

Assessing the Planning Skills of Biology Students in Selected Senior High Schools in Eastern Region of Ghana

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Abstract: *This study is on assessing planning skills of biology students in selected senior high schools. One public/government science school offering biology was selected randomly and one private science school offering biology was also selected purposively for this study. A task was developed for assessing the planning skills of biology students at SHS 3. The research questions were answered using the Mann-Whitney U-test. The results indicated that males performed better than females in planning skills and the result was statistically significant. On school type, students from private schools scored higher than students from public schools on the planning skill but the result was not statistically significant. It was recommended that female science students must be given more attention in planning activities in order to arouse their interest in science and develop their planning skills. Students from both private and public school must be made to perform more science activities that require them to do planning in order to develop their planning skills.*

Keywords: Assessment, Planning skills, Psychometric testing, Performance task, Dichotomous scoring

1. Introduction

The dependence on summative written examination to assess students' ability in science subjects as undertaken in many countries around the world leads to low assessment of Scientific and Technological Literacy (STL) goals (Holdbrook, 1999). Teachers perceive that examinations place heavy restrictions on the permitted teaching approaches. It is clear that, assessment practices need to change if scientific and technological literacy is to be achieved. These assessment practices run parallel to the practices that exist in Senior High Schools in Ghana. The internal as well as West African Secondary School Certificate Examination (WASSCE) assessment had mainly been paper-and-pencil tests. But the syllabus emphasizes the learning of major conceptual themes more by the activity method than learning factual information. The current trend therefore, is to adopt assessment practices that could fairly measure performances and promote "hands-on" or activity method of learning. Ossei-Anto (1996) opined that any student in any field of study, at any level of education, should show some proficiency in acquisition of scientific skills of planning, performing and reasoning. For acquisition and exhibition of adequate proficiency in laboratory skills of planning, the students must be engaged in non-traditional and performance-based tasks. This will involve the students to have hands-on and minds-on activities to enable the students see that science is real and interesting.

2. Literature Survey

Performance assessment also referred to as Alternative assessment comprise the use of alternative assessment tools as well as the use of assessment as a learning process. The tasks used for assessment of learning can also be used as exercises through which students can further explore their

understanding and application of knowledge in a topic of study. Since they focus on both assessment of achieving and developing understanding, they help students learn the contents and skills targeted by the assessment tasks (Moorcroft, Desmrais, Hogan, & Berkowitz, 2000). Performance assessment is used to refer to assessment techniques that integrate science investigations, such as hands-on practical tasks to measure and evaluate a student's content and procedural knowledge, his/her ability to use the knowledge in reasoning and solving problems. Students are able to demonstrate their knowledge, skills and work habits through:

- 1) Manipulating and operating scientific instruments and equipment to generate relevant data.
- 2) Recording, analysing and interpreting data
- 3) Drawing relevant conclusions from data
- 4) Communicating the product of their investigation orally and in written reports.

Performance assessments are more complex than objective-type test in that they measure multiple reasoning and knowledge. Performance assessments have the potential to allow all students the opportunity to demonstrate such competencies in an active and engaging manner (Shaw, 2009). Constructing good performance assessment tasks requires considerable time. Several trial runs with students to get their input are necessary before the task can be used for the actual assessment (Shavelson & Baxter, 1992). Good performance assessment tasks are essential if they are to positively influence teaching. Therefore, educators are cautioned not to assume that changing the assessment formats will necessarily change teaching styles. Therefore, the use of performance assessments with teachers who teach to test will improve their teaching. Teaching to poorly constructed performance tests may lead to distorted hands-on science teaching. If performance assessments are to influence teaching, then the tasks and corresponding rubrics

need to be carefully constructed and scorers adequately trained.

A considerable amount of work had been done in performance assessment in Ghana. Anthony-Krueger (2001) worked on elective biology students in the central region of Ghana, and he assessed students in the skills of interpreting, inferring and predicting. He found out that students' interpretation of biological data was low. Addae (2001) worked on elective physics students in the Kumasi Metropolis and he assessed them in the skills of planning, observing and reasoning. He found out that students' skill of planning and observing was higher than their skill in reasoning. On gender and performance, there are mixed reports on the research on gender differences in science. Afuwape and Oludipe (2008) opined that there are no longer distinguishing differences in the cognitive, affective and psychomotor skill achievements of students in respect of gender. Several other researchers (Freedman, 2002; Sungur & Tekkaya, 2003) also found a similar thing in their study. Other researcher's has reported differently on this issue. Eriba and Sesugh (2006) found out that boys outperformed girls in science and mathematics achievements. Some other research studies reported that males are becoming the disadvantaged gender in schools, and that fewer males are interested in science (Alkhateeb, 2001; Omoniyi, 2006; Weaver-Hightower, 2003). Johnson (2001) found out in his study that females performed better than the males in the skill of planning. In Ghana, most females were not considered in the sciences some time ago. In a comparative study that support the above view, Awortwi (1999) referred to a Ghanaian situation and pointed out that Science, Technology and Mathematics (STM) were considered to be male preserve. Girls were therefore not engaged to participate in these subjects. The few girls who ventured to study these subjects suffered discouragement from teachers, parents, male counterparts and society at large. On the type of school a student attends, there have been several studies conducted on the effect of school type (public/private) on the achievement of students in science. Sapelli (2002) found out that the difference in scores between private schools and public schools are statistically significant, even controlling for socioeconomic background of students. The students in private schools did better than those in public schools. Seshie (2001) asserted that performance of private schools were better than that in the public schools in both planning and observing skills. Young and Fraser (1994) also stated that students demonstrated adequate skills of planning in the participating private school in his study.

Planning Skills

Planning refers to the process of deciding what to do and how to do it (Todd, 2010). Planning occurs at different levels, from day to day decisions made by individuals and families, to complex decisions made by businesses and governments. Planning is an art as well as a science. It requires judgment, sensitivity and creativity. Planning often deals with in-between issues and so requires the perception of what an artist called negative space. For example, architects are concerned with building designs while planners are concerned with the spaces between buildings. Good planning requires a methodical process that clearly

defines the step that lead to optimal solutions. This process should reflect the following principles:

- 1) Comprehensive- all significant options and impacts are considered.
- 2) Efficient- the process should not waste time or money.
- 3) Inclusive- people affected by the plan have opportunities to be involved.
- 4) Informative- results are understood by stakeholders (people affected by a decision).
- 5) Integrated- individual short-term decisions should support strategic, long-term goals.
- 6) Logical- each step leads to the next.

A principle of good planning should support strategic long-term goals (Todd, 2010). This requires comprehensive evaluation and negotiation to help people accept solutions that may seem difficult and costly in the short-term. Good planning is comprehensive, insightful and strategic. Effective planning requires correctly defining problems and asking critical questions. Planner should strive to truly understand problems, not just a single perspective or manifestation. A planning process should not be limited to the first solution proposed or the concerns of peoples who attend a meeting. Planning requires preparing for a future that is often impossible to predict, and so must incorporate uncertainty. Planners must manage information flows, including gathering, organizing and distribution (Todd, 2010). Planners should strive to be objective and fair. For example, a planning process to determine the rules that dog owners must follow in public parks should not be affected significantly whether the planners involved love or hate dogs, since decisions should reflect the community's rather than the planner's preferences. Planners must frequently shift between general concepts and specific applications. For example, a planner must be able to describe a general concept such as equity or safety, and apply these concepts when evaluating a specific policy or plan. Planners work at the intersection of many disciplines and so need basic knowledge of many subjects. Planners need many skills including the ability to:

- 1) Accurately, critically and objectively evaluate problems.
- 2) Collect and analyze data.
- 3) Apply general concepts to specific situations.
- 4) Manage complex processes.
- 5) Communicate complex issues with many types of people.
- 6) Listen respectfully.

3. Statement of the Problem

From the Chief Examiners' report (WAEC, 2006-2015) it is clear that the poor WASSCE results in biology can be attributed to lack of students' competence in the skills of planning, observing and reasoning during practical work. Reid and Shah (2007) also found in their study that students do not show satisfactory competence when confronted with practical issues in the laboratory. This was also confirmed by Ossei-Anto (1996) in his study in optics. The biology students in SHS in the Birim Central Municipality are no exception to the situation. It is of concern therefore to assess the planning skills of biology students in the SHS to determine whether they have the skill of planning.

Purpose of the Study

The purpose of the study was to determine whether Senior High School Form 3 Biology students have the skills of planning.

Research Questions

Specifically, the study was guided by the following research questions:

- 1) Is there a significant difference between the male and female elective biology students in their proficiencies in the laboratory skill of planning?
- 2) Is there a significant difference between private and public school elective biology students in their proficiencies in laboratory skills of planning?

4. Methods/Approach

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 analysed 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.

Population

All SHS year 3 elective biology students in the Birim Central Municipality of the Eastern Region of Ghana were used. Each class was made up of an average of 45 students. There were four schools offering biology with an estimated population of 180 students offering elective biology. This constituted the target population. Three of the schools are government /public schools and the other one a private school. SHS year 3 biology students were selected for the study because it was expected that they had been exposed to at least two years of teaching and learning in biology so they would have acquired some process skills in biology.

Sample and Sampling Procedure

Students from two schools were used for the study. The two schools consisted of one public and one private school. The private school was purposively sampled. This was because it was the only private school offering biology in the district. One public school was selected from among three schools using the computer generated random numbers. There was only one science class in the private school that was used for the study. In the public school, there were three science

classes but students from one class who were available during the day of the study were used. In all, 86 students were used consisting of 30 students from the private school and 56 students from the public school.

Instruments

Performance task instruments were developed and were non-traditional. The task was for planning skill. A set of tasks was given to the students and this covered the test for starch in a green leaf. The students were required to plan how to perform the task to test for starch in a green leaf. The task was given background information relevant to the problem posed. Students were given three minutes to read the task and 25 minutes to complete that task. The task was scored dichotomously.

5. Results/ Discussion

Mann-Whitney U test of the sex differences in planning skills is shown in Table 1

Table 1: Results of the Mann-Whitney U Test of the Sex Differences in Planning Skills

Sex	N	Mean Rank	Z	P- value
Male	25	60.2	-4.121	0.01
Female	61	36.66		
Total	86			

Source: field data 2011. Significance: $p < 0.05$

The result of the test for the planning skill as seen in Table 1 was statistically significant, $z = -4.121$, $p = 0.01$ (two-tailed), Mann-Whitney $U = 345.00$. The males had a mean rank of 60.20, while the females had a mean rank of 36.66. This indicates that the males performed significantly better than the females in the planning skills. A similar outcome was obtained by Ossei-Anto (1996) who found a statistically significant difference between male and female students planning a practical activity on refraction. One reason that could be assigned to this was that most of the males knew what they were about during the work and they really understood the instructions that were given to them. Most of the females however, were in haste and wanted to perform the actual task so what they presented on their paper was actually how the task will be performed. However, the outcome of this study is not consistent with other studies in this area. Johnson (2001) found out in his study that females performed better than the males in the skill of planning. Seshie (2001) also found out in his study that both males and females chemistry students engaged in laboratory work exhibited the same level of proficiency in the skill of planning. This shows that there is lack of consensus with regards to the competency level of both males and females. Beaumont-Walters and Soyibo (2001) also asserted that the scores of females on Integrated Science process skills were slightly higher than those of males.

Mann-Whitney U test of the differences between private and public school students in planning skills is shown in Table 2

Table 2: Results of Mann-Whitney U Test of the Difference between Private and Public School Students in the Planning Skills

Sex	N	Mean Rank	Z	P- value
Private	30	43.83	-0.17	0.86
Public	56	42.88		
Total	86			

Source: field data 2011. Significance: $p < 0.05$

A Mann-Whitney U test was conducted to find out students from which of the school type (public/private) is more proficient in the skill of planning. The result of the test for the planning skill was not statistically significant, $z = -0.17$, $p = 0.86$ (two-tailed), Mann-Whitney U = 821.500. The students from the private school had a mean rank of 43.83, while the students from the public school had a mean rank of 42.88. This indicates that both private and public school students were performing at a similar level. Even though the results suggest that both private and public school students are performing at similar levels, a look at the mean rank indicates that the students from the private school scored higher than the students from public school on the task of planning. The outcome of the study is consistent with the findings of the study conducted by Seshie (2001) that the performance of the participating private school was better than that in the public school in skill of planning. Young and Fraser (1994) also stated that students demonstrated adequate skills of planning in the participating private school in his study. Several factors may account for this difference.

The size of the school has been found to be contributory factor to science achievement. In general, private schools tend to be smaller than public schools (Anderson & Resnick, 1997). Smaller schools are often found to be associated with higher school performance (Darlington-Hammond, 2000). In a study of almost 6,500 at-risk eighth-grade students nationwide, Finn and Voelkl (1993) found that smaller school size was positively associated with a more nurturing environment and greater minority student engagement. Class size has also been found to influence achievement. The best evidence available indicates that smaller class sizes boost achievement (Krueger & Whitmore, 2001). This smaller class size is commonly found in the private schools. As a result of this, teachers may get ample time for the students and they may give them attention and guide them as to how to plan their scientific activities.

Private school parents tend to be more involved than their public school counterparts (Choy, 1997). Public high school teachers report that their students have greater absenteeism and poorer attitudes toward learning in the home and the school. If parents do not monitor their children, they are likely to absent themselves from school and this may affect their performance. However, in more recent studies using National Assessment of Educational Progress (NAEP) data, Lubienski & Lubienski (2006) found that mathematics and science achievement in public schools was slightly higher than that in demographically similar private schools. There are other studies that were carried out in Latin-American countries, where no differences were found between the two types of schools (Somers, McEwan, & Williams, 2004). With this, it shows that the gap between private and public schools are being bridged. It should be noted from the

results that science students from the private schools performed better than their counterparts in the public school. Educational administrators and headmasters must also ensure that they maintain a smaller class size in public schools so that the teachers can handle them effectively to bring about an improvement in their performance. Parents who have their wards in the public schools must also get involved in the day to day activities of the school as this has been found to improve performance.

6. Conclusions

The study sought to determine whether Senior High School Form 3 Biology students show satisfactory competence on the skills of planning. It can be concluded that males performed significantly better than females in the skill of planning. Students from the private school scored higher than students from the public school in the skills of planning even though the difference in their score was not statistically significant. The mean rank of the students from the private school was higher than the students from the public school.

7. Recommendations

The following recommendations are offered based on the outcome of this study:

- 1) Female science students must be given more attention in planning activities in order to arouse their interest in science and develop their planning skills.
- 2) Students from both private and public school must be made to perform more science activities that require them to do planning in order to develop their planning skills.

8. Future Scope

This study was limited to some urban schools in Eastern Region. Hence, further studies can done with schools in the rural areas.

Mann-Whitney U test was used to answer research questions one and two and this test is non-parametric, hence a weaker test. Therefore, further studies can be done with using parametric test.

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