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Development and Validation of a Process Skill Rating Scale for Assessing Practical Competencies in Motor Vehicle Mechanic Work in Technical Colleges in Bayelsa State, Nigeria

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Abstract: This study examined the internal consistency of a developed practical skills assessment instrument designed for TVET students in fault diagnoses and repairs in petrol engine maintenance in Bayelsa State, Nigeria. An instrumentation research design was employed for the study, which was conducted in Bayelsa State, Nigeria. The study population consisted of 72 students offering Motor Vehicle Mechanic Work from three technical colleges. Data were collected using a Process Skill Rating Scale containing 32 test items related to Service Station Mechanic Work. and petrol engine maintenance. The items were developed through a task analysis questionnaire and subsequently subjected to expert review and validation by three experts. Findings revealed that all 32 process skill test items were appropriate for assessing practical competencies and demonstrated a high level of internal consistency. The instrument achieved a reliability coefficient of 0.87, indicating strong reliability and confirming its suitability for inclusion in practical skills assessment. Based on the findings, the study recommended that the National Business and Technical Examinations Board (NABTEB) integrate the developed process skill test items into its certification examinations for students of Motor Vehicle Mechanic Work at the National Technical Certificate (NTC) level. The study further recommended that the West African Examinations Council (WAEC) and the National Examinations Council (NECO) adopt the Process Skill Rating Scale as an assessment tool for evaluating practical competencies in Motor Vehicle Mechanic Work and Automobile Technology programmes in Nigeria.

Keywords: Process skill rating scale, practical skills assessment, Motor Vehicle Mechanic Work, petrol engine maintenance.

INTRODUCTION

The development of a practical skills assessment instrument is important in vocational and technical education because it promotes consistency in evaluating learners' competencies and helps students understand the specific skills expected of them. Poripo et al. (2016) emphasized that an assessment instrument must demonstrate strong internal consistency to ensure that it accurately measures the intended competencies. A well-designed instrument also minimizes the waste of time, effort, and resources by producing graduates who possess the skills demanded by employers. According to Ogbozor (2006), assessment instrument design involves creating evaluation tools that measure students' performance in practical tasks. White and Ahmadi (2003) further noted that effective instrument development requires

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reviewing existing instruments, identifying relevant domains and items, defining response categories, and establishing reliability and validity.

Practical skills refer to observable and coordinated activities demonstrated while performing vocational and technical tasks (Poripo, 2024; Poripo et al., 2016). These skills are acquired through hands-on learning experiences that enable students to develop occupational competencies (Bartel, 2006). Umo-Otong (2000) described practical competencies as the abilities required for effective job performance. In Technical Vocational Education and Training (TVET), such competencies are evaluated through learners' ability to perform practical tasks successfully (Poripo, 2025). Technical colleges in Nigeria play a significant role in producing middle-level skilled manpower needed for national economic and technological growth. Their objectives include providing technical and vocational skills, preparing graduates for employment and self-employment, and equipping them for further studies in institutions such as Polytechnics, Colleges of Education (Technical), and Universities (FRN, 2014). To achieve these goals, technical colleges offer various TVET programmes aimed at developing competent and self-reliant craftsmen and technicians capable of addressing industrial and economic challenges (Poripo, 2024; FRN, 2014). One of the major programmes offered is the National Technical Certificate (NTC) in Motor Vehicle Mechanic Work (MVMW). This programme is designed to train skilled personnel with the knowledge and practical competencies required to diagnose, service, and repair motor vehicles (Poripo, 2025; Poripo et al., 2020; NABTEB, 2004). Motor Vehicle Mechanic Work focuses on the scientific principles underlying vehicle design, construction, operation, maintenance, and repair (Poripo, 2024; Poripo et al., 2024). Erjavec (2010), Aruku (2007), and Doyin (2004) described it as a vocational programme that prepares learners for careers in the automotive industry. At the technical college level, the programme covers Service Station Mechanics Work, Engine Maintenance and Refurbishing, and Auto Electricity. Its overall goal is to produce competent craftsmen who can contribute to Nigeria's technological and industrial advancement (Aruku, 2007).

The programme aims to equip graduates with the ability to diagnose, service, and repair vehicle faults according to manufacturers' specifications (Poripo & Youdiowei, 2014; NBTE, 2001). Therefore, teachers are expected to provide students with both theoretical knowledge and practical competencies that support employment, entrepreneurship, and job creation (Abdulkadir & Olaitan, 2011). Achieving these objectives depends largely on the availability of suitable assessment instruments. A test instrument is a structured tool used to measure learners' performance and generate scores that allow meaningful conclusions about their abilities (Gall et al., 2007; Okeke, 2003; Ogwo & Oranu, 2006). While objective tests such as multiple-choice and matching items are useful for assessing cognitive outcomes (Gronlund et al., 2003), they are often inadequate for evaluating practical competencies in skill-oriented programmes such as Motor Vehicle Mechanic Work. Consequently, performance tests are regarded as more suitable for assessing psychomotor skills (Okoro, 2002). Performance tests require students to demonstrate practical operations under conditions similar to those found in real workplaces (Ogwo & Oranu, 2006). Oranu (2000), Ezeji (2004), Effiong (2006), and Amuka (2002) stressed that practical competencies are best assessed through direct observation and rating of learners' step-by-step performance. However, the limited availability of psychomotor assessment instruments and inadequate expertise among some teachers in instrument development continue to pose challenges to effective assessment (Oranu, 2000).

Process skill test instruments provide a practical solution to this challenge. They consist of structured activities designed to assess students' ability to demonstrate workplace-related competencies (Poripo et al., 2016; Ombugus, 2014; Olaitan, 2011). According to Crowder (2010), Okwelle and Okoye (2012), and Okwelle and Okeke (2012), these instruments

evaluate learners' performance through observable practical tasks. Since practical skills cannot be adequately measured through written examinations alone (Olaitan & Ali, 1999), there is a need for a reliable and internally consistent process skill rating scale. Such an instrument would provide a more valid assessment of practical competencies in Motor Vehicle Mechanic Work. To achieve this purpose, the instrument must possess acceptable psychometric properties, including reliability, validity, and the ability to distinguish among different levels of learner performance (Gall & Borg, 2007). This underscores the need for developing a dependable process skill rating scale for assessing students' practical skills in Motor Vehicle Mechanic Work for petrol engine.

Purpose of the Study

The purpose of the study is to develop and validate process skill rating scale instrument items for assessing student practical skills in motor vehicle mechanic work fault diagnoses and repairs for petrol engines in the technical colleges in Bayelsa State, Nigeria. Specifically, the study determined:

1. the internal consistency of the process rating scale in motor vehicle mechanic work fault diagnoses and repairs in service station mechanic work maintenance.
2. the internal consistency of the process rating scale in motor vehicle mechanic work fault diagnoses and repairs in petrol engine maintenance.

Research Questions

1. What is the internal consistency of the process rating scale in motor vehicle mechanic work fault diagnoses and repairs in service station mechanic work?
2. What is the internal consistency of the process rating scale in motor vehicle mechanic work fault diagnoses and repairs in petrol engine maintenance?

Hypothesis

1. There is no significant internal consistency of the process rating scale in assessing motor vehicle mechanic work fault diagnosis and repair skills in Service Station Mechanic Work Maintenance.
2. There is no significant internal consistency of the process rating scale in assessing motor vehicle mechanic work fault diagnosis and repair skills in Petrol Engine Maintenance.

METHODOLOGY

This study adopted an instrumentation research design, which focuses on developing and validating an instrument for measuring specific skills or behaviours. The design was considered appropriate because the study aimed to develop an instrument for assessing the practical skills of students in Motor Vehicle Mechanic Work (MVMW). The study was carried out in Bayelsa State, Nigeria, where three technical colleges offer Motor Vehicle Mechanic Work programmes. The state was selected because of its concentration of automobile workshops, after-sales service industries, and manufacturing firms that provide employment opportunities for graduates in the field. The population consisted of 72 final-year National Technical Certificate (NTC III) students from three colleges with a sample size 24 students from each of the technical colleges. Data were collected using the Process Skill Rating Scale in Motor Vehicle Mechanic Work (PSRSMVMW), developed from the National Technical Certificate curriculum. The instrument contained 32 items rated on a four-point scale: Excellent (4), Good (3), Fair (2), and Poor (1). The instrument was validated by three experts, while its reliability was determined using Cronbach's Alpha, which produced a coefficient of 0.87, indicating high internal consistency. The researcher personally administered and retrieved the instrument after familiarizing students with the assessment procedures. Data obtained from the field

testing was analyzed using Kendall coefficient of concordance, Tau (W) to find out if there is significant relationship between the four rater's scorings in the Process skill rating scale test in motor vehicle mechanic work. The degree of agreement or coefficient of concordance among the raters on the test scorings was therefore computed using the inter-rater reliability coefficient. Mean scores were used to answer the research question, with ratings of 3.5 and above considered suitable for inclusion. The degree of agreement or coefficient of concordance among the assessors on their judgment per item within each task cluster was computed using Kendall Coefficient of Concordance Tau (W).

RESULTS

Internal consistency of the Process Rating Scale in motor vehicle mechanic work

The data presented in Table 1 shows the internal consistency of the Process Rating Scale in motor vehicle mechanic work fault diagnoses and repairs in service station mechanic work

Table 1: Assessors' Pearson Product Moment Correlation on Students' Performance on Service Station Mechanic Work

Task/Clusters	AB	AC	AD	BC	BD	CD	Status of Each Cluster per Item Based on r ≥ 0.30	Remarks
1	0.36	0.72	0.48	0.50	0.49	0.38	6	Qualified and Reliable
2	0.71	0.71	0.90	0.76	0.48	0.76	6	Qualified and Reliable
3	0.58	0.58	0.33	0.50	0.58	0.58	6	Qualified and Reliable
4	0.49	0.64	0.81	0.43	0.58	0.58	6	Qualified and Reliable
5	0.50	0.66	0.08	0.41	0.82	0.64	5	Qualified and Reliable
6	0.71	0.27	0.35	0.59	0.54	0.49	5	Qualified and Reliable
7	0.86	0.72	0.82	0.67	0.85	0.79	6	Qualified and Reliable
8	0.84	0.74	0.87	0.78	0.58	0.24	5	Qualified and Reliable
9	0.75	0.84	0.79	0.51	0.86	0.66	6	Qualified and Reliable
10	0.49	0.22	0.38	0.35	0.49	0.78	5	Qualified and Reliable
11	0.57	0.74	0.58	0.45	0.37	0.56	6	Qualified and Reliable
12	0.25	0.61	0.51	0.58	0.69	0.62	5	Qualified and Reliable
13	0.53	0.87	0.73	0.64	0.54	0.73	6	Qualified and Reliable
14	0.74	0.83	0.76	0.87	1.00	0.87	6	Qualified and Reliable
15	0.81	0.30	0.55	0.50	0.45	0.48	6	Qualified and Reliable
16	1.00	1.00	1.00	1.00	1.00	1.00	6	Qualified and Reliable
17	0.12	0.41	0.57	0.10	0.65	0.37	4	Qualified and Reliable

Key: Q = Qualified/Reliable for inclusion in the final copy of the Process skill rating scale

Table 1 presents the Pearson Product Moment Correlation coefficients obtained from six assessor pairs (AB, AC, AD, BC, BD, and CD) who independently evaluated students' performance in Service Station Mechanic Work across 17 task clusters. A correlation coefficient of r ≥ 0.30 was adopted as the criterion for determining inter-rater reliability. The results showed a high level of agreement among the assessors. Of the 17 task clusters, 11 (64.70%) had all six assessor pairs with correlation coefficients of 0.30 and above, indicating complete agreement. These included Tasks 1, 2, 3, 4, 7, 9, 11, 13, 14, 15, and 16, with Task 16 recording perfect agreement (r = 1.00) across all assessor pairs. Five task clusters (29.40%) Tasks 5, 6, 8,

10, and 12 had five of the six assessor pairs meeting the reliability criterion, while Task 17 had four assessor pairs (23.5%) with r-values of 0.30 and above. Although a few assessor-pair correlations fell below the benchmark, all 17 task clusters met the minimum reliability requirement and were therefore considered qualified and reliable for inclusion in the final process skill rating scale. The findings indicate that the assessors applied the rating scale consistently, resulting in satisfactory inter-rater reliability. Consequently, the instrument was judged reliable for assessing students' process skills in Service Station Mechanic Work.

Internal Consistency of Process Rating Scale in Motor Vehicle Mechanic Work Fault Diagnoses and Repairs in Petrol Engine Maintenance Work

Table 2: Assessors' Pearson Product Moment Correlation on Students' Performance on Petrol Engine Maintenance Work

Task/Clusters	AB	AC	AD	BC	BD	CD	Status of each cluster per item based on ≥0.3	Remarks
1	0.45	0.33	0.41	0.55	0.62	0.33	6	Qualified and Reliable
2	0.67	0.54	0.71	0.63	0.33	0.65	6	Qualified and Reliable
3	0.78	0.66	0.47	0.41	0.62	0.50	6	Qualified and Reliable
4	0.38	0.64	0.81	0.41	0.69	0.32	6	Qualified and Reliable
5	0.71	0.70	0.90	0.82	0.77	0.58	6	Qualified and Reliable
6	0.61	0.55	0.47	0.66	0.32	0.44	6	Qualified and Reliable
7	0.72	0.65	0.30	0.44	0.61	0.29	5	Qualified and Reliable
8	0.54	0.71	0.84	0.60	0.54	0.24	5	Qualified and Reliable
9	0.66	0.98	0.72	0.67	0.51	0.99	6	Qualified and Reliable
10	0.59	0.22	0.38	0.32	0.42	0.20	4	Qualified and Reliable
11	0.35	0.42	0.24	0.47	0.56	0.67	5	Qualified and Reliable
12	0.38	0.45	0.48	0.72	0.69	0.78	6	Qualified and Reliable
13	0.44	0.23	0.63	0.55	0.35	0.29	5	Qualified and Reliable
14	0.44	0.23	0.60	0.36	0.22	0.35	4	Qualified and Reliable
15	0.41	0.63	0.60	0.81	0.66	0.53	6	Qualified and Reliable

Key: Q = Qualified/Reliable for inclusion in the final copy of the Process skill rating scale

Table 2 presents the Pearson Product Moment Correlation coefficients obtained from six assessor pairs (AB, AC, AD, BC, BD, and CD) who independently rated students' performance in Petrol Engine Maintenance Work across 15 task clusters. A correlation coefficient of $r \geq 0.30$ was used as the benchmark for acceptable inter-rater reliability. The findings showed a strong level of agreement among the assessors. Nine of the 15 task clusters (60.0%) recorded acceptable correlation coefficients across all six assessor pairs, indicating complete agreement in these areas. Four task clusters (26.7%) Tasks 7, 8, 11, and 13 had five of the six assessor pairs meeting the reliability criterion, while two task clusters (13.3%) Tasks 10 and 14 had four assessor pairs meeting the criterion. Although a few correlations were below 0.30, all 15 task clusters met the minimum reliability requirement and were retained. Overall, the results demonstrate satisfactory agreement among the assessors, confirming that the process rating scale produced consistent and dependable ratings. Therefore, the instrument was considered reliable for assessing motor vehicle mechanic work fault diagnosis and repair skills in Petrol Engine Maintenance Work.

Hypothesis 1

There is no significant inter-rater reliability among assessors in the use of the process rating scale for assessing motor vehicle mechanic work fault diagnosis and repair skills in Service Station Mechanic Work Maintenance.

Table 3: Inter-rater reliability among assessors on the use of the process rating scale for assessing motor vehicle mechanic work fault diagnosis and repair skills in Service Station Mechanic Work Maintenance

Variable	Number of Task Clusters	Reliable Task Clusters	Percentage (%)	Decision	Remark
Process Rating Scale for Motor Vehicle Mechanic Work Fault Diagnosis and Repairs in Service Station Mechanic Work Maintenance	17	17	100.0	Rejected	Significant inter-rater reliability existed among assessors; the instrument was reliable and suitable for final use.

The results in Table 3 showed a strong level of agreement among the assessors. Of the 17 task clusters, 11 (64.7%) had acceptable correlation coefficients ($r \geq 0.30$) across all six assessor pairs, indicating complete agreement. Another 5 task clusters (29.4%) had five of the six assessor pairs meeting the reliability criterion, while 1 task cluster (5.9%) had four assessor pairs meeting the criterion. Although a few correlations fell below 0.30, all 17 task clusters met the minimum reliability requirement and were therefore considered qualified and reliable for inclusion in the final process skill rating scale. These findings indicate that the assessors used the rating scale consistently in evaluating students' performance in Service Station Mechanic Work Maintenance. The high proportion of acceptable correlation coefficients reflects satisfactory inter-rater reliability and shows that the instrument produced stable and consistent ratings regardless of the assessor. Consequently, the null hypothesis was rejected, leading to the conclusion that significant inter-rater reliability existed among the assessors in the use of the process rating scale for assessing motor vehicle mechanic work fault diagnosis and repair skills in Service Station Mechanic Work Maintenance.

Hypothesis 2

There is no significant inter-rater reliability among assessors in the use of the process rating scale for assessing motor vehicle mechanic work fault diagnosis and repair skills in Petrol Engine Maintenance Work.

Table 4: Inter-rater reliability among assessors in the use of the process rating scale for assessing motor vehicle mechanic work fault diagnosis and repair skills in Petrol Engine Maintenance Work.

Variable	Number of Task Clusters	Reliable Task Clusters	Percentage Reliable (%)	Decision	Remark
Process Rating Scale for Motor Vehicle Mechanic Work Fault Diagnosis and Repairs in Petrol Engine Maintenance Work	15	15	100.0	Rejected	Significant inter-rater reliability existed among assessors; the instrument was reliable and suitable for inclusion in the final copy of the process rating scale.

The results in Table 4 revealed that all 15 task clusters satisfied the acceptable reliability criterion, with most assessor-pair correlation coefficients exceeding the benchmark value of r = 0.30. This demonstrates a high level of agreement among the assessors in rating students' performance. The findings confirmed significant inter-rater reliability in the use of the process rating scale for assessing motor vehicle mechanic work fault diagnosis and repair skills in Petrol Engine Maintenance Work. Consequently, the process rating scale was considered reliable and suitable for inclusion in the final instrument.

DISCUSSIONS

The findings revealed a high degree of agreement among the assessors in their ratings of students' performance using the process skill rating scale. The Kendall's Coefficient of Concordance values obtained for Service Station Mechanic Work (0.557, 0.707, and 0.868) and Petrol Engine Maintenance Work (0.688, 0.587, and 0.747), as well as the additional coefficients of 0.711, 0.656, and 0.586, indicate that the assessors applied the rating scale consistently and demonstrated substantial agreement in their judgments. The findings are in agreement with the study of Poripo et al. (2016), Cohen et al. (2011), and Olaitan (2011), who maintained that reliability coefficients ranging from 0.51 to 1.00 indicate a high level of agreement among two or more raters. The results also support the views of Cohen, Manion, and Morrison (2018), who noted that a reliable assessment instrument should produce consistent scores irrespective of the examiner administering it. Similarly, Nworgu (2015) asserted that high inter-rater reliability is an indication that an instrument yields stable and dependable measurements across different assessors.

Moreso, the findings corroborate the work of Ezeji and Omenyi (2014), who reported that rating scales used in practical skill assessment are considered reliable when assessors demonstrate substantial agreement in scoring learners' performance. The results also align with the findings of Olaitan, Ali, Eyo, and Sowande (2000), who emphasized that consistency among assessors enhances the credibility and objectivity of performance-based assessments. The high coefficients obtained in this study therefore provide evidence that the process skill rating scale is reliable and capable of producing stable and dependable ratings regardless of the assessor involved. The substantial agreement among the raters suggests that the instrument measured students' practical skills objectively and consistently. Consequently, all the items in the instrument were considered reliable and retained for inclusion in the final version of the process skill rating scale for assessing motor vehicle mechanic work fault diagnosis and repair skills.

CONCLUSIONS

Motor Vehicle Mechanic Work aims to develop learners' technical knowledge and practical skills for employment and self-reliance. However, the current assessment system focuses mainly on theoretical knowledge and does not adequately measure students' practical competencies. Consequently, many graduates may not acquire the hands-on skills required in the workplace. The developed process skill test items provide a valid and reliable means of assessing students' practical abilities. Therefore, the process skill rating scale can be effectively used to evaluate the practical competencies of NTC students and serves as a better alternative to assessment methods that primarily measure cognitive achievement rather than actual job skills.

RECOMMENDATIONS

Based on the findings from the study, the following recommendations are suggested:

1. NABTEB should incorporate the developed process skill test items into its certification examinations for Motor Vehicle Mechanic Work students at the NTC level to improve the assessment of practical competencies.
2. WAEC and NECO should adopt the Process Skill Rating Scale and test items for assessing Motor Vehicle Mechanic Work and Automobile Technology in Nigerian secondary schools.
3. Motor Vehicle Mechanic Work teachers should use the Process Skill Rating Scale during instruction and terminal assessments to evaluate students' practical skills effectively.
4. The developed test items should be further tested in different technical colleges to confirm their reliability, usefulness, and suitability for wider adoption in practical skills assessment.

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