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A CRITIQUE OF CURRENT ASSESSMENT PRACTICES OF SSS PHYSICS PRACTICAL EXAMINATIONS: THE WAY FORWARD IN THE 21ST CENTURY

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ABSTRACT

This paper, a critique of current assessment practices of SSS physics practical examination: the way forward in the 21st century, looked at the current method of assessing physics practical during class work and during the final examinations that lead to the award of the Senior Secondary School Certificate. It was found that in addition to assessing the psychomotor domain of instruction, the examination question paper also examines some aspects of the cognitive aspects which can be taken care of by theory papers, and that the current system can encourage examination malpractice because the step-to-step activities that lead to the results obtained are not rewarded. It was suggested that Observation Schedule be used because apart from increasing students skills in manipulating equipment, it can increase also students' performance in examinations, and can ameliorate examination malpractice among students.

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INTRODUCTION

Practical courses in physics at the secondary school level are designed to produce students with the basic knowledge in areas such as Mechanics, Electricity, Magnetism, Optics, Heat, and Electronics among others. In addition, the students are expected to acquire some skills in the manipulation of equipment; be able to carry out simple experiments and make report of same according to acceptable scientific practices. To this end, the students are exposed to the various apparatuses and techniques that will enable them carry out some experiments.

Examination (whether internal or external) is "a means of evaluating a sample of behaviour deliberately evoked, in an attempt to assess achievement", Chamber's Encyclopedia(1973). The "Standard" practical physics examination consists of a series of instructions, which can lead the student to obtain the necessary data, plot graph/or make a required analysis.

It has been observed in both internal and external examinations that some students ignore the sets of instructions on the question paper while writing such practical examinations. They came into the examination hall and start to assemble the apparatuses, take readings and make their reports. In the end, a few intelligent ones get away with it; while others may be stuck and confused. At this point they would resort to examination malpractice or even abandon the examination out of frustration.

All of these are possible because, the student, finding the same familiar apparatuses in the examination concludes that the experimental procedure must be the same as that which he had done in class. So, without regard to the instructions in the question paper, he begins to perform a "wrong" experiment. In some cases data obtained in class are recalled from the memory of a calculator and given the same treatment as in class.

Another obvious reason why the students behave that way is because the evaluation that is carried out, ignores the actions such as (i) Place the rectangular glass block on the drawing paper and draw the outline A B C D, (ii) Remove the block and mark point x along A B (as in figure 1), (iii) Draw the perpendicular to A B and produce to meet D C.(iv) Draw S X such that it makes angle i = 20^{o} with the normal NX. (v)Fix two pins E and F along S X and so on that produce the results.

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This paper tries to show how this is so and how the actions can be incorporated into the examination and evaluation. This is important because according to Ezewu and Okoye (1981), the nature of the cognitive behaviour we are dealing with here are those associated with or incidental to the learning of psychomotor skills.

CURRENT MEASUREMENT AND EVALUATION PRACTICES

The measurement and evaluation practices to be discussed are in two parts –

(i). during the actual practical classes and

(ii). during the final examination leading to the award of the Senior Secondary Certificate (SSC).

I. The report turned in to the teacher at the end of the practical class has the following sections.

(a).	Readings	(d)	Sources of errors
(b)	Graph	(e).	Precautions
(c).	Calculations		

The emphasis differs from teacher to teacher. In the assessment scheme, marks are awarded to each of these sections and the students' report marked based on the correctness as determined by the teacher. Cumulative records are kept to determine the final grade at the end of the term and subsequently the year.

(ii). Presently, Nigeria will continue to use the West African Examination Council as its national examinations body, since this does not prejudice Nigeria National interests, and in fact has advantages (National Policy on Education, 2008). This has been so and they provide what I describe as standard questions and marking schemes.

The prototype practical physics examination question paper and the marking guide for the senior secondary take the form shown below.

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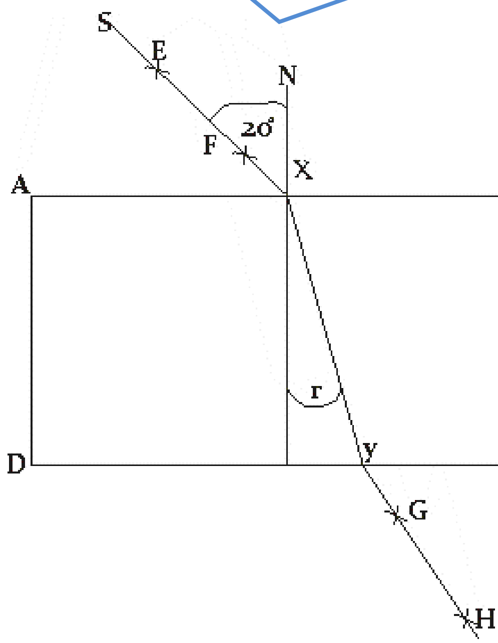

Fig 1

Place the rectangular glass block on the drawing paper and draw the outline A B C D. Remove the block and mark point x along A B (as in figure 1). Draw the perpendicular to A B and produce to meet D C. Draw S X such that it makes angle I = 20^o with the normal NX. Fix two pins E and F along S X. Now replace the block and fix pins G and H such that they are in a straight line with E and F when viewed through the block. Remove the block and the pins. Join HG and produce to meet DC at Y. Join X Y and measure angle r.

Repeat the experiment four more times with i taking values of 30^o, 40^o, 50^o and 60^o. In each case find the corresponding value of r and tabulate your readings.

Plot a graph with (sin i-sin r) on the vertical axis and sin r on the horizontal. Calculate the gradient of the graph.

State two precautions you took when performing this experiment. (31marks)

(ii) (a) Define refractive index. (3 marks)

(b) Draw a ray diagram to show the lateral displacement d for a ray passing through a rectangular glass block, (3 marks)

(c) State two conditions for total internal reflection to take place. (3 marks)

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The marking scheme for the above question shows that it is divided into two parts (1) and (2) as follows:

1. (a) Observation has a total of fifteen (15) marks distributed as follows: (i) five trace – 2mrks (ii) five values of sin i correctly read to at least 3 decimal places - 2½mrks (iii) five values of r – 5mrks (iv) five values of sine r. (treated as above) – 2½mrks (v) five values of sin I – sin r – 2mrks (vi) composite table (containing ii –iv) - 1mrks

   (b) Graph has eight marks as follows:

   (i) Axes distinguished – 1mrk

   (ii) Suitable scale – 1 mrk

   (iii)Five points correctly plotted to the nearest ½ Scale division – 5mrks

   (iv) Line of best fit (at least 3 pts correctly plotted) - 1mrk

   (c) Gradient: have four marks as follows:

   i. Large triangle – 1mrk

   ii. DX correctly read to at least ½ scale divisions -1mrk

   iii. DY correctly read to at least ½ scale divisions- 1mrk

   iv. Gradient – 1mrk

   (d) Accuracy – 2 mrks

   (e) Precaution – 2 mrks

(2). (a). Definition of refractive index - 3 mrks

   (b). Correct diagram showing lateral displacement – 3mrks

   (c). Two conditions for total internal reflection – 3mks

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COMMENTS

A look at the question paper shows that it could be divided into two main parts – the actions and the results of the actions.

The marking scheme, both for class work and the examination, takes care of the results of the actions believing that the result will be incorrect or not possible if the action is wrong. This assumption has loop holes.

(i). A candidate can copy from another who actually carried out the actions.

(ii). Intelligent guesses can be made at the values of some required measurements thereby skipping the actions.

Apart from the above, the question paper overtly examines some cognitive aspects which can be taken care of by the theory paper. We have observed that the main report has a total of thirty one marks (31) distributed over observation, (with emphasis on decimal places); graph, with emphasis on plotting; Accuracy and precautions with the exclusion of the actions taken to arrive at the results. This according to Ezewu and Okoye (1981) would be disastrous, since the assessment of the skills and actions that lead to the results are as important as the results.

It is the view of this paper that in addition to assessing the result, the action/process that leads to it be also assessed and incorporated into the final grading of the students' performance through the use of Observation Schedule. In this way the psychomotor domain would have been adequately catered for.

This can be done by de-emphasizing the result obtained. For example the whole of section (2) can be reserved for the theory paper in physics or at least allot fewer marks to it. By so doing, the actions/process that lead to the result can be allotted marks as indicated below; in the observation schedule

"The observation schedule is as follows:

(i). Placing of block and drawing of its outline - ½ mark

(ii). Marking of point on AB - ½ mark

(iii). Drawing of the perpendicular to AB and producing to DC - ½ mark

(iv). Drawing of line SX to make 20^o with NX - 1 mark

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(v). Fixing of pins E and F along SX - ½ mark

(vi). Replacing Block and fixing of pins G and H - 1 mark

(vii). Removal of block and pins and the joining of HG and XY - 1 mark

(viii). Measurement of r° 1 mark

(ix). Repeating the actions described above, 4 more times; each repetition awarded 4 marks, 3 marks, 3 marks and 3 marks in turn.

(x). Care in handling apparatus - 1 mark

(xi). Extent of completion of experiment - 1 mark

With this arrangement, the result/report should be allotted 20 marks.

The advantages of Observation Schedule:

In preparing this schedule, the performance objectives…must state the actions to be performed; and the intended outcomes; the actions that should lead progressively to the intended outcome must be sequentially ordered (Ezewu and Okoye 1981).

When applied to the classroom situation to prepare students for practical examinations, it ensures that:

(i). the Student does not assume any set of instructions;

(ii). the Student gets used to reading the instructions carefully, knowing that his actions are going to be evaluated;

(iii). the Student does not have to recall from the memory of an electronic calculator, data that were previously obtained from class practice;

(iv). the students builds up confidence in his ability to manipulate any apparatus given to him. More importantly, it ensures that the student acquires the necessary skills through practices; and above all, the student's tendency to cheat in examination will be drastically reduced.

The Way Forward

The way forward is in the effective use of the observation scheduled since it will both increase the students' manipulative skill and students' performance in examinations. This approach is not without problems but possible solutions could be induced to maximize the advantages of the observation schedule.

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PROBLEMS AND POSSIBLE SOLUTIONS

As with all human endeavour, problems are bound to arise during the implementation stage. Some of the problems among others include:-

(i). **Time**: As at now, the physics practical examination is done in one day for three hours. Where the class size is large, the students are examined in batches on that particular day. In other words the maximum time spent is one day (or two days where both alternatives A and B are offered). The use of OBSC necessarily will increase the time considerably beyond two days for large classes.

It is my view of the authors that these additional days can be accommodated based on the aims and objectives of OBSC. This is because there are other subjects whose examinations span more than one week. The conduction of oral English examination for example takes more than one week and yet it is successfully conducted. Considering the number of candidates who take part in oral English, the examination of physics practical where OBSC is incorporated certainly will take less time and comparably faster.

(ii) **Cost**: The cost of a physics practical examination is made up of cost of materials – apparatuses, papers; and allowances for examination officers. The only additional cost will be that of taking care of extra time to administer the Observation Schedule; and this can be accommodated with proper planning.

(iii). **Personnel**: At present, physics practical is successfully organized by the course teacher. It is usual to employ ad hoc staff to assist in preparing students for physics examination where there is no permanent physics teacher. The extra hands that will be needed to make the introductions of Observation Schedule effective can still be obtained in similar manner.

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CONCLUSION

This paper has tried to show that current measurement and evaluation techniques used in both internal and external examinations of physics practical address some aspects of the psychomotor domain of instructions and others that could not correctly be described as psychomotor. In particular the actions which are as important as the report are evidently ignored.

The consequence of this is that while in a practical examination class, the student may or may not carry out the experiment and can still turn in a report. The source of his data could be intelligent guess, or outright examination malpractice. In this way, the necessary skills and confidence in manipulating apparatuses may not have been sufficiently acquired.

The use of Observation Schedule can improve the situation, if adopted, both during class practice and in the main examination; in addition it will produce students with better skills in manipulating apparatuses; more confident in examinations; thereby contributing to the reduction of examination malpractice.

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