Quality Assurance of Instructors in Developing Workshop Based Test for Assessing Practical Skills of Students in Electronic Maintenance and Repair

by

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Abstract

The study investigated the quality assurance of instructors in developing workshop based test for assessing practical skills of students in electronic maintenance and repair in the polytechnics in southwestern, Nigeria. Three research questions guided the study. Descriptive survey design was adopted for the study. The population for the study was 100 instructors from ten government established polytechnics in south western Nigeria. The study involved all the 100 subjects because of their manageable size. Workshop based test and seven item structured questionnaire were used for data collection. The instruments were validated by three experts while Split half technique, Cronbach alpha and product moment correlation coefficient were used to determine the reliability of the two sets of instruments with a coefficient of 0.84 for the questionnaire items and 0.83 for the workshop based test. One hundred copies of the instrument were administered on respondents by the researchers on one to one basis. All the one hundred copies of the instrument were retrieved and analyzed using frequency, percentage, mean and improvement needed index to answer the research questions. It was found out that the instructors of electronic maintenance and repair had no competency in developing workshop based test that will reflect all levels of Simpson psychomotor domain. The study also found out that the instructors needed improvement in developing workshop based test for assessing practical skills of students in electronic maintenance and repair.

Keywords: Quality, instructors, workshop, practical skills, polytechnics, electronics maintenance, repair

Introduction

Polytechnic in Nigeria is a tertiary institution deliberately established to equip students with practical skills for employment in a specific occupation. According to the Report of National Board for Technical Education (NBTE) (2006), a polytechnic or college of technology is that tertiary institution offering varieties of technological/Business Diploma Programmes at National Diploma, Higher National Diploma (HND) and Post Higher National Diploma levels that qualify holders for registration in their professional fields. It is a skill oriented tertiary institution that its programmes are intervened with four months and one year industrial attachment. Varieties of technological programmes such as mechanical engineering technology, computer engineering technology, civil engineering technology, electrical and electronic engineering technology are offered in Nigerian polytechnics.

In the polytechnics, electronic maintenance and repair (EMR) is an important and core course for every Higher National Diploma students in electrical/electronic

engineering technology. Bakare (2009) stated that students learn practical skills needed to operate, maintain, install and repair electrical and electronic equipment. Students of electronic maintenance and repair are expected to carry out maintenance activities on malfunctioned or broken down electronic equipment with the aid of testing and measuring instruments such as Multitester, Avometers, Ammeters, Voltmeters, Ohmmeters, Ring testers, Oscilloscopes, Wattmeter among others. EMR is always taught by instructors in order to equip students with practical skills necessary for self reliance

Instructors are individuals who had acquired knowledge, skills and attitudes in an approved course for effectiveness in instructing students in tertiary institutions. Clopso (2010) said that an instructor is a person who had undergone training in an approved course and is competent in instructing or lecturing at an approved seminar. Instructors of EMR in this study are charged with the responsibilities of training and testing students on how to maintain and repair all kinds of electronic equipment with the help of electronic measuring instrument and tools. These instructors are expected to teach and assess practical skills acquired from the training by students with functional testing instrument.

Practical skills are organized and coordinated forms of practical observable skills in the use of tools and equipment to perform tasks. Hull in Bashir (2006) defined practical skills as manual dexterity through repetitive performance of an action. Practical skills are acquired in a well equipped workshop. A workshop according to Nwachukwu, Bakare and Jika (2009) is a place where tools, equipment and machines are used to perform manual activities or operations. Practical skills are workshop based skills. Denga in Bashir (2006) noted that most activities in vocational and technical education (electronic maintenance and repair inclusive) required practical skills for carrying them out. Therefore assessment of students with a view to determining whether such practical skills have been acquired will require workshop based test.

Workshop Based Test (WBT) is a type of instrument used for assessing practical skills acquired by students. Basher (2006) said that the most appropriate and suitable test for assessing the objectives of electronic maintenance and repair at HND level is workshop based test. To enable students to carryout activities such as uses of various electrical and electronic measuring instrument for maintenance and repair of faulty equipment, diagnosis and rectify of faults in electronic equipment and alignment of electronic equipment as stated and expected of them in the report of NBTE (2002) are in psychomotor domain which should be assessed through Simpson domain whose taxonomy are: perception, set, guided response, mechanism, complex overt response, adaptation and origination.

It is observed by the researchers that instructors prefer using test based on bloom's taxonomy of cognitive levels to assess practical skills acquired by HND students of electronic maintenance and repair in the polytechnics in the study area instead of workshop based test that involves all levels of psychomotor domain. This test used for assessing students in the 22 objectives specified in the curriculum of EMR will not allow instructors to know students who have acquired enough practical skills. Those electrical/electronic engineering technology graduates who eventually secured employment in relevant industries as it was observed by the researchers are now experiencing retrenchment because they could not perform up to expectation in their place of work. All these consequences on part of the HND graduates might be attached to the in competences of the instructors in developing functional workshop based lest for assessing

practical skills among students. Therefore it is necessary to determine the quality assurance of instructors in developing workshop based test for assessing practical skills of students in electronic maintenance and repair in polytechnics.

Quality assurance is a system in which the delivery service of the quality of the product is assessed and compared with that required or standard. American Society for Quality (2016) defined quality assurance as the planned and systematic activities implemented in a quality system so that quality requirements for a product or service will be fulfilled. Quality assurance in this study is the determination of the competence of instructors in developing workshop based test for assessing actual practical skills in HND students. The purpose of the study therefore was to determine the quality assurance (level of competence) of instructors in developing workshop based test for assessing practical skills of students in EMR in the polytechnics in south western, Nigeria. Specifically, the study south to achieve the following:

1. determine level of ability of instructors in developing workshop based test using Simpson's levels of psychomotor domain;
2. determine performance of instructors in the mastery of the practical content
3. identify content areas of electronic maintenance and repair where instructors needed improvement for high quality mastery.

Research Questions

The study sought to answer the following research questions:

1. How competent are the instructors in developing workshop based tests in electronic maintenance and repair adopting Simpson's levels of psychomotor domain?
2. What is the level of performance of the instructors in the mastery of the content of electronic maintenance and repair on which they are to develop workshop based test for measuring practical skills acquired by students?
3. What are the levels of Simpson's taxonomy of psychomotor domain where instructors need improvements for efficiency in developing workshop based test for measuring practical skills?

Method

The study adopted descriptive survey design. Descriptive survey design according to Olaitan, Ali, Eyo, and Sowande (2000) is a plan, structure, strategy, that the investigator wants to adopt in order to obtain solution to research problems using questionnaire in collecting, analyzing and interpreting the data. The questionnaire was used to collect data from instructors of electronic maintenance and repair in the polytechnics in the study area.

The study was carried out in the government established polytechnics in southwestern, Nigeria. The population for the study was 100 instructors of electronic maintenance and repair in the Department of Electrical/Electronic Engineering Technology. The entire population of instructors constituted the sample because of its small size. Two sets of instrument were developed for the study; A 7-cluster item questionnaire covering all the areas electronics maintenance and repair was developed for collecting data from respondents. The questionnaire had a 4-point response option of Highly Needed, Averagely Needed, Slightly Needed and Not Needed with a nominal value of 4, 3, 2 and 1.

A 44 –item workshop based test was developed to cover 14 cluster areas of electronic maintenance and repair using the seven levels of Simpson's taxonomy of the psychomotor domain. The levels of the psychomotor domain are: Perception (5) items, Set (7) items, Guided response (6) items, Mechanism (6) items, Complex overt response (7) items, Adaptation (3) items and Origination (6) items. The two instruments

were validated by four experts; two from Department of Vocational Teacher Education, two from Department of Electronics Engineering, University of Nigeria, Nsukka. Their corrections and suggestions were used to provide the final copy of the questionnaire and testing instrument.

Cronbach alpha reliability method was used to determine the internal consistency of the questionnaire which yielded a coefficient of 0. 84. Split half technique and product moment correlation method was used to determine the internal consistency of the test which yielded a coefficient of 0.83. One hundred and one (100) copies of the questionnaire were administered on respondents on one to one basis for 25 minutes while 100 copies of the test were also administered on respondents on one to one basis for 35 minutes. All the copies of the questionnaire and the test were retrieved.

The performance of instructors on the tests was analyzed using frequency, percentage and mean score to determine their quality assurance in electronic maintenance and repair. The questionnaire made use of Improvement Needed Index (INI) converted to percentage scores to determine areas of electronic maintenance and repair where instructors need improvement. The level of performance of instructors is determined thus: 70% or above very high performance, 60% to 69% high performance, 50% average performance, 40% to 49% low performance and below 40% poor performance. The improvement needed by instructors in the areas of electronic maintenance and repair was determined as follows:

A. The mean score (Xn) of the needed scale was calculated for each cluster.
B. The performance gap (PG) was determined by finding the difference between Xn and $\bar{X}$p, that is Xn – Xp = PG.

Where PG is negative (-) it means improvements is not needed because the level at which instructors performed is grater than the level at which that item was needed. If PG is positive, it means improvement is needed because the level at which the instructors performed is lower than the level at which that item is needed. If PG is zero (0) it means improvement is not needed because the level at which the instructors performed is equal to the level at which that item it is needed.

Result

The result of the study was obtained from the research questions answered through data collected and analyzed.

Research Question 1

How competent are the instructors in electronic maintenance and repair in developing workshop based tests using Simpson's levels of psychomotor domain?

The data for answering research questions 1 are presented in Table 1 below:

Table 1: Percentage Mean Scores of Instructors in Electronics Maintenance and Repair in Developing Workshop-Based Tests using Simpson's Level of Psychomotor Domain N = 100

S/No	Item Statements	No of item level	Frequency	Percentage (%)	Remarks
1	Perception	5	32	32.00	Poor performance
2	Set	7	50	50.00	Average performance
3	Guided response	6	28	28.00	Poor performance
4	Mechanism	6	33	33.00	Poor performance
5	Complex overt response	7	20	20.00	Poor performance
6	Adaptation	3	37	37.00	Poor performance
7	Origination	6	26	26.00	Poor performance
	Average			36.14	Poor performance

Data in Table 1 reveal that instructors in electronic maintenance and repair in the polytechnics in the study area obtained average performance score (50%) in set. The Table also revealed that the instructors obtained poor performance in perception (32.00), guided response (20.00), mechanism (33.00), complex overt response (20.00), adaptation (37.00) and origination (26.00). Generally, the instructors obtained poor performance on all the items (perception to origination) as indicated in the average performance value of 36.14.

Research Question 2

What is the level of performance of the instructors in the mastery of the content of electronic maintenance and repair on which they are to develop workshop based test for measuring practical skills by students?

The data answering research question 2 are presented in Table 2

Table 2: Percentage Mean Scores of Performance of Instructors in Electronic Maintenance and Repair on the Mastery of the Content of Electronic Maintenance and Repair on which they are to Develop Workshop Based Test for Measuring Practical Skills by students N = 100

S/No	Electronic Maintenance and Repair Clusters	Frequency	Percentage (%)	Remarks
1	Safety rules and regulation in electronic maintenance and repair	43	43.00	Low performance
2	Tools and measuring instrument for electronic maintenance and repair	35	35.00	Poor performance
3	Maintenance of electronic measuring instruments	31	31.00	Poor performance
4	Types of electronic maintenance	50	50.00	Average performance
5	Testing of electrical and electronic components	28	28.00	Poor performance
6	Tracing of faults in electronics	41	41.00	Low performance
7	Uses and application fo oscilloscopes	37	37.00	Poor performance
8	Steps in carry out repair activities	29	29.00	Poor performance
9	Electrical and electronic components	30	30.00	Poor performance
10	Installation of electronic equipment	37	37.00	Poor performance
11	Various sages in electrical and electronic equipment	29	29.00	Poor performance
12	Supervision of maintenance work	44	44.00	Low Performance
13	Identification of tools and equipment for carrying out maintenance and repair	39	39.00	Poor performance
14	Using AVO meter for testing semi conductors	25	25.00	Poor performance

Data in Table 2 reveal that instructors of electronic maintenance and repair in polytechnics in south west zone of Nigeria obtained average performance in only one item – type of electronic maintenance (50%), low performance in three items; safety rules and regulation in electronic maintenance and repair (43%), tracing of faults in electronics (41%) and Supervision of maintenance work (44%) and poor performance in ten (10) items with a range of 25% to 39%. Generally, the instructors had poor performance as indicated in the average performance value of 35.57%. This shows that the instructors possessed poor quality assurance in the mastery of the content of electronic maintenance and repair on which they are to develop workshop based test. This implies that the poor quality assurance of instructors in the mastery of the content of electronic maintenance and repair may also have effect on their ability to develop workshop based tests on the clusters.

Research Question 3

What are the levels of Simpson's taxonomy of psychomotor domain where instructors need improvement in developing workshop based test for assessing practical skills?

The data for answering research question 3 are presented in Table 3.

Table 3: Performance Gap Analysis of the Mean Ratings of the Responses of the Instructors on the levels of Simpson's Taxonomy of Psychomotor Domain for Development of workshop based Test in Electronic Maintenance and Repair **N = 100**

S/No	Items	Xn	Xp	PG (Xn-Xp)%	Remarks
1	Perception	61.6	25.0	36.6	Improvement Needed
2	Set	57.3	21.5	35.8	Improvement needed
3	Guided Response	58.3	25.1	33.2	Improvement Needed
4	Mechanism	74.5	40.6	33.9	Improvement needed
5	Complex Overt Response	72.5	48.4	24.1	Improvement Needed
6	Adaptation	55.9	23.2	32.7	Improvement needed
7	Origination	62.3	41.2	21.1	Improvement Needed

Data in Table 3 reveal that all the seven items had positive performance gap values ranging from 21.1% to 36.6%; and are positive. This indicates that the instructors need improvement because the level at which the seven levels are required are much higher than the levels at which the instructors could perform them.

Discussion of Result

It was found in Table 1 that instructors of electronic maintenance and repair in polytechnics had poor quality assurance in developing workshop based test using Simpson's levels of psychomotor domain for assessing practical skills of students in electronic maintenance and repair. It was also revealed in Table 2 that the same instructors generally possessed poor quality assurance in the mastery of the contents of electronic maintenance and repair on which they are to develop workshop based test. This implies that they need improvement in electronic maintenance and repair clusters in the Table. This finding agreed with the findings of Olaitan, Okeme and Egbe (2009) who in a study carried out on quality assurance of teachers of agricultural science in developing psycho-productive multiple choice items for measuring students' performance in agricultural science in senior secondary schools in Kogi State. The authors found out that the teachers of agricultural science lack competences in developing psycho productive multiple choice items for measuring student's performance in agricultural science in secondary schools in Kogi State. Data in Table 3 revealed that instructors of electronic maintenance and repair in the area of study need improvement in all the 7 items where they could develop workshop based tests. The items include perception, set, guided response, mechanism, complex overt response, adaptation and origination.

The results of this study was also in agreement with the finding of Okeme, Ifeanyieze and Eze (2009) who in a study carried out on capacity building needs of teachers to measure the achievement of the objective of agricultural science curriculum in senior secondary schools in Kogi State. The authors also found out teachers of agricultural science lack competences in developing test items to measure the cognitive and psychomotor objectives of agricultural science curriculum in senior secondary schools in Kogi State. The findings of the researchers cited above had further improved the reliability of the results of the study.

Conclusion

It was found out from the study that instructors of electronic maintenance and repair needed improvement in developing workshop based test for assessing practical skills of students in electronic maintenance and repair in the polytechnics in southwestern, Nigeria. It is therefore recommended that instructors of electronic maintenance and repair should be retrained through workshops, seminars and short term training in the tertiary institutions. It is also recommended that all instructors teaching electronic maintenance and repair in the polytechnics should undergo compulsory training in education in the university.

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