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Assessing laboratory planning skills of selected junior high school students in selected integrated science topics

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ABSTRACT

This study assessed laboratory planning skills of selected Junior High School Students in selected integrated science topics. In all 225 students from six intact classes from Cape Coast Junior High Schools students were randomly selected for the study. The students participated in planning task. Three of the intact classes were from public schools and three from private schools. The students were assessed on 7 skills on planning task. Thus each student was expected to exhibit 7 skills in the planning task. The independent t-test, means and percentages were used to analyze data. The results of the study showed that students of JHS from the private schools performed better on the planning task as compared with students of JHS from the public schools. As a result of these findings, it was recommended that hands-on activities in the laboratory should be given a second look on our curriculum. Hands-on activities need to be encouraged more in Junior High Schools in Cape Coast Metropolis.

Introduction

Many people are of the opinion that a science performance assessment is an easy task to be carried out by anybody without any special training once the person has the initial academic knowledge relevant for the task. But this is not true because research has revealed that few people know that there is an assessment called performance assessment. Research findings support strongly the assertion that learners of all ages hold their own views about a wide range of physical phenomena prior to their formal learning of science in schools (Gunstone, 1991). A finding from a research has also shown that it is difficult for students to change their initial ideas because their own beliefs are grounded in the long personal experiences (McDermott, 1991). Performance based assessments concentrates much on the process skills that is hands-on activities as well as minds-on activities. Globally, the mode of assessing science has changed since science is tentative, therefore the mode of assessment should also change to reflect on the new methods of assessing the subject. Joshua (2005) refers to the 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). Laboratory skills assessment, as epitomized in Kruglar’s works in his physics classes at the University of Minnesota, have been in practice since 1954 (Ossei-Anto, 1996). Ossei-Anto (1996) developed and validated instruments to assess the laboratory skills of students in the high school physics science courses, and produced prototype instruments for assessing the competency levels of laboratory skills these students were demonstrating, whilst undertaking tasks in Optics.

In performance tasks on ‘’planning’’, a student is required to come out with what goes on in his or her the mind, the steps and the preparation he or she intends to undertake before taking the necessary action to accomplish a given task. Any student in the field of study and at any level needs to show some proficiency in the acquisition of the scientific skills of planning (Ossei-Anto, 1996) (p. 7). For the planning task, a check-list form of a scoring format is used to assess the student. For this reason, this study addresses the problem by developing and validating an instrument in the form (of performance tasks) used in assessing the planning skills of Junior High School students in the Cape Coast Metropolis of Ghana to find out the degree to which they possess those skills.

Purpose of the Study

The purpose of the study was to assess laboratory planning skills of selected Junior High School students in selected integrated science topics.

Statement of the Problem

According to Osborne and Freyberg (1991), the aim of science education is to enable learners to make better sense of their world by helping them to restructure their ideas in useful and usable ways.

Trends in International Mathematics and Science study (TIMSS, 2007) measures trends in mathematics and science achievement, monitor curricular implementation and identify the best or beneficial instructional practices from around the world. Their sole aim is to provide comparative information about educational achievement across countries in order to improve teaching and learning in mathematics and science (TIMSS, 2007). This examination is not for countries to participate for placement but after the papers have been marked a league table is prepared to show the performance of countries that participated. The result released in the year 2003, which was the year Ghana participated for the first time, our country was last but one and only managed to beat South Africa. The target population is students falling between 13 and 15 years worldwide. In Ghana, Junior High School students in form two and who are in public and registered private schools in all the ten regions of Ghana are the targeted students to write the TIMSS examination.

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Ghana again participated in the year 2007 and the report showed slight improvement from that of 2003. TIMSS (2007), report clearly stated that the 2007 score, 303, was significantly higher than 2003 score of 255, a 48 point increase. Ghana's performance according to TIMSS (2007) though improved significantly, still remained among the lowest in Africa and the world, and this leaves much to be desired as a developing country. Achenhold, Harlen, Ossei-Anto and Swain as cited by Johnson (2001) report that most science educators assume that students at the senior secondary level have real difficulty grasping concepts in science. Hence, the latter do not show satisfactory level of competency in the development of skills of planning when confronted with practical issues in the laboratory and when involved in non-performance-based activities. Hoffer, Radke & Lord (1992) pointed out that practical experiences that utilize 'hands-on' inquiry can be considered as one of the most effective methods of learning about science and developing the higher order thinking skills.

For this reason, this study addresses the problem by developing and validating an instrument in the form (of performance tasks) used in assessing the planning skills of Junior High School students in the Cape Coast Metropolis of Ghana to find out the degree to which they possess those skills.

Research Questions

The following questions guided the study

1. To what extent do the JHS 2 students exhibit proficiency in exhibiting scientific tasks involving planning?
2. What differences exist in the level of proficiency of exhibiting scientific task by public JHS as compared to that of private JHS?

Delimitation of the Study

There are quite a number of science process skills at the disposal of science students but this study was restricted to planning skills. The topics that these tasks covered were limited to germination of seeds. The study targeted students in JHS 2 of Cape Coast Metropolis.

Limitations of the Study

This study was restricted to some urban schools in the Cape Coast Metropolis of the Central Region of Ghana. For this reason, findings may not be necessarily applied to rural schools in the country. The administration of performance task should have been done at the science laboratory but conducted in the classroom without any alternative and this might affect the performance of some students. Students at JHS are not regularly exposed to practical science, this might affect their performance. The sample size of 225 for planning task, out of total sample of 10,054 should have been larger so that the sample could have been representative enough for generalization to cover many schools. The students of the schools involved in the study were all mixed schools from both public and private, so their performance could not be used to generalize.

Significance of the Study

When the data was analysed based on the research questions, quantitative method was used to determine the proficiency level of planning skills exhibited by JHS 2 students in both public and private schools. This may enable teachers to adopt new methods of teaching science where students are placed at the centre of teaching and learning using a lot of hands-on activities for their findings. The findings of this study could form the basis for organizing workshops for teachers to upgrade their planning skills on performance assessments. Teachers could be trained on how to use the materials to support the methods they have been using to improve students' performance on planning tasks. The outcome of the study could show teachers how the performance assessments could help our students to be pragmatic in their thinking. Finally, the findings could reveal the students weaknesses on the planning tasks and the support needed to help them overcome those weaknesses.

Population

The purpose of this study was to find out Junior High School students' proficiency levels in process skills such as planning in integrated science at the Junior High Schools level in Cape Coast Metropolis. For this reason, the students of both public and private schools formed the population of the study. Precisely, Junior High School students in forms 2 (Basic School 8) were used. There were 77 schools (both public and private JHSs) in the Cape Coast Metropolis for 2010/2011 academic year with the total population of 10,054. Out of the total number of schools and total number of students, there were 59 public schools with total population of 7276 students and 18 private schools with total population of 2808. It was an expectation that the JHS 2 being the target population might have at least acquired some science process skills from the primary school either knowingly or unknowingly. Hence the focus was on the JHS 2 students to find out the extent to which they had developed their planning skills.

Sample and Sampling Procedure

The 77 JHSs in the Cape Coast Metropolis were stratified into public and private schools. Three schools each were randomly selected from public and private schools. In all the public school students from an intact class were used for the study. This was because the public schools were made of only single streams. In the private schools students from one class out of the two classes were randomly selected as an intact for the study. In all 225 students were involved in the study. Table 1 presents the number of students from each of the six schools.

Table 1: Number of Students from the Two School Types (N = 225)

School	Type	n	%
A	private	38	16.9
B	private	39	17.3
C	private	36	16.0
D	public	37	16.4
E	public	37	16.4
F	public	38	16.9

Their ages were between 11 and 13 years.

Research Instrument

The instrument for the study was planning task on performance assessment that was developed by the researcher. The instrument dealt with only planning task.

Planning Task

Task 1 required students only to plan their work on "Germination of a seed". They listed in order or the steps used to solve the problem, drew diagrams to support the plan that they used to carry out the task. Materials that were used by the students and the scoring format for assessing the task had a score of 1 mark for exhibiting a skill or zero mark for not exhibiting a skill. [For details see Appendix A].

A pilot test was carried out using 31 students in an intact class selected randomly from one of the JHSs in Abura Dunkwa District in the Central Region of Ghana. The data were collected on 21st of October, 2010. The data were subjected to complete item analysis to find items that were not valid to re-construct them. This was done to test the research questions formulated for the main study, and to evaluate the instruments before they were finally used for the main study. Both questions papers and answer sheets were collected from the students after they had finished the task on planning. They spent 30 minutes on the task.

Validity and Reliability of Instrument

The reliability coefficient of the instruments was determined by using Kuder-Richardson (K-R20) and had the alpha values of 0.81 for planning task. This enabled the researcher to make confirmation on the instruments for the main study. The inter-rater reliabilities of the planning task were established using the Pearson Product-Moment Correlation Coefficient. The inter-rater reliability for the planning task was found to be 0.80. This was done to ensure that the scores were consistent with respect to the number of raters used and to confirm the reliability of the instruments.

Data Collection Procedure

A letter of introduction from the Department of Science and Mathematics Education, Faculty of Education was sent to each of the six schools used for the study. This was to seek permission from the headmasters or the headmistresses of the schools selected for the research. The teachers, most especially those in classes that were involved in the research were contacted for their consent before collecting the data. Rapport was established with the students for them to know the reason for the research. Explanation was made on what the tasks required the students to do. The performance task involving planning was given to the students. The individual task was given to the students' one after the other where students were required to exhibit skills in the planning task. Students were arranged such that each answered a question in the task that was the same. The task was administered within the selected schools between 19th November and 8th December, 2010. Duration of the task was 30 minutes.

Data Analysis

The data was analysed by using the research questions as a guide. The data was coded using public school students and private school students. Inputs were then made of the coded data e.g. scores, public, and private schools using the Statistical Package for Social Sciences (SPSS) software.

Research question 1 was answered using the descriptive statistics such as frequencies, and mean and the outcome obtained were used to make suggestions that; hands-on activities in the laboratory should be given a second look on our curriculum; hands-on activities need to be encouraged more in the JHSs in the Cape Coast Metropolis. The frequencies showed and explained the degree of proficiency of the skills exhibited and the difficulties the students encountered. For research question 2, independent-samples t-test was employed to determine whether there was any statistical significant difference between students from public and private schools in the skills of planning.

Review of Related Literature

Assessment could be explained as the systematic process of collecting information about a student's achievement in relation to specified curriculum expectations. The students become satisfied with their performance and change their attitudes, enhance their knowledge and skill level after the assessment (Kirkpatrick, 1994). After the teacher has finished teaching a group of students, he or she would like to find out how well the objectives have been achieved. It should not be concluded that once the students sit in the classroom then learning has taken place. Most of the time, teachers have found out that what the students learn in the classroom does not measured up to the effort that was put into the teaching process. Assessment is the process of identifying whatever lapses or gaps left out between what was taught and what was learned by students.

When the teacher has been able to identify the problems and difficulties encountered by the student in the instructional process, then this provides the platform for the teacher to gather information to address these difficulties. The assessment may help the teacher to collect data on students learning behaviour and achievement level. It includes "any method used to better understand the current knowledge that a student possesses" (Dietel, Herman, & Knuth, 1991), or "all activities that a teacher and students undertake to get information that can be used diagnostically to alter teaching and learning" (Black & William, 1998). Therefore assessment is the only way to help the teacher to find out whether the students are learning or meeting the instructional expectations. Assessment could be carried out during prior instruction by the teacher to ascertain how much knowledge input students have brought to a new learning situation, and how ready they are for new learning. The approach to obtaining such information is called diagnostic test or test of entry behaviours (Gallagher, 1998). During instruction too, it could be done to helping students to learn more.

Laboratory Assessment, many studies have been conducted on the importance of laboratory work while teaching science. Currently science educators and teachers agree that laboratory work is indispensable to the understanding of science (Ottander & Grelsson, 2006; Tan, 2008). Laboratory activities have been used in many natural science disciplines to teach students of many age spans in very different cultural and classroom contexts. In the many studies and the varied research settings important issues and variables intersect. Laboratory work in science education has been discussed for several decades. Teachers, researchers and policy makers are convinced about its value for understanding science (Psillo & Niedderer, 2002). Laboratory work engages students in 'finding out' and 'learning how' through first-hand experiences (Seshie, 2001). According to Collete & Chiappetta (1989) laboratory work permits students to plan and to participate in investigations or to take part in activities that help them improve their manipulative skills.

However, there have been many substantive differences in the laboratory settings and other variables reported. To develop research in the field, the science education community must be careful to provide detailed descriptions of the participating students, teachers, classrooms and curriculum contexts in research reports. Among the many variables to be reported carefully are based on (Lunetta, Hofstein, & Clough, 2007): learning objectives, the nature of instructions provided by the teacher and the laboratory guide (printed, electronic or oral) materials and equipment available for use in the laboratory investigation.

The role of laboratory work in science education has been detailed by some researchers (Lazarowitz & Tamir, 1994; Lunetta, 1998). The main purpose and ideas behind teaching the laboratory work in science education is to provide students with conceptual and theoretical knowledge to help them learn scientific concepts, and through scientific methods, to understand the nature of science. Laboratory work aid or assist or give the students the opportunity to experience science by using scientific research procedures. The students will be able to polish scientific skills, achieve meaningful learning; scientific theories and their application would be achieved by the students.
Moreover, laboratory work should encourage the development of analytical and critical thinking skills and encourage interest in science (Ottander & Grelson, 2006). There are concerns about the effectiveness of laboratory work in helping students for understanding the various aspects of scientific investigation (Lazarowitz & Tamir, 1994). Teachers usually work to develop

students' higher order thinking skills, like critical thinking through laboratory work; but to what extent they can achieve this is controversial (Bol & Strage 1996; Ottander & Grelson, 2006). Therefore there is the need for the teachers to analyse the purposes and benefits related to laboratory work, to the benefits of the students.

In spite of efforts to better define the purposes and role of laboratory work in science education, research has shown that teachers see laboratory activities as contrived (Tan, 2008; Tobin, 1986). Teachers should again see to the fact that laboratory activities are regarded as conceptually integrated with theoretical science lessons. In addition teachers should see to it that laboratory activities may provide opportunities for students to produce new knowledge through scientific investigations.

According to a research conducted by Kang and Wallace (2005), teachers perceive laboratory work solely as an activity for the purpose of verification. Laboratory work or tasks carried in the science laboratories should create an atmosphere that will enable the students to gather their wits to come out with their hidden talents. It should be a place where students will be allowed freely to develop their basic scientific skills such as manipulative skills, observational skills, drawing skills and many more.

Different reasons have been shown for the problems relating to laboratory work (Tan, 2008). Some of the reasons are that students have direct contact with, and handle science apparatus and objects physically. It also bring experimental evidence to the exhibiting of basic scientific skills. According to Bencze and Hodson (1999), problems in laboratory work arise when students blindly follow the instructions of the teachers. So teachers are required to state clearly what the student need to know and what to be done to carry out the laboratory task without deviations from what they are expected to do. Wilkinson and Ward (1997b) have connected the problems with laboratory work to a poor evaluation of the purposes of the tasks undertaken in the laboratory. The general purposes of the laboratory tasks may be to support theoretical knowledge, discovery and development of psychomotor skills, and developing skills by manipulating tools and equipment and allowing students to apply skills instead of memorizing. The teachers agree that carrying out a traditional laboratory work is a good without fully considering what the real purposes of the practical activity.

Hirvonen and Viiri (2002) have reported that as a result of learning practical skills and scientific learning methods, students experience an increase in motivation and teachers gain opportunity to evaluate the knowledge of their students. This provide formative and summative data about the students learning and attainment, provides diagnostic data to improve learning, assists instructional planning by providing teachers with informed feedback, help to determine effectiveness of approaches and methods, and serves as a tool to communicate to others. Through the feedback, students become aware of target learning outcomes, the kind of performance they need in order to succeed and where they need to apply effort (Elliot, 2000).

The laboratory task is designed by the teachers and he or she holds on to these skills that are to be exhibited by the student so teachers should have in depth knowledge on how the tasks are designed. Science learning and development of process skills are integrated activities. Woolnough & Allsop (1985) argue that the development of science process skills is valid aim for science laboratory work. Blosser (1988) proposes that there is much theoretical support for the value of laboratory work in helping students to understand science classes. Massachusetts State Department of Education (1987) in a report on science instruction in their elementary schools claims that their teachers lack basic science skills. They suggest that teachers should be involved in considerable number of hands-on science to develop the appropriate skill to guide the students to solve scientific problems.

Ottander and Grelsson (2006) investigated the ideas of biology teachers on the role of laboratory work. According to the results of the study, teachers agreed that laboratory work is an important part of science which focuses on the most common purposes of laboratory work, such as building connection between theory and practice and increasing motivation. Furthermore, teachers do not consider the purposes of laboratory work as being concerned with scientific process skills.

The importance of laboratory work in science education is well known. However, there is a lack of clarity regarding the purposes of laboratory work and the perceptions and experiences of the students do not conform to known purposes (Reid & Shah, 2007). It is very important that as a science teacher he or she should be able to communicate his/her ideas in a way that will be understood by the students in order for the expected outcomes to be achieved from laboratory tasks and for the proper planning of lessons.

The performance assessment is used to refer to assessment strategy that incorporate science investigations, such as hands on practical tasks to measure and evaluate a student's content and procedural knowledge and the ability to use knowledge in planning, performing and reasoning, and solving scientific problems. According to Shavelson, Baxter, & Pine (1991) for a performance assessment to be useful for teaching, it needs to be linked directly to instructional units, and have a well-designed scoring system that clearly reflects what students understand and can do. Instruments in the form of performing tasks were validated to assess these basic scientific skills of JHS 2 students of Ghana.

Performance assessment also known as alternative authentic assessment is a form of testing that requires students to perform a task rather than select an answer from a readymade list. According to Wiggins (1990) authentic assessment means "engaging in worthwhile tasks and problem-solving activities that demand students' use of acquired or requisite knowledge effectively and creatively". Such tasks are either replicas of or analogous to the kinds of problems faced by adult citizens and consumers or professionals in the field. Stiggins (1987) sees authentic assessment as one that calls upon the examinee to demonstrate specific skills and competencies; that is, to apply skills and knowledge they have mastered. For example, a student may be asked to explain scientific events, generate scientific hypothesis, solve science problem, or conduct research on an assigned topic. The students need the process skills both when doing scientific investigations and during their learning process (Harlen, 2001). Hart (1994) provides a comprehensive account of various authentic and performance-based assessment approaches.

The effectiveness or value of these methods hinges on the use of suitable structured tasks and scoring rubrics. A rubric establishes a set of explicit criteria by which a work will be judged (Radford, Ramsey, & Deese, 1995). For example, a rubric to assess the application of higher-order thinking skills in a student's portfolio might include criteria for evidence of problem-solving, planning, and self-evaluation in the work. A number of formal and informal protocols for assessing students self-regulated learning strategies also incorporate components that focus on metacognitive skills (Pintrich & De Groot, 1990; Ward & Traweek, 1993).

The metacognitive knowledge monitoring assessment (Tobias, Everson, & Laitusis, 1999) and Assessment of Cognitive Monitoring Effectiveness (Osborne, 2000) are more targeted measures that are suitable for use in classroom situation. Both instruments have also demonstrated sound psychometric properties in empirical evaluations (Osborne, 2001).

A difficulty that is faced in the use of performance assessment is determining how the students' responses will be scored. Scoring rubrics provide one mechanism for scoring student responses to a variety of different types of performance assessments. In performance assessment, there is the need to have a guide such that actual skills needed to be assessed will be relevant. The assessor should state clearly his or her goals and objectives when developing performance assessment, developing the scoring rubrics, administering performance assessments and scoring, interpreting and using the results. These points guide the classroom assessment process planning (Moskal, 2000a). Insufficient knowledge on their use by teachers to fairly assess students' performance, unsuccessful experiences and or inconclusive executions of performance assessment is thought to be responsible for their poor acceptance by teachers (Brualdi, 1998).

The lists of suggestions provided are specific to formal assessment activities (Stiggins, 1987). Formal assessment activities refer to activities in which the students are aware that they are being evaluated; informal assessment activities refer to activities in which the students are not aware that they are being evaluated (Stiggins, 1987).

Brualdi (1998) implementing performance assessment in the classroom, provides an introduction to performance assessments and how they may be used in the classroom. Moskal (2000b) discusses the basis of scoring rubric development in the article designing scoring rubrics for your classroom. Mertler (2001) outlines how to develop and implement scoring rubrics in the classroom for assessing students' performance on tasks.

Before the performance assessment is organized as well the writing of the scoring rubrics, the purpose of the tasks should clearly be stated, a clear statement of goals and objectives should be written to guide the development of both the performance assessment and the scoring rubric. 'Goals' are broad statement of expected student outcomes and 'objectives' divide the goals into observable behaviours (Royers & Sando, 1996). The assessor should have in mind questions such as "What do I hope to learn about my students knowledge or skills?" "What content, skills and knowledge should the activity be designed to assess?," and "What evidence do I need to evaluate the appropriate skills and knowledge?". The statement of goals and objectives should be clearly aligned with the measurable outline of the performance activity. When the goals and objectives are focused upon complex learning outcomes, such as reasoning, communication, and teamwork, a performance assessment is likely to be appropriate (Airasian, 2001).

As the term suggests, performance assessments require a demonstration of students' skills or knowledge (Airasian, 2000; Airasian, 2001; Brualdi, 1998). This type of assessment can take on many different forms, which include oral demonstrations and activities that can be completed by either a group or an individual.

A factor that distinguishes performance assessments from other extended response activities is that they require students to demonstrate the application of knowledge to particular context (Brualdi, 1998; Wiggins, 1993). Through the observation or analysis of a student's response, the assessor may or may not determine what the student knows, what the student does not know and what misconceptions the student holds with respect to the purpose of the assessment. Performance assessment task should be carefully constructed in a manner that may help students to achieve the intended learning outcomes. Additionally, the task should not give unfair advantage to a particular subset of students (Brualdi, 1998; Wiggins, 1990).
When a task is given to a student, the student is required to read the instructions carefully for better understanding and what he or she is suppose to do. Questioning and answering promote participatory learning, good communication skills, and the confidence building in the learning process. A good way of engaging students is by asking thought provoking questions, engaging them in a worthwhile activity, and by prompting them to answer or ask questions. Hackling & Garnet (1991) state that "students at all levels show poorly developed skills of problem analysis, planning, and carrying out of controlled experiments". In a study of first year tertiary students, Moneira (1980) claims that many students cannot identify the basic questions involved in experiments.

This would also allow a teacher to assist students to resolve misconceptions and check understanding. Research findings point to positive effect of student-teacher classroom interaction, through questioning, on learning (Guldermond & Meijnen, 2000; Walsh & Sattes, 2005). Feedback is a vital component of assessment for the purpose of maximizing learning. It provides students with information on their learning status, indicating how well they are meeting the expectations of the teacher. Feedback enhances learning, and retention because the information can help students to direct and structure their learning, as well as guide them doing self-appraisal of their learning (Enerson, Plank, & Johnson, 1994; Gredler, 1999; Hargreaves, 2001; Smith, 2007; Tierney & Charland, 2007). Positive feedback motivates students to work harder on a subsequent task.

At the middle of the 20^{th} century, the term "performance assessment test" was in most cases connected to the meaning of practical test not requiring written abilities. In education the expectation was to measure individual's competency and proficiency in handling certain tasks at their disposal. It was found out that the correlation between facts and knowledge, on the one hand, and performance based on these facts and knowledge, on the other were always not highly correlated. The low correlations between knowledge and theory are in line with the authors who have compared different forms of assessment, albeit in different circumstances (Gott & Duggan, 2002; Gray & Sharp, 2001). The ideal situation was allowing the person to perform so that desirable judgement could be passed. Out of school, such practical performance tests could be used by students to polish their practical skills. From the 1980's onwards there has been an upsurge in the amount of articles on performance assessment.

The growing interests in performance assessments, and the new focus on more theoretical subjects, seem to have emanated from dissatisfaction with the extensive use of multiple choice tests. The validity of these tests as indicators of complex performance was experienced to be too low, and to have negative effect on teaching and learning (Kirst, 1991). Performance assessment has been found by the advocators to be more in line with instruction than paper and pencil test, and multiple-choice tests. It can also in a positive way guide instruction and student learning and promote student desirable attitudes; and additionally viewed as having better possibilities to measure complex skills and communication which are considered important competencies, proficiencies and disciplinary knowledge needed in today's society in solving scientific problems.

When performance assessment is described in terms of its attributes, the descriptions mostly embodied cognitive processes required by students, contextualised tasks, judgemental marking in the assessment, communication, real world applications, instructionally meaningful tasks, significant commitment of student time, and effort and qualitative judgements in the marking process. The conducive atmosphere created is such that the students are the main focus as they work freely. Constructivism as a theory of learning focuses on the learner and as a result, the constructivist learning environment is learner-centered rather than teacher- centered (Proulx, 2006).

Most definitions offered for performance assessment can be viewed as response-centered or simulation centered. The response centered definitions focus on the response format in the assessment, and the simulation centered definitions focus on the observed student performance. In some of the simulation centered definitions practical activity, through the use of equipment or apparatus not normally available on paper-and-pencil test, are required.

Arter (1999) also focuses on response format but demands more of performance assessment. Airasian (1991) and Stiggins (1987) defined performance assessment as "assessment based on observation and judgement". Airasian (1994) claims that with paper-and-pencil test items, the teacher only observes the results of the students' intellectual processes, but not the thinking that produced the result. Some teachers are hesitant to implement performance-based assessment in their classroom. Commonly this is because these teachers feel they do not know enough about how to fairly assess a student's performance (Airasian, 1991).

Another reason for reluctance in using performance-based assessments may be previous experience with them when the execution was unsuccessful or the results were inconclusive (Stiggins, 1987). When students are expected to show the end results of their work, there is the possibility that students showed little or no evidence that they have followed the expected process. Kane (1999) assert that, the definition of performance assessment does not have to do with response format. They claim that all assessments demand some kind of performance from the testees.

The impact of educational assessment on educational systems has effects on our curriculum design, education policies, institutions of academic teaching and learning modes, and the learning styles students have employed. It is normal practice that if someone should be introduced to a method of doing something which is new to him, a prototype is provided to guide that person. For educational assessment similar is done by providing assessment expectations and the structure of how the students could be assessed.

Educational assessment is thus an integral component of the education process, in particular teaching and learning (Ashbacher, 1991; Gipps & Stobart, 2003; Shepard, 2000). According to Broadfoot (1996), assessment is the most powerful policy tool in education and will probably continue to be the single most significant influence on the quality and shape of students educational experience and hence their learning.

Assessment is very essential in science for decision making on our students' learning and development. From our instructional point of view, assessment may be defined as a systematic process of determining the extent to which instructional objectives are achieved by students (Linn & Gronlund, 1995). Performance assessment in my view is not just for assessment purposes, but for improving students' understanding of science and developing their thinking skills.

It is necessary to discuss assessment into details, and touching on it deeply to know its purposes necessary for the discussion of the performance assessment. Educational assessment can be perceived as an endeavour by teachers to ascertain the status of students' knowledge (cognitive understandings and abilities), skills and attitudes as variables of educational interest (Popham, 1999). Educational assessment not only embodies the techniques teachers and examining bodies apply when grading students' knowledge and skills comparing them to one another (Wiggins, 1997). It is also a means to help students to learn well, and helping teachers to improve their instruction. It stands to reason that assessment should be seen and regarded as assessment for learning and skills development and not simply as assessment of learning. In assessment for learning, the assessment activities are designed considering the capabilities of the students, to contribute to the acquisition and consolidation of students' knowledge and skills (Gipps & Stobart, 2003).

Assessment activities provide useful information on the students that serves several functions of significance to students themselves and the teacher. Such information could be used for summative and formative purposes. The summative assessment provides a summary of the students overall performance. This summary determines the progressions the students have made and how they have attained the set goals for educators to use in forming educational policies. Judgements are made based on formative assessment concerning the strength and weaknesses of individual students to help the assessor to decide on how to assist the students to improve on their performances. It also helps to decide how to improve instruction and promote productive interactions with their students (Elliot, Kratochwill, Cook, & Travers, 2002). More often than not, schools in Ghana have been using paper and pencil test for their students at the basic schools to assess their planning, performance, and reasoning skills. Information obtained from traditional assessment model does not adequately reflect the quality of the students thinking and level of understanding (Ashbacher, 1991). The acknowledge weaknesses of the paper and pencil assessment have led to the recent development of alternative testing strategies.

Many schools are now using the performance task to assess the extent to which their students exhibit basic scientific skills. This methodology also fits the nature of science, that is, the study of active structures, and frequently changing phenomena (Atkin, Black, & Coffey, 2001). The hallmark of the performance assessment is the use of the graded, authentic task. An authentic task is one in which students are required to address problems grounded in real-life contexts. It provides an opportunity for students to individually achieve highest level of learning (Baker, 1996).

Assessment is authentic when we directly examine student's performance on worthy intellectual tasks. It requires students to be effective performers with acquired knowledge, and present the student with the full array of tasks that mirror the priorities and challenges found in the best instructional activities. It is situated in a real world context, and it can mirror actual tasks implemented by professionals (Mabry, 1999). Students are required to perform the task rather than select an answer from a ready-made list. Authentic assessments attend to whether the student can craft polished, thorough and justifiable answers, performances or products. This type of assessment achieves validity and reliability by emphasizing and standardizing the appropriate criteria for scoring.

Beyond these technical considerations the move to reform assessment is based upon the premise that assessment should primarily support the needs of learners. Such tasks sometimes look very complex, somewhat not completely defined, engaging problems that require students to apply, synthesize, and evaluate various problems solving approaches (Shavelson, Baxter, & Pine, 1991; Wiggins, 1990). In the context of science laboratory, students are graded on the performance of manipulating, identifying hypotheses, making measurements and calculations, organizing and managing data, and communication of results (Slater & Ryan, 1993).

Experiences from the United States of America show that hands-on performance assessment can distinguish students who have experience in hands-on science from students who do not (Shavelson *et al*., 1991). Students taught this way by the use of paper and pencil test to show the competency and proficiency in the possession of science planning, performance, and reasoning skills will have less, if any practice with hands-on tasks and therefore be unfairly assessed if practical based assessments are used on them. When hands-on activities are used to assess students' performance on skills their senses are well sharpened and they are able to articulate better as ideas, methods, and strategies are not imposed on them but they use their own intuitive reasoning to draw justifiable conclusions. Students manipulate instruments to carry out the tasks given them so the instruments (apparatus) used in such tasks should guide the assessor to assess the degree to which the students exhibit their skills, and therefore provide accurate information about student's level of knowledge (Robert & Gott, 2004).

If the instruments are too sophisticated for the students to use, students may or may not be able to manipulate the instruments to achieve the intended purpose. The instruments should not be complex but very simple for the students to manipulate them to carry out the tasks. Students are able to portray their in depth knowledge, skills and habit of the mind through manipulating and using scientific instruments and equipment to generate relevant data, recording, analysing and interpreting data, drawing relevant conclusions based on data, communicating the product of their investigation orally and in written reports. In performing the assessment task the students may apply procedure learned in class, a combination and integration of procedures, as well as thoughtful adaptation of their knowledge to the given task (Brualdi, 1998; Linn & Gronlund, 2000).

In Swaziland it was found out that students only encounter practical based assessment at the senior level and it's not helping their students to develop cognitively. To expose the junior science students to performance assessments an exploratory study was conducted (Kelly, 2007). The tasks was designed to direct students attention to demonstrate knowledge and procedural skills through planning, investigating and recording, analysing and interpreting data, and applying the data in a given situation.

When students have successfully gone through the tasks, they express their opinion on their experiences. Students felt the tasks were more challenging and difficult because some of the questions were found to be above their standard. However, students again expressed their joy because the tasks engaged them in thinking processes they were not normally exposed to, which they appreciated. Students were convinced that once they were used to the way the questions were asked they would be able to handle them effectively with time.

The tasks helped them to understand science and improving their retention of the subject content. Most of the students said the tasks required them to think and manipulated apparatus with hands relegating questions like "define photosynthesis" to the background where they just know the answers from their notes. Here they had to combine thinking, reasoning, performing, planning, and together with what they know from the class. Performance tasks provided for students to revisit what have been taught with the help of colleagues. Tasks were thus seen as learning activities which created room for students to consult opinions and ideas from their colleagues improving collaborating learning.

Performance assessment using hands-on looks more complex than the paper and pencil test to assess in that they measure multiple reasoning and knowledge and students make use of all their senses. Constructing good performance assessment tasks requires a lot of time. One should consider the age, class, topic, time allotted, instruments, wording appropriateness, and the purpose of constructing the tasks. Several trial runs with students to get their inputs are necessary before the tasks can be used for the actual assessment (Shavelson & Baxter, 1992). These authors again advise that good performance assessment tasks are essential if they are to positively influence teaching and learning. When students are taught well with the requisite performance assessment tasks, students may apply them appropriately to solve scientific tasks.

The tasks and the corresponding guidelines need to be constructed and the scorers adequately trained. Studies on performance assessment have shown that specific scoring criteria and examples showing expected competencies are essential for consistence evaluation through performance assessments. Indicating to students the expected performances regarding the tasks motivates them to improve their performance (Gipps & Stobart, 2003). For students to improve their performance assessment skills and to obtain a more comprehensive picture of student's knowledge and skills, a substantial number of performance tasks are necessary.

This would mean constructing a number of different performance tasks per subject over a longer period of time (Linn & Gronlund, 2000; Roberts & Gott, 2004; Sanders & Horn, 1995). A good performance in one task does not necessarily mean that the same student will demonstrate similar abilities in different task (Popham, 1999; Sanders & Horn, 1995; Shavelson, 1991). To make the performance assessment interesting to attract the attention of the students, in the interest of ensuring more efficient education for them, educators need to broaden approaches to assessments.

The observations highlighted support Gott and Duggan (2002) and Gipps and Stobart (2003) asserts that multiple assessment formats are necessary to give students adequate opportunities to demonstrate their understanding and ability to apply their knowledge. In a performance assessment, students craft an observable performance that requires problem solving, inquiry, decision making or role playing. This sometimes takes place over an extended period of time. Some instructional programs use the term to refer to hands-on tasks only; others include wider array of performance that draw upon scientific knowledge and skills. It is designed to providing a more complete picture of students' achievement, to judge student abilities to use specific knowledge and research skills thus providing insight into a student's level of conceptual and procedural knowledge.

Studies that have looked closely at performance assessments find that, if the criteria is clear and that examples are available to show levels of competency, performance assessments are highly consistent across different evaluators (Kulm & Malcom, 1991). There is the belief that when students are exposed to task using hands the expectation is that, their performance may be improved.

Johnson (2001) asserts science is basically taught through practical methods; students are required to experiment techniques to test hypotheses they have formulated about behaviour of the materials they are examining and to build into concepts, theories and generalizations. German, Aram and Burke (1996) proposed that student's ability to perform science process successfully during an experimental inquiry is dependent upon the student's previous experience, knowledge and skills.

Some benefits that may be derived from performance assessment include: allowing for reward that is commensurate with performance thereby it strengthens the student's sense of judgement and justice; promotes the realization of the organizations requirements; it may have positive effects on the student's performance and activate their hidden capabilities.

School Types

The debate on school quality often centers on the government versus the private provision of education. A case for private schooling is made on several grounds, to support the limited number of government public schools Ghana. A role for the private sector is strengthened by empirical evidence that higher public spending does not mechanically translate into higher students' achievement (Hanushek, 2003). Public school expansion is also favoured on the ground that charging fees increase accountability of schools towards parents, and potentially also increases efficiency. Under certain conditions, competition generated through emergence of private schools may also improve efficiency of stagnant government sectors.

However, not everyone is convinced by the case for private schools. Some authors see private schools as playing only peripheral role as 'conduits' for educational expansion in most developing countries (Lockheed & Jimenez, 1994). Moreover, unconstrained expansion of fee-charging schools is questioned on equity grounds: that they only cater for the elite urban areas and marginalize the poor. Studies have revealed an unprecedented expansion of private schooling rather than just a 'peripheral' role.

Furthermore, evidence support that private school do not cater only for the urban elite but are also utilized by the poor (Alderman, Orazem & Paterno 2001; Andrabi, Das, & Khwaja, 2002). In recent years there have been global trends toward increased private sector involvement in school management and finance (Bray, 1996). While government policies stimulating this shift may differ in detail across countries, they share two common expectations from the increased role of the private sector: (a) that it would counteract the adverse effects of right public budgets on educational development; and (b) that it will improve sector performance by strengthening the incentives for all schools to operate efficiently. Available research to date provides some evidence that these expectations have indeed been born out in the experience of some experience in some countries (James, 1993). Several studies based on production function estimates for such countries as the Philippines, Thailand, Tanzania and Colombia, also suggest that, in terms of enhancing students learning schools in private sector at both the primary and secondary levels are generally more efficient than those in the public sector (Psacharopoulos, 1987; Jimenez, 1988, 1991a, 1991b). Similarly studies focusing on process issues have also concluded that decentralized school management yields better results in terms of student performance (Jimenez & Paqueo, 1993; Winkler & Rounds, 1993; Hoxby, 1994).

There are two main types of schools in Ghana: government owned schools (called public) and private schools. Private schools are privately-owned entities and managed by individuals. It is commonly held view that private schools are of better quality than the government public schools in Ghana. This perception is formed by private schools academic performance and BECE examination results which are better of than public schools. Arif and Saqib (2003) find that private schools are better in imparting learning to pupils. Studies from several countries have shown that private schools perform better in test of achievement and students of private schools pursue courses of higher education (Bedi & Garg, 2001; Brown & Belfield, 2001). According to Young & Fraser (1994) the type of school from which the students came is one of the factors that influence science achievement. According to Seshie (2001), performance of private schools is better than that in the public schools in both planning and performing skills for science practical activities. Beaumont-Walters & Soyibo (2001) also found out in their study government (public) high school students performed substantially higher and the difference was statistically significant than that of private high school students.

The private school students in the study have science laboratories to practice science hands-on activities. The private schools science laboratories have basic science equipment for the students to practice science practical activities. The public school students in the study did not have school science laboratory to practice science practical activities. When the students are to practice science activities because of lack of science laboratory equipment, the teachers demonstrate it in the classroom for the students to observe. This may affect the students' performance in the exhibiting scientific skills based on hands-on activities.

In Ghana when the BECE results are released, in order to know the performance of each school in the various Districts and Metropolis, Ghana Education Service of Cape Coast Metropolis uses the results to prepare a league table on schools performance year after year in the Metropolis. The poor performance of the JHS students in BECE exams most especially in the year 2008 necessitated a meeting of the Metro Director with all Headteachers in the Metropolis to discuss measures that may be adopted to ensure improvement in future results (Ghana Education Service [GES], 2008). As a result of the meeting, Headteachers resolved to team up with the teachers to set targets for the subsequent years and to work towards its attainment. According to GES, the BECE results released in the year 2007 and 2008 by WAEC, the performance of students in the 2008 BECE was below the level attained in 2007. The percentage of students who obtained aggregates 6 to 30 reduced from 62% to 55.3%. When the BECE results were arranged in order of merit in the Cape Coast Metropolis, private schools occupied nine out of the first ten places (GES, 2005; 2006; 2007; 2008; 2009; & 2010). In 2005 the first five spots were occupied by private schools, 2006, first five spots were taken by private schools, 2007; first five spots were occupied by private schools again, 2008, the story was no different when private schools occupied nine out of the first ten places. In 2009 and 2010 results, followed the same trend. With these results, one may be tempted to draw conclusion that private schools do better academically than the public schools. But there are some probable factors that may contribute to the better performance academically of private schools. These factors may not be solely attributed to a school-type effect as it may be likely that most private school students come from well endowed and more privileged homes. These students are more motivated, and have more conducive home learning environments. Students from private schools may be at advantageous position due to the fact that they may have number of books at home, have more educated parents who are well to do and more likely to be gainfully employed. Another factor is that, the numbers of student's in public schools are many as compared to the number of students from private schools so learning needs are well catered for in private schools. Notwithstanding the performance of private school students being significantly higher than the public school students, some authors have argued that the small size of the private sector in most developing countries limits private-public comparisons (Glewwe & Patrinos, 1999).

Other factors may be the quality of teachers, their motivational level, classroom facilities, and methodology to carry out instruction. However, school-type effectiveness is measured as the difference in students learning achievement not of schools' student intakes.

Discussion and Results

The purpose of the study was to assess laboratory skills of Junior High School students in selected Integrated Science topics. This was to find out whether it is true that students are unable to solve scientific problems as it was reported by TIMSS in the years 2003 and 2007, involving planning skills or not. But this study was conducted in JHS using students of Cape Coast Metropolis in some selected schools. The results that are discussed in this chapter were obtained from a sample of six Junior High Schools randomly selected in the Cape Coast Metropolis of the Central Region of Ghana. Students were Form Two Junior High School students in public and private schools. All the six schools were mixed (i.e. both males and females), three schools were public and three were private.

The performance of each student was scored by the use of the scoring format or marking schemes (Appendices A to E). Statistical analyses were done using Statistical Package for Social Sciences (SPSS). The ages of the students were from 11 to 15 years. The total sample of the study was 255 for planning task. Students were instructed to do the task since there was no option for the task. The samples from both public and private schools were 112 and 113 respectively which gave a total of 225 students for planning task.

Characteristics of the Students

The students who participated in the task were all in Form Two and offering Integrated Science, which is compulsory subject at Junior High School level in Ghana. These students, it was assumed, had all studied integrated science from the upper primary to the Junior High School. Any time there is a science hands-on activity, teachers demonstrate for students to observe. When the students were to work in groups due to lack of enough science equipments, few students had the chance to manipulate apparatus with the rest of the students observing.

This method may affect the students' science basic skills development and the cognitive reasoning of the students. Students asked some questions such as "sir, what will happen to the seeds?" "Sir should I draw diagrams?" when all the necessary information was provided. There might be a reason that students have not been exposed to planning task. Hence they did not have much practical science skills. The students who were able to go through the planning task did not find it easy. In one of the three private schools, students portrayed their level of proficiency in manipulating science apparatus because they have small science laboratory with a lot of basic science apparatus the students use for hands-on activity.

Research Question One

To what extent do the JHS 2 students exhibit proficiency in exhibiting scientific tasks involving planning?

Students' Proficiency

Research question 1 sought to find out to what extent do the JHS 2 students exhibit proficiency in handling scientific tasks involving planning. To accomplish this, JHS 2 students were given tasks under the following headings: Task A - Planning task

Planning Skills

Under the planning skills, the students were made to perform a task, and the skills exhibited by the students were scored using the scoring format or marking scheme (see Appendix A). A credit of one point was scored for the correct response showing the students proficiency and zero point scored for wrong response showing that the students were not proficient on that particular skill. Students were considered to be very proficient according to the number of skills exhibited in the tasks. In all, the total score under the planning skills were seven. When a student scored four and above in the skills of planning, then that student was regarded as proficient. On the other hand, if a student scored between zero and three skills, then the student was not regarded as proficient in the task.

With a mean of 3.93 (SD = 1.21) out of a maximum of seven, almost two-thirds of the students involved in the study exhibited skills in the planning task in a range of 2.72 to 5.14. The results of the performance of students in the planning task are shown in Table 2.

Table 2: Students' Proficiency in the Planning Skills (N = 225)

Score	N	%
1	3	1.3
2	26	11.6
3	50	22.2
4	75	33.3
5	47	20.9
6	23	10.2
7	1	0.4

From Table 2, out of the total number of 225 students, three students scored one point out of total of seven points representing 1.3 percent, 26 scored two out of seven points, representing 11.6 percent 50 students scored three points representing 22.2 percent.

One hundred and forty six students (146) students representing 64.8 percent had more than three marks out of the total of seven marks. The total percentage mark obtained by students who performed below half was 35.1 percent. More than 50 percent of the students recorded high marks. This result signified that the students were proficient on the planning skills. This is because majority of the students (64.9%) were proficient in the planning skills whilst 35.1 percent of the students were not proficient.

From Table 2, considering the total number of students and percentage scores, it could be deduced that large number of students representing 64.9 percent exhibited their level of proficiency in the planning skills.

Figure 1 shows Respective number of students and their percentages in public schools proficiency of skills exhibited in planning task.

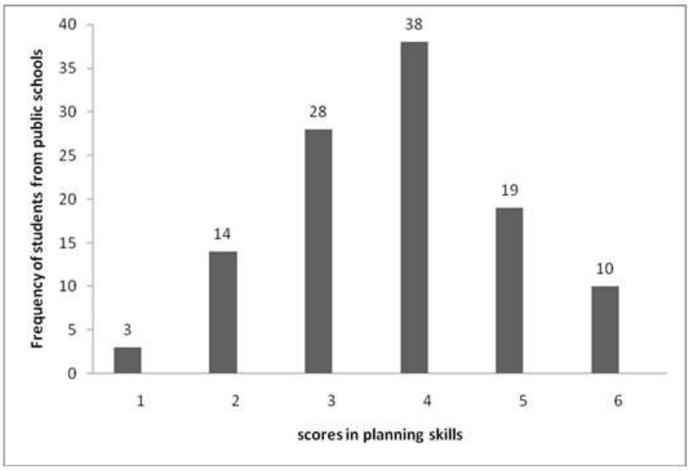

Figure 1. Public schools students' proficiency in the planning skills

From figure 1, the findings show a pattern of skills demonstrated by the students from the public schools who took part in the planning task. This is because the number of students who attained each score increased from score one to four (that is 3, 14, 28, and 38 respectively); and decreased from score four to six (that is 38, 19, and 10 respectively). This could be attributed to the fact that the students are not generally required to plan when confronted with scientific tasks.

Figure 2 shows the number of students in private schools with scores in proficiency of skills exhibited in planning task.

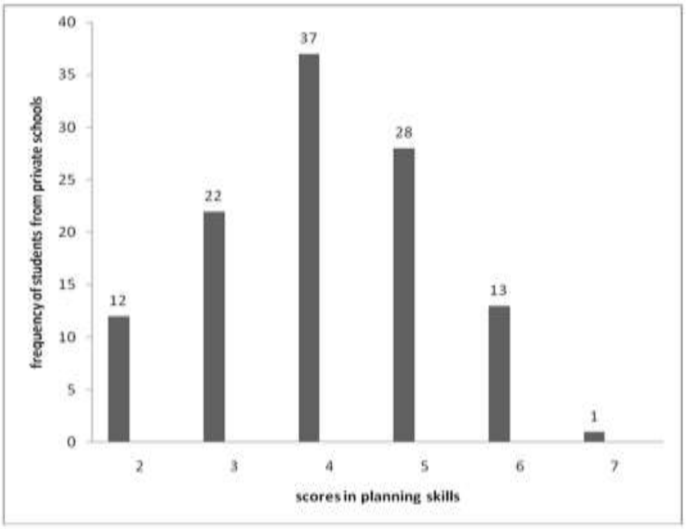

Figure 2. Private schools students' proficiency in the planning skills

The findings in figure 2 show a pattern of skills demonstrated by the students from the private schools who participated in the planning task. This is because the number of students who attained each score increased from score two to four (that is 10.6%, 19.5%, and 32.7% respectively); and decreased from score four to seven (that is 32.7%, 24.8%, 11.5%, and 0.9% respectively). This could be attributed to the fact that the students are not generally required to plan when confronted with scientific tasks. From Figure 2, one student exhibited all the skills in the planning task. This could be that the student is exceptional in the exhibition of planning skills in the planning task.

Table 3 shows the summary of the students' performance on the planning skills.

Table 3: Summary of Students' Proficiency in Planning Skills (N = 225)

Score	N	%
1 to 3	79	35.1
4 to 7	146	64.9

From Table 3, 146 students representing 64.9 percent exhibited their skills in the planning task which signified that these students are proficient on planning skills in the planning task.

Planning Task

The Task required the students only to plan what they can do to test whether the seeds provided for germination are viable so that they can sow the seeds. The points awarded for the task I is found in Appendix A. One student portrayed all the seven required skills on the planning task, and the other student portrayed six required skills out of total seven skills on planning skills.

Responses on Task

Details of the students' responses on the skills are found on Table 3. Scoring format was used to know the students level of performance in each skill. Each skill had two different scoring: full mark of one recorded for exhibiting proficiency of the required skill; no mark or zero mark recorded for not exhibiting the proficiency of the required skill. Here are some examples of students' answers on planning task.

Students' Answers on Planning Task

Under the planning task, four answered sheets of the students were selected: two for exhibiting proficiency of skills and two for not exhibiting proficiency of skills in the planning task.

Selected answer sheet of a student who exhibited proficiency in planning skills.

1. I will clear my land and use a nursery box filled with black soil.
2. nurse the seeds to see ones that may germinate
3. Water the seeds
4. Fence around the seedling
5. Water it every evening
6. Plant the seeds on the main plot.
7. Water it morning and evening.

Selected answer sheet of another student who exhibited proficiency in planning skills.

1. I will first weed the plot
2. Burn the weeds
3. Nurse the seeds first to see number of seeds that will germinate
4. Plant the seeds on the cleared plot
5. Water the seedlings
6. Fence around the plot
7. Water it morning and evening.

Selected answer sheet of a student who could not exhibit proficiency in planning skills.

1. Clear the land
2. Dry soil is not suitable for seed germination.
3. It cannot germinate the seed
4. Boiled cooked water
5. Wet soil is not suitable for sowing seeds

Selected answer sheet of another student who could not exhibit proficiency in planning skills.

1. We would need bowls of water
2. We would test for the viable seeds
3. Pour some seeds into bowls of water
4. You will observe the one with temperature that is high
5. Seeds will not germinate

Adequate and Inadequate Responses

The responses of students in the planning task were grouped with respect to the response of the students being correct or wrong after scoring of the three tasks. Any correct response provided by a student on each task was said to be adequate and any wrong response provided by the students on each task was said to be inadequate.

Planning Task

Students' responses on planning task are presented in Table 3.

Table 3: Students' Responses in each Type of Skills in the Planning Task (N = 225)

Value label	Full score		No score	
	N	%	N	%
Plan	3	1.3	222	98.7
Systematic plan	26	11.6	199	88.4
Detailed plan	50	22.2	175	77.8
Workable plan	75	33.3	150	66.7
Diagram	47	20.9	178	79.1
Safety measures	23	10.2	202	89.8
Additional plan	1	0.4	224	99.6

From Table 3, only 1.3 percent students out of the 225 students involved in the study had the skill plan correct, only 11.6 percent students had the skill of systematic plan correct, and only 22.2 percent students had the skill of detailed plan correct. The results in Table 3 further showed that out of the 225 students involved in the study, only 20.9 percent students had the skill of diagram correct, only 10.2 percent students had the skill of safety measure correct, and only 0.4 percent had the skill of additional plan correct. The findings from Table 3 show that majority of the students could not adequately exhibit the individual skills under the planning task. For instance, 88.4 percent, 89.8 percent 98.7, percent, and 99.6 percent students could not exhibit the skills of systematic plan, safety measure, plan, and additional plan respectively. This could be attributed to the lack of practical section in science education at the JHS level.

Research Question Two

What differences exist in the level of proficiency of exhibiting scientific task by public JHS as compared to that of private JHS?

School Type and Level of Proficiency

Research question two sought to find out whether the level of proficiency in handling scientific tasks depends on the type of school attended by the JHS students. To find answers to this, the independent-samples t-test was used to ascertain whether there were any significant differences between the level of proficiency exhibited by students from public and private schools in the skills of planning.

Planning Task

The results of the independent-samples t-test analysis on the students' proficiency in the planning skills are presented in Table 4.

Table 4: Results of Independent-Samples t-test for Scores of Public and Private Schools in Planning Task

Type of schools	Number of students (N)	Mean	SD	t	df	P
Public	112	3.77	1.22	2.057	223	0.041*
Private	113	4.10	1.87			

* Significant at $p < 0.05$

The results in Table 4 show there was statistical significant difference between the level of proficiency exhibited by students from public and private schools. The mean of the level of proficiency exhibited by students from private schools ($M = 4.10$, $SD = 1.87$) was significantly higher than the mean of the level of proficiency exhibited by students from public schools ($M = 3.77$, $SD = 1.22$, $t(225) = 2.057$, $p = 0.041$) with an effect size ($d = 0.02$).

The outcome of the study is consistent with the findings of the study conducted by (Jimenez & Paqueo, 1993; Winkler & Rounds, 1993; Hoxby, 1994) who found that studies focusing on process issues have also concluded that decentralized school management yields better results in terms of student performance. Studies from several countries have shown that private schools perform better in test of achievement and students of private schools pursue courses of higher education (Bedi & Garg, 2001; Brown & Belfield, 2001). These findings are also in consistent with the findings of Seshie (2001) that performance of private schools students was better than that of public schools students in both planning and performing skills. These results indicate that the students from both schools have varying proficient level on planning task with private schools standing out as the best. This showed that, students of private schools were proficient in the planning task.

Key Findings

The following are the findings of the study according to the research questions on the planning, performing and reasoning tasks.

1. The students were more proficient in exhibiting of skills in the planning task.
2. There was a major setback on Task I (planning). Only one student representing 0.4% out of 225 students could portray all the seven levels of skills in the planning task scoring total marks of seven out of seven (7) marks. The reason for this number of students percentage mark might be that adequate provision had not been made for planning which is one of the basic skills of the process skills used by the students at Junior high schools.
3. Twenty four students (24) representing 10.6% were able to draw diagrams to support their plan. The reason might be that planning task most often do not require students to draw diagrams, rather diagrams are drawn for students to label parts. That might have affected their drawing skills.
4. On the precautionary measures which was the skill level five on the planning task, 71(31.5%) out of 225 students exhibited that skill. The reason might be that, the paper and pencil practical test questions for performance tasks do not create or require the students to state any precaution.
5. Generally, on the whole of planning task, 146(64.8%) performed above mean score of 3.93 which was of no mean an achievement showing their proficiency level on the skills levels 4, 5, 6 and 7. Additionally, 75(33.3%) showed their proficiency levels on skill levels 1 to 4 which was not very encouraging.
6. Using performance task to assess the proficiency of students at planning was more appropriate. The reason is embedded in an assertion of Haertel (1992) that in performance assessment

students are engaged in some activity and German and Aram (1996) conclude that scores are provided for students' efforts in the activities they are engaged in to be able to determine their performance. Ossei-Anto (1996) had observed that among other factors students previous experience in science and the subject matter determined the shape and form of the performance assessment.

7. From the analysis of performance according to the Types of school (public and private schools), it could be inferred that the type of school has a relationship with performance with students' of private schools having the highest mean score of 4.10 in the planning task followed by public school students with mean score of 3.77. Therefore the students' of private schools exhibited proficiency better in the planning task than public school students. The students of Private schools are more proficient in the planning task. Generally, the students' of the private schools who were involved in this study had school laboratories for science hands-on activities. This was clearly shown in the tables used for the results and discussions. Experiences from the United States of America showed that hands-on performance assessment can distinguish students who have experience in hands-on science from students who do not (Shavelson et al., 1991). From the discussions, 67(59.8) of students' from public schools were proficient on skill levels 4 to 6 whilst private schools, 79(69.9%) students were proficient on exhibiting skills in the planning task. In the nut shell private school students exhibited greater number of skills in planning task than the students' of public schools.

Conclusion

From the study, it could be inferred that teacher should guide students to improve performance in dealing with exhibition of individual skills in the tasks. According to Collete & Chiappetta (1989) laboratory work permits students to plan and to participate in investigations or to take part in activities that help them to improve their manipulative skills. Teachers might also need to motivate students using laboratory work to improve proficiency of exhibiting skills in the planning, performing, and reasoning tasks.

The study has proven that performance assessment is one of the tools that could be used to assess or to measure the extent to which students could exhibit the proficiency of skills in the various scientific tasks.

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Appendix A

TASK 1 (Planning Task)

Introduction

This experiment poses a problem and list of materials that need to be used. You have 30 minutes to plan and design an experiment to solve the problem. You will use 5 minutes to read the task to know what you are required to do before starting the task.

Problem

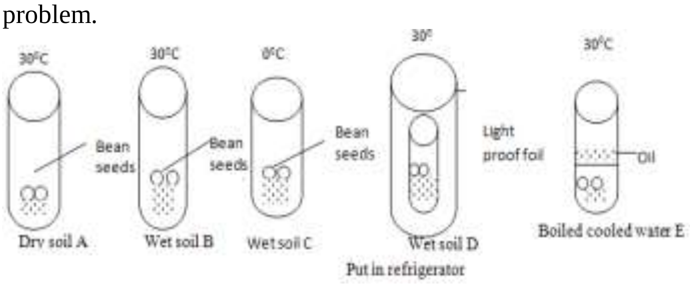
To find out whether the bean seeds provided can germinate. You should have five milk tins, wet and dry soils, Boiled cooled water, oil and refrigerator, bean seeds. [see set up A, B, C, D, E.].

Assuming that you are a farmer and would want to find out whether the bean seed provided for sowing can germinate. [Viable seeds germinate under favourable environmental conditions].

a. List in order the process or the steps you will use to solve the problem. Draw diagrams to support the plan that would be executed for the experiment. Mention the safety precaution that will ensure at least accurate results.

b. At the end of 30 minutes your answer sheet will be collected.

NB: You are only to plan and organize a way to solve the problem.



1.	Plan	0	1
2.	Systematic plan	0	1
3.	Detailed plan	0	1
4.	Workable plan	0	1
5.	Diagrams	0	1
6.	Safety measures	0	1
7.	Additional plan	0	1
		Total	7

Materials/Apparatus

Five milk tins, wet and dry soils, Boiled, cooled water, oil, refrigerator, Bean seeds.

Procedure

………………………………………………………………
………………………………………………………………
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Diagrams

SCORING FORMAT

School/student ID No. …………………..... Reader ID No. ………………………

Date ……………………… Time ………………………………….

Course: Biology Task A

GERMINATION OF SEEDS

1. Award one mark when there is clear evidence of showing a particular skill by the student and find the total marks.

Task 1:planning

Detailed Marking Scheme

1.	Award one mark if student demonstrated planning.	0	1
2.	Award one mark if students plan is systematic.	0	1
3.	Award one mark if student's method is detailed.	0	1
4.	Award one for workable plan.	0	1
5.	Award one mark for diagrams.	0	1
6.	Award one mark for any safety measures.	0	1
7.	Award one mark for additional plan.	0	1
		Total	7