



The Influence of Reinforcement Skill on Academic Performance of Secondary School Physics Students in Obio-Akpor Lga, Rivers State Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author NNSM designed the study, wrote the protocol and supervised the work. Authors OLG and NNSM carried out laboratories work and performed the statistical analyses. Author OLG managed the analysis of the study. Author NNSM wrote the first draft of the manuscript. Author OLG managed the literature searches and edited the manuscripts. Both authors read and approved the final manuscript.

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ABSTRACT

This study is aimed at assessing the influence of reinforcement skill on the Academic Performance of Secondary School Physics students in Obio/Akpor Local Government Area of Rivers State, using three research questions and one hypothesis. The study which adopts the descriptive and quasi-experimental research design employed a sample size of sixty teachers and one hundred and twenty students of senior secondary One (SS1) in the sample Area. The questionnaire titled "Teachers Reinforcement Skill Questionnaire" (TRSQ) was part of the instrument and fundamentals of Measurement in Physics. The statistical mean was used to analyse the data for the research

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questions while standard deviation and Z-test were used to analyze the data to obtain the validity of the hypothesis. The findings revealed that some factors such as insincere reinforcement, adoption of only one form of reinforcement, among others, hinder proper application of reinforcement skill. It was also found that the use of reinforcement influences the academic performance of Physics students. Based on this, it was recommended that teachers should always apply reinforcement skill, be sincere in the application and attend training programmes on teaching skills.

Keywords: Reinforcement; academic performance; physics; secondary school students; Obio-Akpor.

1. INTRODUCTION

Micro teaching is a process that offers trainee teachers the opportunity to acquire certain teaching skills in order to be competent in a teaching process. Teaching skills are part of the competences to be exhibited by the student-teachers in a micro teaching session and it is a concept that is viewed by different authors to mean overt specific behavioural activities or actions exhibited in the classroom to enhance lesson presentation in order to achieve the specific objectives of the lesson [1]. There exist a catalogue of teaching skills, such as set induction, stimulus variation, closure, questioning, planned repetition skill, reinforcement skill and others, which is fall out of monumental work undertaken by Allen and Cooper in the field of teaching over four decades ago [2].

The skill of reinforcement which is the focus of this study was clearly illustrated in B. F. Skinner's study of Operant Conditioning. Skinner was particularly interested in showing the effects of the reinforcement skill as the basic principle involved in the formation of associations, especially as it relates to teaching and learning. In this landmark study by Skinner as described in [3], series of experiments were developed to observe the effects of presentation of foods (reinforcement) on a hungry rat. The actions (or responses) of the rats were reinforced by allowing the dropping of food into the cage when the bar is raised and the increased activity of the rat was noticed through the rate at which the rat presses the bar. On presentation of the food when the bar was pressed under certain condition, such as immediately after ringing a bell, also made the rat change to pressing the bar when the sound of the bell is heard and the rate of pressing of the bar at any other time dropped noticeably. Later intervention by Skinner to reinforce according a routine schedule by deciding to reward the rat every second or third time the bar is pressed and the bell was ringing also showed that the pattern of reinforcement

causes alteration of the pattern and rate of response from the rat as the rat learnt to press the bar more frequently when its behaviour was reinforced. The response rate and capabilities of the rat, if not continually reinforced, would have gone into extinction. The teacher is expected to apply the appropriate teaching skills to enable them present their lessons effectively to achieve its specific objective(s). The lesson from Skinner's study clearly shows that reinforcement strengthens acts which immediately precede it and teachers' awareness of the impacts reinforcement will have on behaviours immediately preceding its application is an important step towards the effective application of this teaching skill. Teachers' ability to recognize only correct responses is vital because it will prevent students from associating the reward with inappropriate responses since the teacher should make students aware of the particular aspect of their behaviours that is desirable. In other words, students should be made to know exactly what behaviour(s) of theirs that is being reinforced so as to encourage them. The spontaneity of reinforcement is a very important aspect of the learning situation that is often overlooked by most teachers. The best time to encourage students to repeat or continue a particular response or desirable behaviour is immediately following the response and teachers should be able to recognize within the classroom setting, desirable responses and reinforce them immediately following such response(s). If what needs to be reinforced is a written work, then the scripts should be returned within a few days so as not to delay the reward for too long because the longer the scripts and results are delayed the less the reinforcing value will be to the students. The implication is that if reinforcement is delayed for too long or feedback is completely withheld, the students will not know which behaviours or responses to be repeated and which should be extinguished. It is therefore important for teachers to recognize that effective application of the reinforcement skill is a crucial aspect of the learning process and that feedback should be valued, frequent and fairly immediate.

The reinforcement skill, which is one of the teaching skills that can be applied to modify or change behaviour of the learner, may be positive or negative [4]. In this study, the effectiveness of the reinforcement skill in teaching and its influence on the academic performance of secondary school physics students will be investigated.

1.1 Statement of Problem

It is a universally acknowledged fact that reinforcement can bring about positive changes in the behaviour of the learner, if applied appropriately. Both professional and trainee teachers ought to apply reinforcement in a teaching and learning process. Depending on the situation and response from the learner, the teacher in the classroom should apply positive or negative reinforcement when necessary during the teaching-learning process.

Back to the focal point of this work and from observation as a teacher, it should be expected that students will have preferences for teachers' praise as feedback. While some students may not be too comfortable with praise for their academic performance, others will prefer to be praised as a way of motivating them. There are some other groups of students that prefer not to be praised in public and those that may not want it at all-publicly or in private, while some want it public. Whereas it can be observed that public praise and feedback may produce discomfort and punishment for some students due to negative social consequences such as bullying, teasing and belittling by other students, these tools are still very important teaching skills that are vital in the teaching-learning process. It is believed that teachers' application of reinforcement enables students to gain confidence in the teacher's explanation and their responses as learners when questions are asked by the teacher thereby enhancing the academic performance of the student in any subject.

However, it has been observed that some teachers do not apply reinforcement skill fully resulting in strong negative influence on students' academic performance. Adequate knowledge of this and other teaching skills can be brought to the attention of the teachers and other stakeholders in education through seminars and other training programmes geared towards updating on current issues in these teaching skills and their applications. The trend at the moment shows that some teachers are yet

to understand the meaning of this concept, its application and benefits. Thus, the researchers assume that wrong application of reinforcement can lead to poor academic performance of secondary school students and may lead to high rate of failure. This is what necessitated this study which is aimed at assessing the influence of reinforcement skill on academic performance of Secondary School Physics students in Obio/Akpor Local Government Area Rivers state.

1.2 Significance of the Study

The result of this study will provide valuable information to teachers on how to handle their students, using reinforcement skill in the class and outside the classroom environment. The study will also lay a foundation for providing policy direction towards improvement on existing teaching skills in academic institutions for School Managements, Government and other stakeholders. It will also assist the Ministry of Education to plan training and retraining programmes for teachers to equip them on the application of reinforcement. Researchers could use information from this research as reference material for their work.

1.3 Purpose of the Study

This study is designed to achieve the following objectives:

- To find out factors that hinder the application of reinforcement skill in the teaching of Physics;
- To proffer solutions to the identified factor(s) that hinder Physics teachers' application of the reinforcement skill;
- To ascertain the influence of reinforcement skill on students' academic performance in physics.

1.4 Study Area

The study area is Obio Akpor, one of the Council Areas in Port Harcourt Metropolis, Rivers State, Nigeria. Therefore, the study area is one of the major centres of economic activities in Nigeria covering a total land area of 260km² and, by the 2006 population census has a population of 464,789. The noticeable high number of inhabitants of this area makes assessments of this nature very important as it will help to improve the quality of education in our Secondary Schools.

1.5 Research Questions

To guide this study three research questions were formulated:

- What are the factors that affect Physics teachers in applying reinforcement skill?
- What are the solutions to the identified factors that hinder the application of reinforcement skill by Physics teachers?
- What influence does the skill of reinforcement have on students' academic Performance in Secondary School Physics?

1.6 Hypothesis

There is no significant relationship between teachers' application of reinforcement and students' academic performance in secondary school physics.

2. REVIEWS OF RELATED LITERATURE

Reinforcement is a skill applied to modify or change pupils' behaviour positively not negatively [1] which can be applied by the teacher or presenter to increase positive behaviour of the learners and also discourage learners' negative behaviour. Generally, reinforcement involves those techniques that results in positive alterations of learning behaviour. There are two main types of reinforcement- positive and negative reinforcement.

Positive reinforcement is the process in which the teacher encourages positive behaviours of learners to enable them achieve the specific objective(s) of the lesson [5,6,7]. The teacher can smile, praise the learner, or make complementary comments such as well done, good, splendid, etc. This process encourages pupils' attention, maintains motivation and modifies disruptive behaviour thereby helping to improve learning.

Negative reinforcement refers to the application of skills and techniques that will reduce, decrease or discourage negative behaviours in the learner [8,9]. This can be achieved through the teacher giving punishment to the learners as a means of making them improve on their performance or discouraging those behaviours that may have led to the poor performance, shouting at the learner, making such comments

as too bad, no, very poor, shaking the head or closing his eyes, etc.

Reinforcement has several components as stated by [10] in which seven components of reinforcement were identified and described, and comprise of:

- ✓ Verbal reinforcement which involve the ability of teachers to make verbal comments, both positive and negative, depending on the situation while teaching the learners. This type of reinforcement involves the use of such words as good, correct, yes, that's right, neat work, as positive; while no, bad, too ugly, poor etc., are negative reinforcements;
- ✓ Gestural reinforcement involves the use of facial expression like smile, delightful laugh, bodily expression, clapping, nodding, thumbs up or arms raised by teachers. On the other hand, a teacher can equally apply twitching of face, moody face, a finger crossing the mouth as negative reinforcement;
- ✓ Proximity reinforcement involves the teachers' display of interest in the students' performance by moving nearer, standing next to or sitting close to the students;
- ✓ Contact reinforcement can be used by the teacher by patting the student's head, shoulder, back, hand shake or by raising the student's hand in the class.
- ✓ Activity reinforcement involves the teacher giving to the students any task which they prefer as reinforcement for work;
- ✓ Token reinforcement entails the teacher giving awards, marks and sweets comment on books, test papers etc.
- ✓ Rewards like privileges given to the learner or recognition by the teacher falls into this category.

Some of the factors that may hinder the proper application of reinforcement by Physics teachers have been identified by [11] as:

- No students show interest in the application of the skill always
- Insincerity on the part of the teacher in terms of praise.
- Over use of one type of reinforcement and its relativity to others.

Measures to mitigate these factors include frequent application of reinforcement in the classroom and the fact that the reinforcement should be task-centred and not ego-centred.

Reinforcement from teachers should be sincere to the students, warm and full of enthusiasm. Furthermore, the use of reinforcements of various types should also be encouraged. It is believed that reinforcement skill has influence on students' academic performance because it captures the students' attention and gets them motivated as a result of some internal feeling of identification and reward. In the process, students' participation in classroom discussion is enhanced and the study pattern of behaviour of students is improved. Consequently, student's confidence is increased and disruptive behaviours are modified. It also strengthens teacher/student relationship in the classroom.

This is in agreement with [12] and [10] who had separately shown that reinforcement skill exist as both a motivating factor or a demotivating factor based on the students' interpretation of the daily verbal interaction occurring between class teachers and student. Therefore, it can be agreed that verbal interaction between teachers and students influences student performance level in a positive or negative way. This position is in agreement with [12] and [13] who had separately stated that positive interaction between teacher and students spurs academic performance or growth.

Similar work has been undertaken on other teaching skills. In 2010, a study was carried out by Mandah and Douglas on the application of the Planned Repetition skill to remedy lack of understanding as a result of forgetting in learning French among first year students of Rivers State University of Education, Port Harcourt, Nigeria. The study by [14] also considered the proper application of the Planned Repetition skill by teachers in French Department to enable students to understand oral, vocabulary and dictation exercises in French. The study had one research question and one hypothesis. Two groups were involved-Groups A and B. Group A was taught with the application of the Planned Repetition skill and Group B taught without the application of Repetition skill on a conventional teaching process. It was found that most students who were treated with the Planned Repetition skill performed better than some who were not treated with the Planned Repetition skill. It was also found that gender does not make any significant difference in application of planned repetition skill. Based on the above finding it was recommended that French teachers should always apply Planned Repetition skill to reduce forgetting and enhance recall.

3. RESEARCH METHODOLOGY

The experimental design adopted in this study was both descriptive and quasi experimental design. The population of the study was made up of all the eighteen (18) Public Secondary Schools in Obio/Akpor Local Government Area of Rivers state, and the entire staff of Physics teacher in those public Secondary schools.

From the eighteen (18) secondary schools in the Local Government Area, nine (9) schools were selected for the study through simple ballot technique. The random sampling technique was used to select thirty (30) Physics teachers out of the thirty-six (36) teachers in the (9) selected schools. Similarly, from the two hundred and forty-eight (248) students in the nine (9) selected schools one hundred and twenty (120) were selected through random sampling technique for the quasi experimental study.

The instrument for data collection was the questionnaire titled "Teachers Reinforcement Skill Questionnaire" (TRSQ), which was divided into two sections; Section A was designed to elicit preliminary information concerning the respondents and section B was used to solicit information on the influence of reinforcement on academic performance of the students. This part contained a four (4) point Likert Scale comprising Agreed (4), Strongly Agreed (3), Disagreed (2) Strongly Disagreed (1) as response mode.

The treatment procedure for the experimental group was such that there was no pretest with the one hundred and twenty (120) students being divided into two groups of A and B containing 60 students each with the aid of simple ballot system. Group A was taught 'fundamentals of Measurements in Physics' with the application of reinforcement skill for 40 minutes and three days in a week. While group B was taught same without the application of reinforcement skill.

Immediately after the treatment session for groups A and B, a post test was administered to both groups separately. The duration for the research procedure was two weeks. The students were subjected to a set of ten multiple objective questions on fundamentals of Measurements in Physics. The face and content validity of the instrument were ensured using experts in measurement and evaluation. The reliability of the TRSQ was determined by the use of the split half reliability technique. A correlation coefficient of 0.74 was obtained using

the Pearson's Product Moment Correlation Coefficient determination technique. This technique adequately confirms that the instrument was highly reliable. The instruments were personally distributed to the respondents by the researchers and all the 30 questionnaires administered were returned.

The data collected was analyzed with the aid of statistical means (\bar{x}) for the research questions, while the hypothesis was analyzed with the aid of standard deviation(S) and Z- test.

4. DATA PRESENTATION AND ANALYSIS

The findings of the study are as presented and discussed below:

4.1 Research Question 1

What are the factors that affect Physics teachers in the application of reinforcement skill?

Table 1 shows the mean responses of the respondents. The table reveals that statement 1 has a mean score of 3.26, statement 2 has mean score of 2.3, statements 3, 5 and 6 have mean scores of 2.9 each and statement 4 has a mean score of 2.5. The responses show that most of the teachers praise the students unnecessarily instead of commending them on desirable responses and that teachers tend to apply one form of reinforcement most of the time. Furthermore, some of the teachers' praise are not sincere making the students doubts them, and the teachers not fully understanding the concept and effective application of the reinforcement skill. All these responses seriously

affect effective application of the reinforcement skill by teachers.

4.2 Research Question 2

What are the solutions to the factors affecting Physics Teacher in the application of reinforcement skill?

Table 2 shows the mean response of the respondents on solutions to the problems affecting teachers in the application of reinforcement skill. The table shows that statement 1 and 3 have mean scores of 3.1 each while statements 2,4 and 5 have mean scores of 3.3, 2.9 and 3.4 respectively. These responses reveal that teachers should apply the reinforcement skill frequently, sincerely, and its application should be warm and full of enthusiasm. Further response revealed that application of this skill should be task-centred and that teachers should apply a variety of reinforcements.

4.3 Research Question 3

To what extent is reinforcement skill influencing academic performance of secondary school Physics students?

Table 3 shows that items 1 and 4 have mean scores of 3.3 and 3.0 respectively. While items 2, 3, 5, and 6 have mean scores of 3.0, 2.6, 3.0 and 2.3 respectively. The responses reveal that reinforcement skill captures students' interests and motivates them, it enhances students' participation in classroom activities, it improves classroom discipline and modifies behaviour, it increases self-confidence and it improves the study pattern and behaviour among the students.

Table 1. Mean score of factors affecting physics teachers in application of reinforcement skills

S/No	Statement	A (4)	SA (3)	D (2)	SD (1)	CR	N	\bar{x}
1	Most teachers praise the students during lessons instead of commending them on the tasks they had done right.	15	10	3	2	98	30	3.26
2	Teachers lack the interest to apply reinforcement.	05	07	10	08	69	30	2.3
3.	Teacher tends to over use one form of reinforcement.	12	08	06	04	88	30	2.9
4	Some teachers praise students even when the student does not deserve it.	05	08	15	2	76	30	2.5
5.	Students doubt some teachers' praise during the lesson and feel that they are not sincere.	10	8	12	0	88	30	2.9
6.	Some teachers do not understand the concept and application of reinforcement skill during their lesson presentation.	14	06	04	06	88	30	2.9

Table 2. Mean scores of respondents on the solutions to the factors affecting physics teachers in the application of reinforcement skill

S/No	Statement	A (4)	SA (3)	D (2)	SD (1)	CR	N	\bar{x}
1	Application of reinforcement skill during lesson presentation should be Frequent.	15	6	6	3	93	30	3.1
2	It should be task-centred not ego-centred.	19	4	4	3	99	30	3.3
3.	Teachers should apply variety of reinforcement forms.	17	5	3	5	94	30	3.1
4	Application of the various reinforcement forms during the lesson should be warm and full of enthusiasm.	14	6	4	6	88	30	2.9
5.	Teachers should apply it with sincerity during the lesson.	20	05	03	02	103	30	3.4

Table 3. Mean scores of respondents on the influence of reinforcement on academic performance of physics students

S/No	Statement	A (4)	SA (3)	D (2)	SD (1)	CR	N	\bar{X}
1	Reinforcement skill captures students' interest and motivates them.	15	12	01	02	100	30	3.3
2	It enhances students' participation in class discussion during the lesson.	12	10	03	05	89	30	3.0
3.	It improves the study pattern of behaviour of students during lesson presentation.	08	08	10	04	80	30	2.6
4	It increases self-confidence among students during the lesson and in other endeavours.	14	08	03	05	91	30	3.0
5.	It improves classroom discipline and modifies behaviour.	14	06	05	05	89	30	3.0
6.	It creates a cordial relationship between the teacher and students during the lesson and beyond.	05	10	05	10	70	30	2.3

4.4 Hypothesis 1

There is no significant relationship between application of the reinforcement skill and academic performance of Secondary School Physics student.

From Table 4 at 0.05 level of significance and degree of freedom of approximately 60, the critical or table value of $Z = \pm 1.671$ and the calculated Z-value is 6.7. Since the calculated Z-value is greater than the Z – critical value, the hypothesis is rejected. This means that there is a significant relationship between the application of the appropriate form of the reinforcement skill and the academic performance of Physics students.

5. DISCUSSIONS OF FINDINGS

The result of the research question one (Table 1) indicates that a lot of factors such as teachers' praise of students instead of commending their

task; teachers' over use of one form of reinforcement, students doubting some teachers' praise and others are some of the barriers to the proper application of the reinforcement skill and adversely affect Physics teachers in their application of the reinforcement skill. This result may not be unconnected to the fact that some teachers lack the capacity to apply reinforcement skills. The findings corroborate the result reported by [10] who stated that teachers tend to use only one type of praise and this can contribute to student dependency and maladaptive behaviours which can affect their academic performance. Also [12] and [15] reported that some students are aware when teachers offer praise that is insincere and this may hamper the effective application of reinforcement skill.

The result of research question two (Table 2) also revealed that the identified factors in Table 1 and discussed above can be remedied if teachers can adequately master the

Table 4. Mean, standard deviation and Z-test scores on the extent of relationship between reinforcement skill and academic performance of physics students

Reinforcement	\bar{X}	SD	n	Z-test score
Experimental group (A)	14	2.53	60	6.7
Control group (B)	10	3.85	60	

reinforcement skill to the extent that it can be applied frequently. The application of variety of reinforcement types including both verbal and non-verbal reinforcement types, teachers' sincerity during the application of reinforcement skill on students, among others, will also help to remedy these identified factors. These findings may not be unconnected with the fact that some teachers need to be retrained in order to help them keep abreast of the techniques of the reinforcement skill. This finding is in line with that of [4] and [2] who separately agreed to the use of various types of reinforcement and their frequent application in a teaching and learning process to improve the academic performance of the students.

Research question 3 reveals that proper application of the reinforcement skill influences academic performance of Physics students. This position is shown by the responses which indicate that proper application of the reinforcement skill captures and motivates students, enhances students' participation in classroom discussion, modifies disruptive behaviour, among others. This finding is in line with that of [16] who confirmed that rewards, praise, or extrinsic motivators can enhance students' academic performance. Finally the result of the null hypothesis indicates that there is a significant relationship between the application of reinforcement and academic performance of Physics students.

6. CONCLUSION

This study was a descriptive and quasi experimental type that focused on the application of the reinforcement skill to enhance the Academic Performance of Secondary School Physics students in Obio/Akpor LGA in Rivers State, Nigeria by considering factors such as teachers' praise pattern, teachers' lack of interest in the application of the reinforcement skill, teachers' non-use of a variety of reinforcement types, teachers' praising undeserving students, teachers' insincerity while praising the students as well as teachers' lack of proper understanding

of the concept and application of the reinforcement skill. From the findings it is established that factors such as insincere praise, continuous use of one form of reinforcement and others adopted by Physics teachers during application of reinforcement skill have some negative impact on the academic performance of the students. It was also found that sincere reinforcement (praise), frequent use of a variety of reinforcement forms are solutions towards factors that affect Physics teachers in their application of the reinforcement skill. Furthermore, it was found that reinforcement skill influences the academic performance in Physics by capturing their attention, making the students participate actively in classroom discussions, and improving on study patterns among other advantages.

7. RECOMMENDATION

Based on the findings of the study and the conclusion reached, the following recommendations were made:

- ❖ Teachers should use more than one type of praise to prevent mal-adaptive behaviours that may affect students' academic performance. Teachers' praise should be sincere so as to achieve the goal of its application.
- ❖ Physics teachers should always apply a variety of reinforcement skills while teaching the students.
- ❖ The stakeholders of teacher education should organize seminars, training programmes and other related activities that will assist teachers to have adequate understanding of the concept and application of teaching skills in general and the reinforcement skill in particular.
- ❖ Based on the fact that there is a significant relationship between the application of the reinforcement skill and academic performance of students in Physics, teachers should always apply reinforcement skill while teaching the students.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX A

Tabulation of the Scores of the Experimental and Control Groups

a) Experimental group

Class interval	F	x	FX	x- \bar{x}	(x - \bar{x}) ²	F(x - \bar{x}) ²
10-12	24	11	264	-3	9	216
13-15	23	14	322	0	0	0
16-18	11	17	187	3	9	99
19-21	2	20	40	6	36	72
	60		813			387

The mean, $\bar{x} = \frac{\sum Fx}{\sum f} = \frac{813}{60} \cong 14$

Similarly the Standard Deviation, $S = \sqrt{\frac{\sum F(x-\bar{x})^2}{\sum F}} = \sqrt{\frac{387}{60}} = \sqrt{6.45} = 2.54$

b) Control group

Class interval	F	x	Fx	x- \bar{x}	(x - \bar{x}) ²	F(x - \bar{x}) ²
6-8	16	7	112	-3	9	144
9-11	22	10	220	0	0	0
12-14	19	13	247	3	9	171
15-17	3	16	48	6	36	576
	60		627			891

The Mean, $\bar{x} = \frac{\sum Fx}{\sum F} = \frac{627}{60} = 10.45 \cong 10$

Standard Deviation, $S = \sqrt{\frac{\sum F(x-\bar{x})^2}{\sum F}} = \sqrt{\frac{891}{60}} = \sqrt{14.85} = 3.85$

APPENDIX B

Determination of the Z-test

Z-Test is determined as follows:

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}} = \frac{14 - 10}{\sqrt{\frac{2.53^2}{60} + \frac{3.85^2}{60}}} = \frac{4}{\sqrt{\frac{6.40}{60} + \frac{14.8}{60}}} = \frac{4}{\sqrt{0.11 + 0.25}} = 6.7$$

APPENDIX C

Objective multiple test items on physics topic: Measurements

- 1). Many simple observations and experiments can be done without any special measuring instruments: True False
- 2). The latest system of units which has gained universal acceptance is -----
- 3). Physical quantities are often divided into ----- and -----
- 4). ----- are products and quotients of the fundamental units.
- 5). Instruments such as the micrometer screw gauge, vernier calipers, metre rule, tape rule and clocks can be used to measure the distance between two points: True False
- 6). ----- states that the extension Produced in an elastic body is proportional to the applied force provided that the elastic limit is not exceeded.
- 7). ----- is the instrument used to compare unknown masses of objects with known standard masses.
- 8). The beam balance is based on the principle of -----
- 9). When measurements are required to an accuracy greater than 1 mm, ----- is used.
- 10). The measuring instrument that is capable of measuring accurately to one- hundredth of a millimeter is the -----

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