other scientists and the wider community. Data have to be analyzed and interpreted, and inferences have to be made to produce and extend knowledge which is to have usefulness and meaningful applications for life. Fom (1991) undertook research on teachers' mastery and effective use of the skill of interpreting data in the teaching and guided study of integrated science in Nigerian schools. It was found that in

spite of teachers being aware of the importance of the skill and having a high degree of mastery of the skill themselves, their students indicated that they rarely used the skill. No significant relationship was established between teachers' experience and their expertise in the use of the skill. The value and the necessity of the skill of interpreting data needs to be given greater prominence.

2. Statement of the Problem

One of the general aims of the Teaching Syllabus for Biology (Senior High School) emphasises the "development of practical skills required to work with scientific equipment, biological materials and living things" (Ministry of Education, Science and Sports [MOESS], 2008, p.ii). In line with this, the need to teach Biology is to "guide and inculcate in the learner skills in observing and measuring, formulating hypothesis, predicating and designing, investigating, recording data and interpreting results, drawing conclusions and communicating them" (MOESS, 2008, p.ii). Yet WAEC Chief Examiners for Biology have over the years (2001-2007) reported of students' weaknesses in scientific skills such as planning, performing, reasoning, interpreting and predicting. This has necessitated the need to assess the interpreting skills of biology students in selected senior high schools in Ghana.

3. Purpose of the Study

The purpose of the study was to determine whether the type of school a student attends affects their performance in interpreting biological data.

4. Research Question

What is the relationship between the type of school and the interpreting skills of SHS biology students in the senior high schools in Ghana?

5. Methodology

The research design used was survey design but the study adopted the "Basic Skills Assessment" approach or method. Basic skill assessment is a psychological assessment which is basically a judgmental process whereby a broad range of information, often including the results of psychological tests, is integrated into a meaningful understanding of a particular person. Psychological testing is thus a narrower concept referring to the psychometric aspects of a test, the actual administration and scoring of the test, and the interpretation made of the scores (Domino & Domino, 2006). Psychometric tests are standardized test designed to evaluate psychological functions; intelligence, ability, interests and values. They are pen and paper or computer based and are taken under standardized conditions. The results are quantified by reference to a scale derived from research and the answers are objectively marked and analyse to produce a score or profile. The rationale for this approach was that it would test the minimum competency in basic skills. Students were engaged in hands-on activities that were scored dichotomously as right or wrong. The weakness

of basic skill assessment or psychological testing is that it is usually not possible to control all the extraneous variables.

The population for this study was 665 senior high school 3 elective biology students offering General Science programme in the Cape Coast Metropolis in the Central Region of Ghana. There were seven schools offering the general science programme and were classified as Single-sex boys, Single-sex girls and Mixed school. There were three single-sex boys' schools, two single-sex girls' schools and two mixed (co-educational) schools.

The sample consisted of 114 students from both single sex and co-educational Senior High Schools (SHS) offering elective biology for the West African Secondary School Certificate Examinations (WASSCE). Simple random sampling was used to select the schools which participated in the study. One single-sex girls' school, one single-sex boys' school and one co-educational school were selected.

The research instrument that was developed for the study was performance assessment tasks on interpretation. On the interpreting task, students were presented with a biological data and were asked to interpret the data as far as they can. Students were also required to establish relationship between two variables on the data provided. The reliability of the instrument was established using Kuder-Richardson (K-R 20) since the tasks was scored dichotomously. Alpha value of 0.76 were obtained for the interpreting skills.

6. Results/Discussion

The research question was answered using Kruskal-Wallis test which is an alternative to ANOVA. This is because when the test of normality of distribution of scores was done using Kolmogorov-Smirnov statistics, a significant value (sig. value) of 0.001. This suggests a violation of the assumption of normality, hence Kruskal-Wallis test.
The performance of the type of school on the interpreting skills has been shown on Table 1.

Table 1: Kruskal-Wallis Analysis of Interpreting Skills by School type

Value label	Interpreting Skills
Chi-square	3.94
df	2
p – value	0.14

$P > 0.14$

The significance level was found to be 0.14 and this is greater than the alpha level of 0.05. This result suggests that there is no statistically significant difference in the interpreting skills across the three school types. By this result, one can say that the proficiency on the part of the students to interpret scientific data is the same in the three school types. This findings confirms Anthony-Krueger (2001) that competence on the part of students to interpret data depends on their experience and the degree of their participation in activities that involve interpreting data and not the type of school they attend.

The mean ranks for the school types are shown in Table 2.

Table 2: Mean Ranks for the School Types on Interpreting Skills

Type of school	N	Interpreting Skills(mean)
Single-sex boys	40	56.22
Single-sex girls	29	67.07
Mixed school	45	52.47
Total	114	

From Table 2, the mean ranks for the school types suggest that single-sex girls had the highest score (67.07) in interpreting the scientific data, with mixed school having the lowest score (52.47). This result indicates that when it comes to interpretation of scientific data, single-sex girls are the highest achievers followed by single-sex boys. This finding is in agreement with a finding by National Association for Single Sex Public Education (2005) that girls in single-sex schools are the highest achievers, followed by boys at a single-sex schools, then boys and girls at co-educational schools rounding out the bottom of the list. The finding of this study is also consistent with a finding by Lee and Bryk (1986) that pupils in single-sex schools had higher levels of achievement than pupils in coeducational schools, and that the advantages for single-sex schooling tended to be greater for girls than boys.

7. Conclusions

The study sought to determine whether the type of school a student attends affects their performance in interpreting. It can be concluded that school type was found not to be significantly related to the performance of the students at interpreting skills. However, greater proportion of students in single-sex girls scored higher in interpreting than their counterparts in single-sex boys and mixed schools.

8. Future Scope

The study focussed on some urban schools in Cape Coast Metropolis of the Central Region of Ghana. Hence, further studies can done with schools in the rural areas.

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