

Skill Assessment of Student in Learning Service Stations Mechanic Work and Petrol Engine Maintenance Work Through Evidenced-Based Test at the Technical College

Olaitan Olawale Opeyemi*, Ike Joshua Onyedikachi

Department of Industrial Technical Education, University of Nigeria, Enugu, Nigeria

Email address:

Olawale.olaitan@unn.edu.ng (Olaitan Olawale Opeyemi), Joshua.ike@unn.edu.ng (Ike Joshua Onyedikachi)

*Corresponding author

To cite this article:

Olaitan Olawale Opeyemi, Ike Joshua Onyedikachi. Skill Assessment of Student in Learning Service Stations Mechanic Work and Petrol Engine Maintenance Work Through Evidenced-Based Test at the Technical College. *International Journal of Science, Technology and Society*. Vol. 11, No. 4, 2023, pp. 140-152. doi: 10.11648/j.ijsts.20231104.12

Received: May 25, 2023; Accepted: June 12, 2023; Published: August 4, 2023

Abstract: The study focused on development and validation of evidenced-based test items as a means of improving the skill assessment of student in learning Service Station Mechanic work and Petrol Engine Maintenance work at the technical college. The study adopted instrumentation design and was carried out in Ekiti and Ondo states. The population of the is 125 technical three student (final year student) in the study area. A101 evidenced-based test items was developed and utilized by the study. The instrument was subjected to face and content validation by experts from Measurement and Evaluation and subject matter experts respectively from the University of Nigeria, Nsukka and Federal University of Technology, Minna. The psychometrics properties of the items were first determined by administering the instrument on a pilot sample drawn outside the study area. The reliability of the instrument was determined by using split-half technique and Kuder-Richardson KR-20, and it yielded a coefficient of 0.87 for service station mechanic work and 0.86 for petrol engine maintenance work. Percentages, indices of difficulty, discrimination, distractors and KR-20 were utilized in answering the research questions. It was revealed by the study that the items of the evidenced-based test had a difficulty indices between 0.30 and 0.70, discrimination of not less than 0.20, positive distraction. It was therefore recommended by the study that the examination bodies and classroom teachers should adopt the evidenced-based test in the certification of their student and also in assessing the level of the skill possessed by the student during classroom instruction.

Keywords: Development, Validation, Evidence-Based, Test Items, Assessment, Service Station Mechanics

1. Introduction

The National Policy on Education, [14] defines post primary education as the type of education children receives after primary school education and before tertiary stage. The technical college falls under this category with the following objectives:

- 1) To provide trained manpower in the applied sciences, technology and commerce at sub-professional level.
- 2) To provide technical knowledge and vocational skills necessary for industrial, commercial and economic development.

For the above stated objectives to be achieved, there is need for the stakeholders to make technical college programs

functional and activity based within the industrial technical education complex. Olaitan, S. O. et al. [46] defined industrial technical education as a group of activities directed towards equipping individual learners with saleable skills for earning a living in a chosen trade. Vocational and industrial technical education courses are offered in Trade schools, Technical colleges, Comprehensive secondary schools, Factories and Industrial plants in Nigeria [43].

Motor vehicle mechanic work is one of the industrial technical education programmes offered in the Technical college that involves the maintenance, adjustment, inspecting, installing and repairs of automobile engines; engine accessories, power transmission systems of automobiles, trucks and buses [10]. The programme is designed to provide

training for individuals interested in Motor vehicle repair work, for competence in repairing gasoline and diesel engines, transmission and differentials, cleaning, inspecting, repairing, adjusting, installing and performing routine preventive maintenance on automobiles, trucks and trailers accessories and consequently providing for employment for earning a living. Motor vehicle mechanic work as a programme at the Technical college is designed for the production of craftsmen at the craft (secondary) level as stated in the curriculum [36].

Curriculum as a structured series of intended learning experiences through which educational institutions endeavour to realize the hopes of the society [39, 47] in their own view defined curriculum as all the experiences that are planned, structured and provided by the school to assist the learners in attaining the designated learning outcomes. This suffice that curriculum is an organized body of knowledge presented to the learners in the school. In the context of this study, Curriculum is viewed as a planned series of instructional activities in Motor Vehicle Mechanic Work logically arranged in a sequential order in order to provide the learner the required experiences indicative of competence in Motor Vehicle Mechanic work for earning a living. These organized activities constitute what is called Motor Vehicle Mechanic work programme at the National Technical certificate (NTC) level.

The programme of Motor vehicle mechanic work at the (NTC) level is planned into modules with corresponding task or trades. These modules cover: Service Station Mechanic Work, Petrol Engine maintenance, Diesel Engine Maintenance, Engine Reconditioning (Petrol and Diesel) and Auto Electricity / Electronics. The focus of this study will be on Service stations mechanic work and Petrol Engine maintenance work. These modules are designed to provide training for auto-mechanics craftsmen for Nigeria technological and industrial development.

For the purpose of clear instruction by the teachers, and mastery by the learner, the task or trades are organized into modules, sequentially arranged. Offorma, [43] defined a module as a unit of standard measurement. The authors stated further that the modular approach to curriculum design was given as a unit of curriculum based on the development of entry level competencies of students. The total curriculum of a particular field is divided into units referred to as modules, and these modules are of equal length that will take approximately specified hours of instructional time to achieve with the average group of students. A module in Motor Vehicle Mechanic work has a practical work component that can be readily assessed with specific and performance objectives that can be assessed easily through test [35].

A test can be viewed as items in form of questions developed from an instructional content and presented to the learners to determine their level of understanding of instruction or performance within the context of instructional objectives. [28] stated that test is statements or activities that are presented to the learner that will stimulate him/her to

respond or act while the teacher uses indicators to determine the level of responses on action of the students whether satisfactory or unsatisfactory. Gronlund [19] viewed test as standardized or non-standardized measures of an individual's response to a systematic sample of stimuli or behavior from which references about the general behavior can be made. Gall, Gall and Borg [17] is of the opinion that test indicators are signs or activities that shows whether the student performance is satisfactory or not satisfactory. In the context of this study, test is regarded as items in form of questions developed from the content of Motor Vehicle mechanic work to be administered to students in the Technical College.

Offorma [43] identified two types of test as essay test and objective test. [16] identified five varieties of objectives test to include multiple-choice, true or false, item completion, matching items and item re-arrangement. In the context of this study, the multiple-choice test items developed and covering the curriculum of Motor Vehicle Mechanic Work in the areas of Service Station Mechanic work and Petrol Engine Maintenance, using the Simpson level of taxonomy of psychomotor domain was used in the development of the test.

Development is the act of making something clearer by studying it in more details or the act of making something more organized. Development according to [43] defined development as the process of producing or creating something new or more advanced. In the context of this study, development is writing out clearly short test items in form of instrument on the areas of service station mechanic work and petrol Engine Maintenance.

Instrument according to [4] are selected or developed and well standardized measuring devices, appropriate to a given evaluation. Instrument according to the author can be developed in form of test items to measure student level of knowledge, skill and performance in any teaching and learning situation. Offorma, [43] stated that assessing psychomotor skills or manipulative skills in such a skill oriented programme like the Motor Vehicle Mechanic Work cannot be successfully carried out using written essay or rating scale or interview, this task then rest on the teachers or the public examination bodies to design and develop appropriate test instrument in the psychomotor domain that can adequately assess the psychomotor skill or manipulative skills possessed by the student.

Evidenced-based test can be defined as that type of test that clearly shows the true state or ability of a testee after having been exposed to some form of skill training over a specified period of time and a specified curriculum content [18]. The evidenced based test will clearly shows the true state of knowledge, skill and abilities possessed by the individual that is supposed to take the test. Agrimon-Pallas, M. J; Flores-Mateo, G; Jimenev-Villa, J and Pujol-Ribera, J. [3] stated that evidenced-based test can also be used as an instrument to evaluate the impact of a new curriculum or the old curriculum and also to document the competence of the individual trainees. These authors stated further that the robust psychometric properties in general support their use in

formative or summative evaluations (distracting abilities, discriminating abilities, difficulty indices, reliability and validity evidence). Evidenced-based test can be used in a situation where large student/testee needs to be examined at the same time and in a situation of limited materials, tools and raters to be involved in the conduct of such examination or evaluation. Offroma [43] outlined the following useful activities and procedures in developing an evidenced-based skill test items as an instrument for assessing the manipulative skills or psychomotor skills:

- 1) Identifications of what to test in terms of areas of topics (skills in service station mechanic work and petrol engine maintenance) in this study.
- 2) Specifications of element in topics (in the direction of the Simpson level of the psychomotor domain in this study).
- 3) Arrangement of these elements in a logical sequence representing order of performance (in order of Simpson complex overt response level).
- 4) Clarification of ideas or element that may be confusing (distracters).
- 5) Deciding on the element to be involved in the action or concepts (concept map-table of specifications).
- 6) Deciding on the isolate or distracters in the group (to test student understanding or mastering of the logical ideas element and concepts in the map).

In measuring the extent to which mastery has been achieved or attained in the psychomotor skill of student in Motor Vehicle Mechanic Work at the technical college, and for the test instrument to be good enough to measure the expected performance of students, it is expected that the developed test instrument must be valid and reliable.

The validity of test instrument as stated by Cohen, Manion and Morrison [7] is the extent to which the practical skills or psychomotor skills outlined in the curriculum for Motor Vehicle Mechanic Work are covered by the test. Validity of a test instrument in the view of [3] is the expression of the degree to which the test measures the quality, ability, skills and information which it is designed to measure. Daramola [9] defined validity as the degree to which a test or an instrument measures what it is supposed to measure or the soundness of the interpretation of a test. The Authors classified validity into the following: Face (logical), Content (Domain), Construct and Criterion referenced (Concurrent and Predictive) validity.

Daramola [9] stated that Face validity is the degree to which the items in the test appear to measure what it ought to measure. Cohen, Manion and Morrison [7] viewed face validity as what a test appears superficially to measure i.e. face validity pertains to whether the test looks valid to the examinees that are to take it or the administering personnel who decides on its use. In the context of this study, Face validity is the extent to which the items in the test instrument appears to measure the skill areas in the content of the Technical college Service stations mechanic and Petrol engine maintenance Work curriculum at the NTC level. Experts in Motor Vehicle Mechanic Work and Measurement

and Evaluation judged the extent the multiple choice test items developed as valid in their own opinion.

NBTE [38] viewed Content validity of a test items in an instrument as when the items of the test are representative of a universe of items that is comprehensive enough to represent the presumed objectives of the content field. In the view of [15], content validity of a test item in the instrument is its ability of the items to measure the subject matter content in relation to the instructional objectives. Similarly [52] viewed content validity as the degree to which the items represent the domain or Universe of traits or property being measured. In this study content validity is viewed as the extent to which the items in the test instrument represent the content fields in the areas of service station mechanic work and petrol Engine Maintenance work as judged by the subject matter experts contained in the curriculum for Motor Vehicle Mechanic Work at the NTC level needed to be acquired by the students. For each of the text items to be considered as valid, it must satisfy some psychometrics properties of a test in its development.

Psychometric properties of a test item involves the mental measuring abilities of a test following certain peculiarities or characteristics that helps to distinguish it or expected to be possessed by the test item. FGN [14] stated that there are three types of psychometrics properties that a test item must possess; test validity, test reliability, and item statistics. Test reliability refers to the consistency, stability and precision of test scores. Item statistics on the other hand describes certain properties of individual items in a test or other measurement and the most common item statistics are descriptors of item difficulty, the discrimination power of an item and probability of guessing (distractor index). In the context of this study, Psychometrics properties of the test items involves the measuring abilities of the test items to show the item difficulty the extent to which it discriminates among ability groups (High, Average and Low) and ability to minimize guessing in order to make the test instrument reliable.

Reliability of a test instrument is the ability of the test to produce consistent result each time the test is used Cohen, Manion and Morrison [7]. In estimating the reliability of a test item, [37] outlined the following methods; test retest method, parallel or alternative form method, split half method and internal consistency. Test retests method of estimating reliability also known as the measure of stability is estimated by administering a test to a group of individuals and re-administering the same test to the same group of individuals at a later time or date and correlating the two sets of scores. Parallel or alternative form method is when the test developer may have good reason to construct not just one test, but two tests, one test being similar or equivalent or identical with the other test in nearly all respects. Split-half method literally takes a test, assesses the reliability of the first – half of the test and then compares these estimates to the reliability of the second-half of the same test. Internal consistency method is the application of a number of statistical formulas developed for estimating the reliability of tests which involves only one testing rather than two. In this study, the split half of even numbers method of estimating reliability of

a test will be used to estimate the reliability of the multiple-choice test instrument, the test will be administered once to the student, and therefore favours the use of split half method of reliability.

The current mode of assessing student skill in motor vehicle mechanic work at the technical college is done through the use of a rating scale and an achievement test instrument developed in the cognitive domains of educational objective to measure only the recall of facts and which are considered unsuitable for such a skill oriented learning programme. Aworefa [5] stated that the mode currently used for skill assessment by NABTEB (National Business and Technical Examination Board) in the practical assessment of candidates are the use of a rating scale and the use process and products evaluation method, which are marked by the appointed practical examiners, while in the process evolution, it is required that the examiner or verifier rate the step-by-step operations of the task the candidates perform accordingly. However, the product type of evaluation may be disadvantageous as observed by [36] as all process or procedures are not measured and assessed from the beginning, while the process evaluation involves the ratings of individuals procedure which was also criticized due to the raters bias in the actual skill to be rated [34, 35]. [6] is also of the opinion that there is a limitation in the use of rating scale in assessing performance of student as it measures product and cannot be used to measure process of manipulative skill development for large groups. The author added that the use of rating scale is expensive and involves many raters where class size is large. Hence the need to develop and provide an alternative form of test instrument that can be used to assess the skills of students in Motor Vehicle Mechanic Work.

Since Motor Vehicle Mechanic work is a course in which psychomotor skills or manipulative skills are emphasized, and in order to achieve observable skill acquisition and performance by students of Motor Vehicle Mechanic Work (Service stations mechanic and petrol engine maintenance work) at the Technical college NTC examinations, there is need to measure their performance through a well-developed and validated multiple-choice test instrument. This test can be used in place of the current mode of assessing the skills of student on Service stations mechanic and petrol engine maintenance work and can also be used to overcome some of the limitations of other testing devices such as the rating scale or project method. Against this back ground therefore, there is a need to develop a valid and reliable multiple-choice test instrument that can be used to assess the skills of student and can complement the present achievement test used by teachers and examination bodies in order to enable student to demonstrate the acquisition of production skills and maintenance skills on Service stations mechanic and petrol engine maintenance work at the Technical Colleges.

The programme offered in Technical colleges in Nigeria are designed and aimed at providing skills necessary for securing employment in the industry or be self-employed, hence, the products of the Motor Vehicle Mechanic Work at the Technical college are expected to be empowered and

equipped with job skills to enable the individual perform and progress in the chosen trade and at times enter into employment. However, in a research report by [41] and in the NBTE [38] it was revealed that graduates of Motor Vehicle Mechanic work programme of the Technical college were not able to perform the skills and competence in the trade, consequently are neither employable by the industry nor are they self-employed. This situation can be attributed to various factors which include wrong use and type of assessment instrument used for assessing the skill of student in the various skill oriented programme of Motor vehicle Mechanic work such as Service stations mechanic and petrol engine maintenance work.

It has been observed that the current mode of assessing the practical skills of student in motor vehicle mechanic work through the use of multiple choice and essay test questions used by NABTEB in their examinations is structured in the Blooms taxonomy of the cognitive domain and the practical examination make use of a rating scale with several raters rating the process of each task. Similarly, the approach used by the teachers after classroom instruction is tailored to the pattern adopted by the examination bodies in measuring the achievement of student. Based on these practices of assessment by the teachers and the Examination bodies, some of the performance objectives of each of the skill areas in Motor Vehicle Mechanic work could not be achieved. Hence students graduate from the programme without actually practicing the skills in the work place.

The use of a rating scale to assess the product and process skills of students is prone to certain limitations such as: the rating scale is very expensive in terms of personnel to do a good job, with the use of a rating scale, the examiner can only cover a few student and their product in a day and rater may be bias and material for assessment may be inadequate or may not be available. This in effect are direct opposite of what the test instrument addressed by this study could help the examiner to avoid.

The importance of the developed test instrument are: they cover many practical areas and student can be examined at the same time without conflict, it's less expensive for not having to import raters and observers at a very high cost in terms of honorariums (transport, hotels & feeding). It can also accommodate many External Candidates for the NABTEB (External Candidates Examinations).

Therefore, it will be helpful if a test instrument in the psychomotor domain of educational objectives are developed and validated and utilized effectively to make Motor Vehicle Mechanic Work at the Technical colleges more functional to need and development of the youths. This study therefore will develop and validate a multiple-choice test items that can be used for assessing the skills of student in motor vehicle mechanic work at the Technical colleges.

The purpose of the study is to develop and validate a multiple-choice test items for assessing the skills of student in Service stations mechanic and petrol engine maintenance work at the Technical colleges in Ekiti and Ondo states with a view to providing appropriate measuring indicators of the level of

acquisition of skills in Motor Vehicle Mechanic work at the Technical college specifically, the study will seek to:-

- 1) Develop a multiple-choice test items in motor vehicle mechanic work in service station mechanic work and petrol engine maintenance.
- 2) Determine the content validity ratio of the multiple choice test items in motor vehicle mechanic work service station mechanic work and petrol engine maintenance.
- 3) Determine the difficulty indices of the multiple choice test items in motor vehicle mechanic work service station mechanic work and petrol engine maintenance.
- 4) Establish the reliability of multiple choice test items in motor vehicle mechanic work service station mechanic work and petrol engine maintenance.
- 5) Establish the discrimination index of the multiple choice test items in motor vehicle mechanic work service station mechanic work and petrol engine maintenance.
- 6) Establish the distractor index of the multiple choice test items in motor vehicle mechanic work service station mechanic work and petrol engine maintenance.

2. Methods

Five research questions were developed and answered by this study. Instrumentation design was adopted for the study. Instrumentation design in the view of Frankael and Wallen [16] is the type of design which is aimed at developing and certifying the efficacy of an instrument for the measurement of a given behaviour or construct. This type of research design is considered appropriate for this study since the study sought to develop an instrument for assessing skills of students. The population of the study comprised all the student offering the module Stations Mechanic Work and petrol Engine maintenance under the programme Motor Vehicle Mechanic work, in their final year (Technical 3) in the eight Technical Colleges in Ekiti and Ondo State. There are total of 125 final year student of Motor Vehicle Mechanic work programme offering Service Stations Mechanic and Petrol Engine Maintenance work.

The study was carried out in Ondo and Ekiti states in the southwestern states of Nigeria. The final year (Technical 3) students were considered suitable for this study because they were expected to have covered almost all the areas of the NTC Service Stations Mechanic work and Petrol Engine Maintenance work as specified in the curriculum for Motor Vehicle Mechanic work of the NTC level.

The instrument for data collection was 120 psycho productive skills multiple choice test items developed from the Motor Vehicle Mechanic work in the two programme: Service Station Mechanic work and Petrol Engine Maintenance. The instrument for data collection was the multiple-choice psycho productive (Test Instrument) in Motor Vehicle Mechanic work. The items of the test are based on Simpson's taxonomy of psychomotor domain. This test was developed from the NTC Curriculum for Motor Vehicle Mechanic work covering Service Stations Mechanic

and Petrol Engine Maintenance work. The development was based on the table of specifications and Simpson's taxonomy of psychomotor domain.

The study involved two types of validation. These were face and content validation. Five experts were involved in the face validation of the 120 psycho-productive skill multiple-choice test items: three of them were subject matter experts from the Department of Vocational Teacher Education and two experts from Measurement and Evaluation all from the University of Nigeria, while the content validation made use of Content Validity Ratio (CVR) by nine subject matter experts from Federal University of Technology, Minna and University of Nigeria, Nsukka. The subject matter experts were required to rate each item in the instrument using a three point rating scale of: 1) essential, 2) useful and 3) Not necessary, as developed by [27]. Their ratings were utilized to determine the Content Validity Ratio (CVR). The decision rule on the CVR was made as approaching 1 indicates high level content validity and approaching -1 indicates low level content validity. Any item with a CVR of 0.001 or above was regarded as essential. Any item with a CVR of -0.1 or below was regarded as not essential.

Pilot testing was done after the face and content validation on 30 respondents from three technical colleges in Enugu state. The result of the item analysis revealed that 110 out of 120 items had difficulty indices of between 0.30 and 0.70 (acceptable level); discrimination of 0.20 and above (acceptable level), and acceptable positive distractor indices.

The split half technique and Kuder-Richardson KR-20 were used to determine the reliability of the scores on the two halves of the instrument. The split-half procedure involved scoring two halves (odd and even numbered items) of the test instrument separately for all pilot sampled students. The scores of the two halves were correlated using Kuder-Richardson KR-20 in the two programmes. The correlation coefficient obtained was 0.88 and 0.87 for Service Station Mechanic work and Petrol Engine Maintenance work respectively. The instrument was administered on the respondent with the help of eleven research assistants.

All the 125 Copies of the 110 items was Administered.

The 110 items was administered on the 125 student by the teachers in an examination conditions in their various colleges and the copies were retrieved for the item analysis, to determine the psychometric properties of the test.

3. Results

The results for the study were obtained from the research questions answered through data collected and analyzed.

3.1. Research Question 1

What is the Content Validity Ratio of the developed psycho-productive skills multiple choice test items in Service Station Mechanic work and Petrol Engine Maintenance work? The data for answering research question 1 are presented in tables 1-2.

Table 1. Content Validity Ratio (CVR) of the developed psycho-productive skills multiple choice test items as derived in Service Station Mechanic work.

Item Number	CVR	Item Number	CVR	Item	CVR
1	0.862	21	0.875	41	0.333
2	0.851	22	0.875	43	0.333
3	0.975	23	0.555	44	0.875
4	0.333	24	0.555	45	0.875
5	0.562	25	0.457	46	0.555
6	0.471	26	0.555	47	0.555
7	0.862	27	0.875	48	0.875
8	0.314	28	0.555	49	0.875
9	0.555	29	0.555	50	0.875
10	1.000	30	0.729	51	0.975
11	0.321	31	0.875	52	0.975
12	0.876	32	0.875	53	0.985
13	0.975	33	0.875	54	0.875
14	1.000	34	0.726	55	0.875
15	0.942	35	0.726	56	0.875
16	1.000	36	0.875	57	0.875
17	0.810	37	0.875	58	0.875
18	0.342	38	0.555	59	0.875
19	0.444	39	0.555	60	0.875
20	0.526	40	0.555		

Decision Rule: Items with CVR of 0.01 or above = essential items with CVR of 0.01 or below = Not essential [30].

The data presented in table above revealed that the 60 items in Service Station Mechanic work had CVR ranged from 0.333 to 1.000. These values were above 0.01 indicating that the 60 items in Service Station Mechanic work are all essential.

Table 2. Content Validity Ratio (CVR) of the developed psycho-productive skill multiple choice test items derived in Petrol Engine Maintenance.

Item Number	CVR	Item Number	CVR	Items	CVR
1	0.875	21	0.875	41	1.000
2	0.875	22	0.875	42	1.000
3	1.000	23	0.555	43	0.875
4	0.555	24	1.000	44	1.000
5	0.875	25	1.000	45	0.555
6	0.875	26	0.875	46	0.875
7	0.555	27	0.555	47	0.875
8	1.000	28	0.875	48	0.875
9	1.000	29	0.555	49	0.555
10	0.555	30	1.000	50	0.555
11	0.875	31	1.000	51	0.875
12	0.875	32	0.875	52	1.000
13	0.875	33	0.875	53	0.875
14	0.555	34	1.000	54	0.875
15	1.000	35	0.875	55	1.000
16	0.555	36	0.875	56	0.555
17	0.875	37	1.000	57	0.875
18	1.000	38	0.555	58	0.555
19	1.000	39	0.555	59	1.000
20	0.555	40	0.555	60	1.000

Decision rule: Items with CVR of 0.01 or above= essential items with CVR of – 0.01 or below = Not essential. Lawshe (1973).

The data presented in table 2 above revealed that the 60 items in Petrol Engine Maintenance had CRV ranged from 0.555 to 1.000 these values are above 0.01 indicating that the 60 items in Petrol Engine Maintenance work are all essential.

3.2. Research Question 2

What are the difficulty indices of the developed psycho-productive skills multiple choice test items in Service Station Mechanic work and Petrol Engine Maintenance work?

The data for answering research question 2 are presented in tables 3&4.

Table 3. Difficulty indices of the 55 psycho-productive skills multiple choice test items as obtained from the analysis of students scores on the test in service station mechanic work.

Item Number	Correct option	Different index	Item number	Correct option	Difficulty index
1	A	0.62	30	B	0.53
2	A	0.55	31	B	0.58
3	C	0.47	32	A	0.32
4	B	0.52	33	C	0.59
5	D	0.40	34	B	0.45
6	B	0.56	35	B	0.62
7	B	0.63	36	A	0.55
8	A	0.68	37	B	0.34
9	B	0.46	38	A	0.65
10	C	0.53	39	C	0.31
11	D	0.40	40	A	0.64
12	D	0.46	41	D	0.56
13	A	0.57	42	B	0.33
14	C	0.32	43	A	0.64
15	C	0.55	44	C	0.55
16	C	0.68	45	C	0.62
17	A	0.35	46	B	0.55
18	B	0.32	47	D	0.47
19	B	0.65	48	A	0.52
20	D	0.54	49	D	0.65
21	A	0.65	50	C	0.45
22	B	0.45	51	B	0.53
23	D	0.53	52	C	0.41
24	A	0.33			
25	B	0.41			
26	B	0.60			
27	B	0.59			
28	A	0.53			
29	C	0.51			

Decision rule: 0.00 – 0.29 = very difficult 0.71- above = very easy [7].

The data in table 3 above revealed that the 52 items in Service Station Mechanic work had difficulty indices ranged form 0.31-0.68. This indicated that the items are not very easy or very difficult because they fall within the acceptable range of 0.30-0.70.

Table 4. Difficulty indices of the 49 psycho-productive skills multiple test items as obtained form the analysis of students scores on the test in petrol Engine maintenance work.

Item Number	Correct option	Different index	Item number	Correct option	Difficulty index
1	B	0.28	26	A	0.39
2	B	0.46	27	B	0.40
3	A	0.44	28	A	0.33
4	D	0.41	29	B	0.42
5	C	0.25	30	D	0.58
6	D	0.43	31	A	0.49
7	B	0.45	32	B	0.41
8	C	0.66	33	C	0.63
9	A	0.30	34	C	0.43
10	A	0.44	35	D	0.32
11	A	0.37	36	A	0.40
12	C	0.41	37	B	0.59
13	D	0.46	38	C	0.41
14	C	0.52	39	B	0.61
15	B	0.36	40	B	0.42
16	C	0.39	41	C	0.50
17	D	0.62	42	A	0.36
18	A	0.53	43	C	0.54
19	B	0.58	44	C	0.56
20	C	0.63	45	D	0.47
21	C	0.65	46	A	0.45
22	B	0.62	47	A	0.41

Item Number	Correct option	Different index	Item number	Correct option	Difficulty index
23	B	0.51	48	D	0.69
24	C	0.54	49	B	0.36
25		D		0.42	

Decision rule: 0.60-0.29-very difficult 0.71 and above: very easy Cohen and Swerldik (2003).

The data presented in table 4 revealed that the 49 items in Petrol Engine Maintenance had difficult of indices ranged form 0.30 to 0.69. This indicated that the items are not very easy or very difficult because they fall within the acceptable range of 0.30-0.70.

3.3. Research Question 3

What are the discrimination indices of the psycho-productive skill multiple choice test items in server stations mechanic work and petrol engine maintenance work?

The data for answering research question 3 are presented on tables 5 and 6.

Table 5. Discrimination indices of the 52 psycho-productive skills multiple choice tests items as obtained from the analysis of students scores on the test in service station mechanic work.

Item number	Correct option	Discrimination index	Item number	Correct option	Discrimination index
1	A	0.47	27	A	0.41
2	A	0.43	28	C	0.26
3	C	0.58	29	B	0.60
4	B	0.26	30	B	0.42
5	D	0.33	31	A	0.52
6	B	0.48	32	C	0.25
7	B	0.37	33	B	0.61
8	A	0.59	34	B	0.54
9	B	0.63	35	A	0.33
10	C	0.44	36	B	0.20
11	D	0.35	37	A	0.27
12	D	0.41	38	C	0.32
13	A	0.61	39	A	0.33
14	C	0.33	40	D	0.64
15	C	0.57	41	B	0.56
16	C	0.43	42	A	0.36
17	A	0.46	43	C	0.33
18	B	0.64	44	C	0.31
19	B	0.36	45	B	0.36
20	D	0.32	46	D	0.27
21	A	0.44	47	A	0.36
22	B	0.61	48	D	0.44
23	D	0.45	49	C	0.33
24	B	0.24	50	B	0.53
25	B	0.64	51	C	0.36
26		B		0.34	
52		C		0.36	

Decision rule: 0.00-0.19= Negative discrimination 0.20-and above = positive discrimination [7].

The analyzed data in table 5 revealed that the 52 items had discrimination indices ranged from 0.20 to 0.64 indicating that all the items had positive discrimination.

Table 6. Discrimination indices of the 49 psycho-production skills multiple choice test items as obtained from the analysis of students scores on the test in petrol engine maintenance work.

Item number	Correct option	Discrimination index	Item number	Correct option	Discrimination index
1	B	0.47	26	A	0.58
2	B	0.29	27	B	0.32
3	A	0.48	28	A	0.57
4	D	0.34	29	B	0.41
5	C	0.48	30	D	0.38
6	D	0.62	31	A	0.52
7	B	0.39	32	B	0.48
8	C	0.42	33	C	0.33
9	A	0.26	34	C	0.47
10	A	0.47	35	D	0.26

Item number	Correct option	Discrimination index	Item number	Correct option	Discrimination index
11	A	0.58	36	A	0.32
12	C	0.63	37	B	0.33
13	D	0.39	38	C	0.27
14	C	0.60	39	B	0.36
15	B	0.55	40	B	0.35
16	C	0.54	41	C	0.30
17	D	0.34	42	A	0.40
18	A	0.36	43	C	0.25
19	B	0.61	44	C	0.65
20	C	0.35	45	D	0.47
21	C	0.40	46	A	0.41
22	B	0.31	47	A	0.53
23	B	0.23	48	D	0.33
24	C	0.64	49	B	0.30
25	D	0.51			

Decision rule: 0.00-0.19 = Negative discrimination 0.20- and above = positive discrimination.

The data analyzed in table 6 above revealed that the 49 items had discrimination indices ranged from 0.23 to 0.63 indicating that all the items had positive discrimination.

3.4. Research Question 4

What are the distractor indices of the 101 developed psycho-productive skill multiple choice test items in Service Station Mechanic work and Petrol Engine Maintenance work?

The data for answering research question 4 are presented in tables 7 and 8.

Table 7. Distractor indices of the 52 psycho-productive skills multiple choice test items as obtained from analysis of students scores on the test in service station mechanic work.

Item number					Item number				
Distractor indices					Distractor indices				
S/N	A	B	C	D	S/N	A	B	C	D
1	x	-	+	+	27	+	x	+	+
2	x	+	+	+	28	x	+	+	+
3		x	x	+	29	+	+	+	x -
4	+	x	-	+	30	+	+	x	+
5	+	+	+	x	31	+	+	x	+
6	+	x	+	+	32	x	+	+	+
7	+	x	+	-	33	+	+	+	X
8	x	+	+	+	34	+	+	x	+
9	+	x	+	-	35	+	+	x	+
10	+	-	x	+	36	x	+	+	+
11	+	+	+	x	37		+	x	+
12	+	+	+	x	38	x	+	+	X
13	x	+	+	-	39	+	+	x	+
14	+	+	x	+	40	x			
15	+	+	x	-	41	-	+	+	X
16	+	+	x	+	42	+	x	+	+
17	x	-	+	+	43	x	+	+	+
18	+	x	+	+	44	+	+	x	+
19	+	x	+	+	45	+	+	x	+
20	+	+	+	x	46	+	x	+	+
21	x	+	+		47	+	+	+	X
22	+	x	x	+	48	x	-	+	+
23	+	+	+	x	49	+	+	+	X
24	x	+	+	+	50	-	+	x	-
25	+	x	+	+	51	+	x	+	+
26	+	x	+	+	52	+	+	x	+

Decision Rule: x = correct option; + good distractor - = bad distractor [7].

The data analyzed in table 7 above revealed that 42 at of 52 items that had all alternatives each that distracted negatively. This indicated that the items had good and acceptable level of item distraction.

Table 8. Distractor indices of the 49 psycho-productive skills multiple choice test items as obtained from the analysis of students' scores on the test in Petrol Engine Maintenance Work.

Item number		Distractor indices				Item number		Distractor indices			
S/N	A	B	C	D	S/N	A	B	C	D		
1	+	X	-	+	26	x	+	+	+		
2	+	X	-	+	27	+	x	+	+		
3	x	+	-	+	28	x	+	+	+		
4	+	+	+	x	29	+	x	+	+		
5	+	+	x	+	30	+	+	+	X		
6	+	+	+	x	31	x	+	+	+		
7	+	X	+	+	32	+	x	+	+		
8	+	-	x	+	33	x	+	x	+		
9	x	+	+	+	34	+	+	x	+		
10	x	-	+	+	35	+	+	+	X		
11	x	+	+	+	36	x	+	+	+		
12	+	-	x	+	37	+	x	+	+		
13	+	+	+	x	38	+	+	x	+		
14	+	+	x	+	39	+	+	x	+		
15	+	X	+	+	40	+	x	+	+		
16	+	+	x	+	41	+	+	x	+		
17	+	+	+	x	42	x	+	+	+		
18	X	+	+	+	43	+	+	x	+		
19	+	X	+	+	44	+	+	x	+		
20	-	+	x	+	45	+	+	x	X		
21	-	+	x	+	46	x	+	+	+		
22	+	X	+	+	47	x	+	+	+		
23	-	X	+	+	48	x	+	+	X		
24	+	+	x	+	49	+	x	+	+		
25	+	+	+	X							

Decision Rule: x = correct option; + good distractor - = bad distractor [7].

The data analyzed in table 8 above revealed that 42 at of 49 items that had all alternatives each that distracted negatively. This indicated that the items had good and acceptable level of item distraction.

3.5. Research Question 5

What is the reliability of the 101 developed psycho-productive skill multiple – choice test items in the six levels of Simpson's taxonomy?

The data for answering research question 6 are presented in table 9.

Table 9. Reliability of the psycho-productive skills multiple choice test items based on the six levels of Simpson's taxonomy as obtained from the analysis of students score on the test in service stations mechanic work and Petrol Engine maintenance work using Kidder-Richardson KR – 20 formular.

$N = 125$

S/N	Levels of Simpson taxonomy	Number of item	Number of even items	Number of odd items	Kr – cal
Service station mechanic work 52 items					
1	Perception	4	2	2	0.82
2	Set	4	2	2	0.87
3	Guided Response	12	5	5	0.91
4	Mechanism	14	6	6	0.88
5	Complex overt response	8	4	4	0.92
6	Adaptation	4	2	2	0.83
Petrol Engine maintenance work					
1	Perception	4	2	2	0.85
2	Set	4	2	2	0.86
3	Guided Response	15	4	4	0.81
4	Mechanism	12	5	5	0.93
5	Complex overt response	9	3	3	0.90
6	Adaptation	5	2	2	0.84

Decision Rule: Standard correlation coefficient = 0.61 or above but less than unity (Cohen and Swerdik, 2003) or 0.81 Federer (1973).

The analysis of data in table 9 revealed the reliability coefficient of the instrument in Service Stations Mechanic work and Petrol Engine Maintenance Work in the six levels of Simpson's taxonomy. Service Station Mechanic work with

52 items had the following reliability coefficients: 0.82, 0.91, 0.88, 0.92 and 0.83 in the six levels of Simpson taxonomy of perception, set, Guided response, mechanism, complex overt response and adaptation respectively. Petrol Engine Maintenance work with 49 items had the following reliability coefficient of 0.85, 0.87, 0.81, 0.93, 0.90 and 0.84 in the six levels of Simpson of taxonomy of perception, set, Guided response, mechanism, Complex Overt response and adaptation respectively. The overall reliability coefficient was 0.87.

4. Discussion

It was found out from the study that the 52 items and 49 items in Service Stations Mechanic work and Petrol Engine Maintenance work respectively had Content Validity Ratios ranged from 0.333 and above indicating all the items had content validity. The findings were in conformity with the findings of [10] in a study on Development and Validation of Decision making skills inventory for secondary school principals in Anambra state, where it was found out that 24 items of DMSI were found to be properly loaded and therefore dependable with minimum factor loading index of 24 items of the DMSI.

It was found out that the 52 items in Service Station Mechanic work had difficulty indices between 0.31 and 0.67 while 49 items Petrol Engine Maintenance had difficulty indices between 0.30 and 0.69; the 52 items in Service Station Mechanic work had discrimination indices of 0.20 and above and a positive distractor indices while the 49 items in Petrol Engine Maintenance also had discrimination indices of 0.23 and positive distractor indices. The findings were in conformity with [40] in a study on Development and Validation of psycho-productive skill multiple choice test items in Agricultural science in secondary schools in Kogi State where it was found out that the psycho-productive multiple choice test items in Animal production, crop production and Agricultural Technology had average difficulty indices of 0.30, 0.23 and 0.29 and above respectively and had average discrimination indices of 0.67, 0.61 and 0.69 respectively.

It was also found out from the study that the psycho-productive test items had reliability coefficient of between 0.84 and 0.90 in the six levels of Simpson taxonomy. This implied that the items were reliable in the six levels of Simpson taxonomy tested. These results were in conformity with the findings of [30] in a study on Development and Validation of Generiatrics Knowledge Test for medical students in the University of California. USA, where it was found out that the instrument demonstrated good reliability with Cronbach alpha coefficient of 0.83.

5. Conclusion

It has been observed that graduated student of Motor Vehicle Mechanic work in Ondo and Ekiti States refuse to take career on their chosen trade but instead continue to

search for white collar jobs or okada riding since their training needs are not justifiably satisfied are their interest not well motivated in the trade. This could be attributed to the present mode of assessment of knowledge and cognitive ability achievement of student in Service Station Mechanic work and Petrol Engine Maintenance under the programme Motor Vehicle Mechanic work which has made the realisation of the objective and skill development of the programme in the student unachievable. This study has developed and validated psycho-productive skill multiple – choice test items to fill the gap created by the teaching and learning of Motor Vehicle Mechanic work specifically in the module: Service Stations Mechanic work and Petrol Engine Maintenance work towards achieving the objectives. The inclusion of the developed psycho-productive skill multiple choice test items in the assessment of student performance in Motor Vehicle Mechanic work could therefore provide a sound basis for accurate judgment as to whether all the mentioned objectives have been achieved or not.

It is therefore recommended that the examination bodies (NABTEB) should integrate psycho-productive skills multiple choice test items in their examination and certification of the students. Teachers should be encouraged by the government to make use of psycho-productive skills multiple choice test items during teaching and assessing students in motor vehicle mechanic work especially the curriculum content areas that relates to practical skills acquisition.

References

- [1] Airforce Handbook (2002). *Information for Designers of Instructional Systems: Test and Measurement Handbook*. Vol. 12 Retrieved February 25, 2009, from <http://www.e-publishing.af.mil/shared/media/epubs/AFH36-2235V12.pdf>
- [2] Josep M Argimon-Pallàs, Gemma Flores-Mateo, Josep Jiménez-Villa, I and Enriqueta Pujol-Ribera (2010) Psychometric properties of a test in evidence based practice: the Spanish version of the Fresno test. BMC Education 10, 45.
- [3] Agrimon-Pallas, M. J; Flores-Mateo, G,; Jimenev-Villa, J and Pujol-Ribera, J. (2011). *Psychometric properties of a test in evidence based practice: the Spanish version of the Fresno test*. Retrieved June 25 from <http://www.biomedcentral.com/1472-6920/10/45>
- [4] Ali, A., Ezeadi, S., &Ogbazi, N. J. (1988). *Introduction to Educational Measurement and Evaluation*. Awka: Meks Unique Publishers.
- [5] Aworefa, T. A. (2005). *Designing Instruments for Measuring Students Educational Outcomes: The NABTEB Approach*. Retrieved February 25, 2009 From http://www.curriculum.wcape.school.za/resource_files/22110445_28.doc.
- [6] Berg, B. L. (2001). *Qualitative Research Methods for the Social Sciences. (4thed)*. Needham Heights, M. A: Allyn and Bacon.

- [7] Cohen, R. J & Swerdlik, M. E. (2003). *Psychological Testing and Assessment: An Introduction to Test and Measurement*. 5/e. New York: McGraw-Hill.
- [8] Cohen, L., Manion, L., & Morrison, K. (2011). *Research Methods in Education* 6/e. New York: Routledge Taylor & Francis.
- [9] Daramola, C. O (1991). Nomadic Education: A reflection of Rural Development. *Nigerian Journal of Educational Foundation* 1 (1) 93-99.
- [10] Edikpa, E. C. (2004). Development and Validation of Decision- Making Skill Inventory for Secondary School Principal in Anambra state. Unpublished Ph.D Thesis. University of Nigeria, Nsukka.
- [11] Esterberg, K. G. (2002). *Qualitative Methods in Social Sciences Research*. New York: McGraw Hill.
- [12] Erjavec, J (2010). *Automotive Technology: A Systems Approach*. 5/e United Kingdom: Delmar Cengage Learning.
- [13] Federal Ministry of Education, Science and Technology (2013). *National Policy on Education*. Lagos: NERDC Press.
- [14] Federal Government of Nigeria (2013). National Policy On Education. Abuja: NERDC.
- [15] Federal Ministry of Education (2009) *Draft: Roadmap for Nigerian Educational Sector*. Abuja: Federal Ministry of Education.
- [16] Fraenkel, J. R., & Wallen, N. E. (2012). *How to Design and Evaluate Research in Education*. 5/e. New York: McGraw Hill.
- [17] Gall, M. D., Gall, J. P., & Borg, W. R (2007). *Educational Research: An Introduction* 8/e. New York: Pearson Education Inc.
- [18] Gronlund, N. E (1993). *How to make Achievement tests and Assessments*. 5/e New York. Allyn and Bacon.
- [19] Gronlund, N. E., & Linn, R. L. (1990). *Measurement and Evaluation in teaching*. 6/e New York: Macmillan.
- [20] Haladyna, T. M., & Downing, S. M. (2004). Constructing Irrelevant Variance in High-Stakes Testing. *Educational Measurement: Issues and Practice*, 23 (1), 17-27.
- [21] Hendricson WD, Rugh J. D, Hatch J. P, Stark D. L, Deahl T. Wallmann, E. R (2011). *Validation of an instrument to assess evidence-based practice knowledge, attitudes, access, and confidence in the dental environment*. Retrieved July 25 from <http://www.biomedcentral.com/1472-6920/10/45/prepub>
- [22] Haladyna, T. M. (1999). *Developing and Validating Multiple-choice items*. (2nd Ed.) Mahwah, NJ: Lawrence Erlbaum Associates.
- [23] Haladyna, T. M., & Downing, S. M (1989b). Validity of a taxonomy of Multiple-choice item-writing rules. *Applied Measurement in Education*, 2 (1), 37-50.
- [24] Hillier, V. A. W., & Coombes, P (2004). *Hilliers Fundamentals of Motor Vehicle Technology*. 5/e United Kingdom: Nelson Thornes.
- [25] Hillier, V. A. W., & Rogers, D. R. (2007). *Hillier's Fundamentals of Motor Vehicle Technology: Chassis and Body Electronics*. Book 3. United Kingdom: Nelson Thornes Ltd.
- [26] Hillier, V. A. W., Coombes, P., & Rogers, D. R. (2006) *Hillier's Fundamentals of Motor Vehicle Technology: Power Train Electronics*. Book 2. United Kingdom: Nelson Thornes Ltd.
- [27] Karl, S. (2004). *Motor Vehicle Maintenance*. Retrieved on July 16, 2009, from http://www.findarticles.com/p/articles/mi-qa3828/ai_n9453105
- [28] Kehoe, J (1995). *Basic Item Analysis for Multiple-choice Test*. *Practical Assessment, Research and Evaluation*, 4 (10) Retrieved February 25, 2009 from <http://PAREonline.net/getun.asp?v=4dn=10>.
- [29] Kehoe, J. (1995) *Writing Multiple-choice test items*. *Practical Assessment, Research and Evaluation*. 4 (9) Retrieved February 25, 2009 from <http://pareonline.net/getvn.asp?v=4dn=9>
- [30] Lawshe, C. H (1973). A quantitative approach to content Validity. *Personnel Psychology*, 28 (4) 563-575.
- [31] Linguist, R. (1998). Quality Improvements of Teaching and Learning in Higher Education: A comparison with Developments in Industrial Setting. *Teaching in Higher Education*. 3 (1) 51-62.
- [32] Linn, R. L., Baker, E. L., & Dunbar, S. B. (1991). *Complex Performance-Based Assessment: Expectations and Validation Criteria*. Retrieved July 16, 2009 from <http://www.cse.ucla.edu/RESST/Report/TECH33/-pdf>
- [33] Ming, L; Wilkerson, L; Reuben, D & Ferrell, B. A (2004). Development and Validation of Geriatrics Knowledge test for medical student. *Journal of the American Geriatrics Society*. ISSN 0002-8614.
- [34] Mehrens, W. A., & Lehman, I. J. (1991). *Measurement and Evaluation in Education and Psychology*. (4/e). Orlando, FL: Holt Reinhart and Winston Inc.
- [35] Morris, L. L., Fitz-Gibbon, C. C., & Lindneim, E. (1987). *How to Measure Performance and use tests*. Newburg Park California: SAGE Publications, Lnc.
- [36] Mayberry, P. W., & Carey, N. B. (1999). *Job Performance Tests for Motor Transport Mechanics*. Vol II: Administrative Duties and Job Knowledge Test. Retrieved August 18, 2009, from <http://www.oai.dtic.mil/oai/oai?vert=getRecord&netadataprefix=htm>.
- [37] NBTE (2003). *Motor Vehicle Mechanics Work-National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC)*. National Board for Technical Education. National Technical Certificate.
- [38] NBTE. (2001). *National Technical Certificate and Advanced National Technical Certificate Curriculum and Module Specifications in Motor Vehicle Mechanic Work*. Kadunna: National Board for Technical Education. Retrieved on September 25, 2009 from <http://www.unesco.unesco.org/images/001613/161378e.pdf>
- [39] Nworgu, B. G. (2006). *Educational Research: Basic Issues and Methodology*. Ibadan: Wisdom Publishers Ltd.
- [40] Nwana, O. C. (2007). *Textbook on Educational Measurement and Evaluation*. Owerri: Bomaway Publishers.
- [41] Odu, E. N & Ihejaimaizu, E. C (2001). *Statistics and Basic Methods in Education and Social Sciences*. Calabar: University of Calabar.

- [42] Onyiliofe, M. P (2008). Development and Validation of Criterion reference Test for Assessing student Performance in Petrol Engine Maintenance. *Unpublished M.Ed Thesis*, University of Nigeria, Nsukka.
- [43] Offorma, G. C (2002). *Curriculum Theory and Planning*. Enugu: Family Circle Publications.
- [44] Okeme, I. (2011). Development and Validation of Pschoproductive skill multiple choice test items in Agricultural science for student in secondary schools. *Unpublished Ph.D Thesis*. University of Nigeria, Nsukka.
- [45] Okoro, O. M. (2002). *Measurement and Evaluation in Education* Obosi: Pacific Publisher Ltd.
- [46] Okpala, P. N., Onocha, C. O., & Oyedeji, O. A (1993). *Measurement and Evaluation in Education*. Ibadan: Stirling-Horden Publishers.
- [47] Olaitan, S. O., & Ali, A. (1999). *The Making of Curriculum: Theory, Process, and Product, and Evaluation*. Owerri: Cape Publishers Ltd.
- [48] Osterlind, S. J. (1989). *Constructing Test Items*. Norwell, M. A.: Kluwer Academic Publishers.
- [49] Olubodun, O. J. (2007). *Test Construction Techniques and Principles: Study Guide*. Retrieved on August 20, 2009, from http://www.ebaringenropa.infor/out/?doc_id=12/53drsrid=13219.pdf.
- [50] Okorie (2004). *Introduction to Industrial Technical education*. Onitsha: Cheston Publishers Limited.
- [51] Okeke, E. U & Okoye (2007) *Methodologies in Education*. Awka: Spectrum Publishers.
- [52] Salami, K. A. (2004). *Auto-Technology Fundamentals*. Series 1-3. Ibadan: University Press Plc.
- [53] WEB (2011). Glossary of Keywords. Accessed on 23rd March, 2011 from <http://writting.colstate.edu/guides/research/glossary>
- [54] Simpson, E. J (1972). The Classification of Educational Objectives in the Psychomotor Domain. *The Psychomotor Domain* 3 (2) 43-46.