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Conducting effective physics practical in senior high schools: A case study on challenges in the Bongo District

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Abstract
This is an in-depth research study on the challenges confronting students in conducting physics experiment. A descriptive survey was deployed in this research with a total number of 270 Students and 7 teachers, out of which only 120 Students and 4 teachers were randomly selected as the sample. A good number of challenges were identified during the course of this study, which were: difficulty in identification of physics apparatus, mounting the apparatus, taking accurate readings and making careful observations during the experiment, insufficient laboratory apparatus, absence of standard physics laboratory and lack of effective supervision among others. The recommendations made after this research includes supply of adequate laboratory equipment and sufficient provision of a standard physics laboratory.

Keywords: Physics Practical, Case Study, depth research, laboratory

1. Introduction

1.1. Background to the Study

Science and Technology is the order of this new age as we live today. The lives of individuals has been a revolutionary due to scientific inventions and discoveries. Science is basically the knowledge derived from readings, observations, experimentation and realization.

Majority of the subjects offered today in our institutions comprises of science subjects especially in the primary level of education. These subjects are very essential when it comes to applied sciences and technology because it has the ability to improve upon the living conditions of nations and the entire universe, transforming attitudes, skills and cognition by increasing individuals knowledge about themselves, their surroundings and the world at large.

Science Education is the anchor of every developed nation since their dependance is on science and technology. It has been rated as the most powerful tool that helps in the development of many nations. Technological advancements, health improvement, promoting national wealth and rapid growth of industrialization is all being spear headed by science education (Validya, 2003).

One of the science subjects for comprehending the complexities of technological advancement and modern technology of a nation is Physics. It contributes significantly to many inventions that shapes our today world and also helped to explain many of the situations and events we comes across every day.

Physics is one of the pre-requisite subjects for studying medical science courses, technological engineering and many other science related courses in our tertiary institutions. It provides training and also develops the skills of individuals to be applied in innovative ways in other fields as well. Irrespective of the importance and need of physics in our world today, only few individuals choose to study physics at the secondary and even the tertiary level. Several students perform poorly in this subjects physics, some due to inadequate or lack of practical work can be one of the important reasons for the poor performance and content knowledge and understanding of physics at the secondary and tertiary level (Millar, 2004).

In Ghana, there is a serious shortage of physics teachers and students alike in the secondary and tertiary institutions as discovered in recent research and it has been a concern among researchers, science educators to really identify why this is so.

According to research, the prro performance of students and the reason for few individuals undertaking further physics related courses is a result inadequate laboratory equipment, facilities and logistics which makes the study of physics imperative (Olabanji, 1997) [11], supported by Akanbi (2003) [3]. This is because physics as a course of study is seen to be experimental in nature and understanding practical concepts. Physics education cannot be fully realized if the performance of students in both physics theory and practical is not balanced with regards to the educational objectives (Aina, 2011) [1].

Physics has been tagged as the most conceptually difficult subject especially with the practical aspects. It is therefore necessary to expatiate the underlying challenges and difficulties that impedes the learning qualities and fascinating nature of studying physics. The aim of this study therefore is identify challenges associated with conducting effective physics practical in Senior High Schools in the Namoo District in Ghana.

1.2. Statement of the Problem

The purpose of this study is to make an evaluation analytically with regard to the challenges impeding the conduct of physics practical and possible suggestions that will improve the efficiency and effectiveness of the conduct of physics practical in Senior High Schools in the District of Namoo.

Upon closely examining the methods used in majority of our secondary schools for handling physics practical, it is likely that pupils were forced to view physics as a body of laws. Nonetheless, it is believed that appropriate behavior and student participation in physics are likely to be passive learners even in the laboratory as they observe teachers do demonstrations, experiments, or theoretical instruction because practical has become less important.

Some presumed issues would be that practical work is not valued by students as a means of fostering scientific attitudes and abilities. Jegede & Okebukola (1995) [5], and other scholars have noted that inadequate equipment and facilities can interfere with the efficacy of physics instruction in schools. This is another issue affecting the conduct and learning of physics practical in schools.

The amount of time allotted for physics practical in the school lesson plan is inadequate, which negatively impacts the activities that must be completed. This poses a serious obstacle to the smooth operation of the school's physics practical.

Another issue pertaining to the conduct of physics practical in schools is the stress that physics teachers face. In some parts of the world, inadequate working conditions due to a lack of practical equipment for conducting effective physics practical have been identified as the source of stress. An unpleasant teaching experience can give rise to tension, frustration, anger, anxiety, and depression. Within the Ghanaian setting, this is hardly an isolated instance. These unfavorable working conditions stress out Ghanaian physics professors (Jegede & Okebukola, 1995) [5].

1.3. Objectives of the Study

This research is carried out to find out the following objectives

1. To identify the challenges facing students in conducting effective physics practical in Senior High Schools.
2. To determine the relationship between inadequate physics practical equipment and the conduct of effective physics practical in Senior High Schools.
3. To identify the possible solutions to the problems facing students in conducting effective physics practical in Senior High Schools.

1.4. Research Questions

For the purpose of this research, the following questions were raised:

1. What are the challenges facing students in conducting physics practical?
2. What is the relationship between inadequate physics practical equipment and the conduct of effective physics practical in Senior High Schools.
3. What are the remedies to the challenges facing students in the conduct of physics practical in Senior High Schools?

1.5. Research Hypotheses

For the purpose of this research, the following hypotheses were tested:

1. There are no challenges facing students in the conduct of physics practical.
2. There is no significant relationship between availability of physics laboratory equipment and the conduct of effective physics practical in Senior High Schools.
3. There are no remedies to the challenges facing students in conducting physics practical in Senior High Schools.

2. Methodology

This describes the research design, the population of the study, sample and sampling technique, instrument for data collection, validity of the instrument, reliability of the instrument, administration of instrument as well as techniques for data analysis.

The design used in this research was a descriptive survey research design whereby data were collected, analyzed, and interpreted based on the prevailing circumstances.

2.1. Instruments and Data Collection

The population of the study includes the Science Senior High Schools in the Namoo District out of which only two were selected to represent the whole schools in the district. The sampling procedure was based on random sample of different teachers and students among the two selected schools.

Sixty (60) physics students and three (2) physics teachers were selected from different science classes of each school. This means that a total of (120) students and fifteen (4) teachers were selected to represent the entire physics students and teachers in the district.

The instrument used for the data collection in this research study was a two set of structured questionnaires for Senior High School teachers and students. The questionnaire consists of (15) questions, (10) questions for students and (5) questions for teachers. The student's questionnaire ask questions on students problems in conducting physics practical which include their observed areas of difficulty in conducting and presentation of physics practical experiment i.e. identifying physics apparatus setting apparatus, making observation, preparing table of values, and plotting graph among others. The teacher's questionnaire ask question based on the adequacy of laboratory equipment, laboratory condition, time allocated to physics practical class, and their suggestion on the possible solution to the problems in their

schools.

2.2. Data Presentation and Analysis

The data were presented and analyzed through the frequency tables and simple percentages. This chapter also discussed the findings of the results. There were two sections to the data presentation and analysis. Part A contains the basic frequency table and simple percentages for the answers from students to the questionnaire; Part B contains the basic frequency tables and simple percentages for the answers from teachers to the questionnaire.

Part A (Student's Questionnaire Analysis)

Table 1: Practical Text Book and Practical Manual:

Response	Frequency	Percentage
Yes	32	26.6%
No	88	73.4%
Total	120	100%

Table 1 reveals that 26.6% of respondents said no, and 73.4% said yes. This demonstrates that there are insufficient practical guides and text books available to help pupils. It could be the result of insufficient materials.

Table 2: Identifying Physics Apparatuses

Response	Frequency	Percentage
Yes	48	40%
No	72	60%
Total	120	100%

Table 2 indicates that 40% of respondents said yes, while 60% said no. This demonstrates that finding physics apparatuses is a challenge. This could be brought on by a visual impairment and a lack of essential information.

Table 3: Problem in Setting the Apparatuses

Response	Frequency	Percentage
Yes	115	95.8%
No	15	4.2%
Total	120	100%

Table 4 shows that, of those surveyed, 95.8% said "yes," and 4.2% said "no." This demonstrates that the majority of students struggle to set the physics equipment. This could be brought on by pupils' absenteeism and inadequate monitoring.

Table 4: Problem in Making Observations

Response	Frequency	Percentage
Yes	102	85%
No	18	15%
Total	120	100%

According to the above table, 85% of respondents said "yes," while 15% said "no." This demonstrates that the students struggle to record observations during the experiment, which could be caused by poor lighting in the lab, poor supervision, or both.

Table 5: Problem in Writing Conclusion and Practical Reports

Response	Frequency	Percentage
Yes	63	52.5%
No	57	47.5%
Total	120	100%

As can be seen from the above table, 52.5% of students struggle to write a solid practical report that concludes the experiment they conducted for their physics practical. It could be a language issue.

Part B (Teacher's Questionnaire Analysis)

Table 6: Teacher's Qualification

Response	Frequency	Percentage
Diploma	0	0%
B.Sc Ed	3	75%
B.Sc	1	25%
Total	4	100%

Table 6 shows that 0% of people have a diploma, 75% have a B.Sc.Ed., and 25% have a B.Sc. This provides them with the necessary credentials to respond to the survey.

Table 7: Adequacy of Laboratory Equipment

Response	Frequency	Percentage
Yes	1	25%
No	3	75%
Total	4	100%

Table 7 reveals that 25% of instructors answered "yes," whereas 75% of teachers said "no."
This demonstrates that the lack of proper physics laboratory equipment in schools makes doing practical extremely challenging, if not impossible.

Table 8: Periods allocated to physics practical per week

Response	Frequency	Percentage
Once	3	75%
Twice	1	25%
Thrice	0	0%
Total	4	100%

Table 9: The data indicates that 0% of the respondents said they conduct physics practical three times a week, 25% said they conduct physics practical twice a week, and 75% say they conduct physics practical once a week. This demonstrates that students are not given enough time to complete their physics practical in an appropriate manner.

Table 9: Provision of a Standard Physics Laboratory

Response	Frequency	Percentage
Yes	4	100%
No	0	0%
Total	4	100%

This table shows that 100% of the teachers responded yes, which indicates that provision of a standard physics laboratory could be a solution to the problems in conducting

physics practical.

3. Discussion of Results

Based on the data above, it was found that students struggled to find good practical physics text books. Textbooks are crucial to students' education. There are not many physics practical books available, and the ones that are were expensive for the pupils. Learners must read quality textbooks to get ready for practical job. These books are helpful when combined with a useful guidebook. When reading these books and then going to the lab for practical, the students find them helpful in understanding the theory behind physical laws and concepts. In order to guide students during their physics practical in the laboratory, supervision is crucial. They still require guidance from a lab instructor or technician even with the lab handbook; when this is done incorrectly, they find it extremely challenging to execute properly.

Good performance in the physics practical depends on the conditions of the laboratory, which is why Aina (2010) [2] accentuated that the physics laboratory needs to be constructed in accordance with accepted standards. When a physics lab is not constructed correctly and lacks the necessary amenities, learning Students' performance in such a laboratory will suffer as a result of the practical difficulties. Aina (2010) [2] states that certain facilities are essential for a physics laboratory and should not be compromised in any way.

Physics practical heavily rely on laboratory apparatuses; in the event that these are inadequately provided, student performance suffers. The aforementioned research supports argument that inadequate lab equipment impact a student's science performance. Physics theory and practice are inseparable since the ideas, laws, and concepts that are acquired in theory are implemented in practice. In his work on the relationship between students' academic achievement in theory and practical physics, Aina (2011) [1] contended that Theoretical knowledge is useful in practical situations. Students who do well in physics need to be able to relate the two.

Students should be able to draw accurate conclusions from all of the experimental activities conducted in the physics lab because each experiment must have a conclusion and a report. There should be strong evidence that the students understood the experiment's title. He or she gave a performance. Students of physics must to be proficient in writing practical reports.

3.1. Conclusion

This study has shown that there are issues that make it difficult for senior secondary schools in the community of Namoo to conduct good physics practical. After compiling and evaluating the data, the researcher have arrived at the following conclusions.

Students in senior secondary schools in the community of Namoo face difficulties when conducting their physics practical. Thus, the first hypothesis, which states that there are no issues that students face when conducting their physics practical, is disproved. The issues that students are having with the practical aspects of physics have answers. Thus, hypothesis (2), which states that there are no answers to the issues that arise when students complete their physics practical, is likewise disproved.

Some teachers claim that the absence of laboratories and laboratory supplies makes it more difficult to conduct an effective practical session. Thus, hypothesis (3), which states that the successful execution of physics practical and the availability of laboratory equipment do not significantly correlate, is likewise disproved. Some teachers have stated that the time allotted for the physics practical is insufficient and inappropriate. Thus, it is accepted that hypothesis (4), which states that there is not enough time allotted for the physics practical.

3.2. Recommendations

The following recommendations were made from the light of the above conclusion:

1. The use of good practical text books should be provided by Government and CEOs of the schools.
2. All schools should have a standard physics laboratory that is well equipped with modern physics equipment.
3. All obsolete physics apparatuses should be done away with in senior secondary schools and put new ones in place.

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