BSU Journal of Education (BSUJE)

Vol. 25 No. 1 Dec. 2025
ISSN: 1117-6350

COMPETENCES OF MOTOR VEHICLE MECHANICS WORK TEACHERS FOR TEACHING MODERN AUTO DIAGNOSIS IN SCIENCES AND TECHNICAL COLLEGES IN BENUE STATE

Philip Jongol
Department of Industrial Studies,
Benue State University, Makurdi

Joy Obiageli Nwokolo-Ojo
Department of Industrial Studies,
Benue State University, Makurdi

Abstract
This studyassessed the competences of motor vehicle mechanics work teachers for teaching modern auto diagnosis in sciences and technical colleges in Benue State. Three research questions guided the study. Descriptive survey research design was adopted for this study. The population for the study comprised 31 Motor Vehicle Mechanics Teachers in all the technical colleges in Benue State, which was also used as sample size for the study. A 25-item structured questionnaire titled: "Auto Diagnosis Competences Assessment Questionnaire (ADCAQ)" was developed by the researcher. It was used as instrument for data collection. The instrument was validated by three experts from Benue State University. The reliability coefficient for the instrument was established as $\alpha = 0.94$ using Cronbach Alpha reliability techniques. Data were analysedusingmean (M) and standard deviation (SD) while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 5% level of significance. Findings from the data collected and analysis showed that acceptable proficiency levels in using On-Bold Diagnosis (OBD) II scanners are found among Motor Vehicle Mechanics Work (MVMW) teachers. The study also found that MVMW teachers indicated moderate utilization of advanced diagnostic tools, and that MVMW teachers indicated a general competency in using specialized equipment. The study recommended that specialized training for MVMW teachers so as to provide, enhanced access to advanced diagnostic tools in all zones which should be guaranteed and collaborative learning and experience sharing between zones should be organized

Keywords: *Assessment,Competences, Motor Vehicle Mechanics Work Teachers, Modern Auto Diagnosis, Sciences and Technical Colleges*

DOI: https://doi.org/1 0.60787/bsuje.vol25no1. 2 (https://doi.org/10 .60787/bsuje.vol25no1. 2)

Introduction

The automotive industry has undergone significant technological advancements, resulting in modern automobiles that are highly complex and integrated with sophisticated electronic and computer systems. This complexity necessitates advanced diagnostic and repair skills, which in turn require motor vehicle mechanics work teachers to be proficient in contemporary auto diagnosis techniques. Modern automobiles are equipped with computerized systems that require specialized knowledge and skills to operate and interpret. These systems are designed to monitor and control various aspects of vehicle performance, including engine function, emissions, and safety features. As a result, Igwe, Ikenwa and Jwasshaka (2017) posits that traditional mechanical skills are no longer sufficient for diagnosing and repairing these vehicles, instead, a deep understanding of electronic systems and the ability to use advanced diagnostic tools

Today, auto diagnosis is no longer done via sensory methods as it used to be due to electronic control that has dominated the motor vehicle design. Modern auto diagnosis refers to the advanced methods and technologies used to identify and troubleshoot problems in contemporary vehicles. This approach leverages sophisticated diagnostic tools, software, and systems to accurately and efficiently determine the health and performance of various automotive components and systems. Unlike traditional diagnostic methods that relied heavily on mechanical intuition and experience, modern auto diagnosis is highly data-driven and precise. The key components of modern auto diagnosis include but not limited to; on-board diagnostics II (OBD) systems, diagnostic scan tools, advanced diagnostic software, and specialized diagnostic equipment.

According to Namburu, Wilcutts, Chigusa, Liu, Choi and Pattipati (2006), OBD-II provides standardized diagnostic trouble codes (DTCs) that can be read using a diagnostic scanner to identify specific issues within the vehicle's systems. OBD-II systems also continuously monitor the vehicle's performance, emissions, and other critical parameters, allowing for real-time data collection and analysis. Similarly, diagnostic scan tools like handheld scanners and PC-based scanners are deployed for reading diagnostic trouble codes (DTCs), live data, freeze frame data, and for comprehensive system analysis and reporting.

Training and skills imparted in the field of motor vehicle mechanics are essential in the society today. It is a very important technical and specialized field that requires individuals to have a deep understanding of various mechanical systems and components of motor vehicles. The National Board for Technical Education (NBTE, 2020) emphasizes the importance of skill acquisition in producing highly skilled and self-reliant technicians in the automotive industry. With the advancement of technology, vehicles are becoming more complex, and the need for skilled technicians is on the rise. The training provided in the field ensures that individuals are up-to-date with the latest technological advancement and can effectively handle the maintenance and repairs of modern vehicles. In other words, Motor Vehicle Mechanics Work (MVMW) graduates are expected to diagnose services and completely carry out maintenance and able to repair any fault relating to the conventional automobile assembly main unit to the manufacturers specification. Most mechanics do visual maintenance and also use their knowledge of vehicle behaviour and experience to diagnose and solve problems on vehicles without the full knowledge of On Board Diagnostic (OBD) or automotive scan tool. Sometimes, they help to solve problem on a vehicle but introduce additional problems, thereby, leading to a difficulty on the part of mechanics to repair the vehicle. In the opinion of Baba, Jacob and Issifu (2018), since modern automotive running on the roads are now being manufactured and controlled by modern technology, proper troubleshooting and maintenance of faults associated with these vehicles can only be best carried out by a skilled motor vehicle mechanics who is competent enough to fully undertake the troubleshooting of various aspects of modern vehicles.

Diagnostic scan tools have revolutionized automobile diagnosis, providing motor mechanic teachers in technical colleges with the ability to identify and resolve complex issues efficiently. These tools have become an essential component in modern automotive education, empowering teachers to equip students with the necessary

skills to tackle real-world automotive challenges effectively. This new approach is not just an improvement of the primitive trials by error or exclusively manual method, it is the one of the major ways MVMW Teachers and students in Science and Technical Colleges can remain relevant in 21st century automobile world.

Technical Colleges in Nigeria have been training people to become craftsmen and technicians. Training qualifies them for jobs in both public and private sectors of the economy. Every sector of the economy requires well-trained and competent technician who can operate and maintain the available automobile and technical equipment. Therefore, there is a need for qualitative technical training to produce graduates that can perform excellently in their chosen vocation without a need for pre-employment training.

Motor vehicle mechanics work teachers in technical colleges in Nigeria play a pivotal role in shaping the future of the automotive industry. According to Baba et al, (2018), the primary responsibilities MVMW teachers include teaching students the theoretical and practical aspects of vehicle maintenance and repair technology. Teachers of MVMW are responsible for implementing curriculum materials, staying updated with the latest industry advancements, and ensuring that their teaching methods incorporate current technologies and practices.

Technical competence is a critical attribute for motor vehicle mechanics work teachers. They must be proficient in the latest automotive technologies, including on-board diagnostics II (OBD) systems, diagnostic scan tools, advanced diagnostic software, and specialized diagnostic equipment. This requires continuous professional development to keep abreast of technological advancements and industry best practices. Teachers must be capable of diagnosing complex vehicle issues, understanding advanced automotive electronics, and utilizing sophisticated diagnostic tools. Their technical skills are essential not only for teaching but also for mentoring students through hands-on practical experiences, troubleshooting problems, and ensuring that students gain the necessary competencies to succeed in the automotive field.

Statement of the Problem

Specialized diagnostic equipment, such as engine analyzers and emissions testers play a crucial role in detailed vehicle diagnostics. However, there is a significant gap in both the availability of these equipment in technical colleges and the competence of teachers in using them. According to Okwelle and Okeke (2015), many technical colleges in Nigeria are under-equipped with specialized diagnostic tools, and teachers often lack the training to effectively use what is available. This makes MVMW students in technical colleges acquire inadequate skills in vehicle diagnosis and hence making them incompetent to establish and manage motor vehicle workshops after graduation.

Purpose of the study

The purpose of the study is to assess of the competences of motor vehicle mechanics work teachers for teaching modern auto diagnosis in sciences and technical colleges in Benue State. The study sought to achieve the following specific objectives:

1. Assess the level of proficiency among motor vehicle mechanics work teachers in using On-Board Diagnostics II (OBD) scanners for vehicle diagnosis.
2. Ascertain the extent to which motor vehicle mechanics work teachers utilize advanced diagnostic software in teaching motor vehicle mechanics work.
3. Establish the competency level of motor vehicle mechanics work teachers for teaching with specialized diagnostic equipment.

Research Questions

The following questions were raised to guide the study:

1. What is the proficiency level of MVMW teachers in using On-Board Diagnostics II (OBD) scanners for vehicle diagnosis?
2. To what extent do MVMW teachers utilize advanced diagnostic software in teaching MVMW?
3. What is the competency level of MVMW teachers in teaching with specialized diagnostic equipment?

Hypotheses

The following null hypotheses were formulated and tested at 5% level of significance:

Ho_1: There is no significant difference in the mean proficiency level of MVMW teachers in using On-Board Diagnostics II (OBD) scanners for vehicle diagnosis based on their location.

Ho_2: There is no significant difference in the extent to which MVMW teachers can utilize advanced diagnostic software in teaching MVMW based on their location.

Ho_3: There is no significant difference in the competency level of MVMW teachers in teaching with specialized diagnostic equipment.

Research Method

Descriptive survey research design was adopted for this study. The population for the study comprised 31 Motor Vehicle Mechanics Teachers in all the technical colleges in Benue State which was also used as sample size for the study. The researcher used 25 item structured questionnaire titled: "Auto Diagnosis Competences Assessment Questionnaire (ADCAQ)" as instrument for data collection. The instrument for data collection was validated by three experts. The reliability coefficient for the instrument was established as $\alpha = 0.94$. Data for the study was collected through direct contact and was analysed usingmean (*M*) and standard deviation (*SD*) to answer the research questions, while Analysis of covariance (ANCOVA) was used to test the hypotheses at 5% level of significance.

Data Analyses and Results

Research Question 1: What is the proficiency level of MVMW teachers in using On-Board Diagnostics II (OBD) systems for vehicle diagnosis?

Table 1: Level of Proficiency in using On-Board Diagnostics II (OBD) Systems for Vehicle Diagnosis

Item No.	Item Description	*N*	*M*	*SD*
1	Connecting scan tool to the data link connector (DLC)	30	4.23	.68
2	Reading diagnostic trouble codes (DTCs)	30	4.17	.75
3	Interpreting diagnostic trouble codes (DTCs)	30	3.73	.64
4	Monitoring live data (e.g. engine RPM, coolant temperature, and fuel system status)	30	3.63	.49
5	Using the scanner to clear stored DTCs from the vehicle's memory	30	3.50	.78
6	Performing Emission Tests	30	3.47	.57
7	Regularly checking the OBD-II system for pending or stored codes	30	3.33	.80
8	Using OBD-II Software Applications	30	3.57	.68
9	Performing vehicle performance tuning	30	3.27	.64
10	Recording and Analyzing Data	30	3.43	.68
	Valid N (listwise)	***30***		

From **table 1**, the proficiency of MVMW teachers in using On-Board Diagnostics II (OBD-II) scanners is varied across different tasks. The highest proficiency is seen in connecting the scan tool to the data link connector ($M = 4.23$, $SD = 0.68$), followed by reading diagnostic trouble codes (DTCs) ($M = 4.17$, $SD = 0.75$). Lower proficiency levels were observed in tasks such as performing vehicle performance tuning ($M = 3.27$, $SD = 0.64$) and regularly checking for stored or pending codes ($M = 3.33$, $SD = 0.80$), though still above 3.0, indicating moderate proficiency. The analysis show standard deviation values that ranges from 0.49 to 0.80, indication a high variation in the mean response of MVMW teachers.

Research Question 2: To what extent do MVMW teachers utilize advanced diagnostic software in teaching MVMW?

Table 2: The Extent to Which Motor Vehicle Mechanics Work Teachers Utilize Advanced Diagnostic Software in Teaching MVMW

Item No.	Item Description	*N*	*M*	*SD*
1	Autel Maxisy	30	3.97	.41
2	Snap-on MODIS	30	3.37	.61
3	Bosch ESI (tronic)	30	3.53	.68
4	Alldata	30	3.40	.62
5	Mitchell1	30	3.43	.57
	Valid N (listwise)	***30***		

Table 2 reveals that MVMW teachers' utilization of advanced diagnostic software is relatively high for tools like Autel Maxisy ($M = 3.97$, $SD = 0.41$), while lower utilization is reported for Snap-on MODIS ($M = 3.37$, $SD = 0.61$), showed the least utilization among the diagnostic tools but still exceeded the 3.0 threshold. These results suggest that certain tools are more commonly used or accessible for instructional purposes. The analysis show standard deviation values that ranges from 0.41 to 0.68, indication a variation in the mean response of MVMW teachers.

Research Question 3: What is the competency level of MVMW teachers in teaching with specialized diagnostic equipment?

Table 3: The competency level of MVMW Teachers for Teaching with Specialized Diagnostic Equipment

Item No.	Item Description	*N*	*M*	*SD*
1	Oscilloscopes	30	3.93	.37
2	Exhaust gas analyzers	30	3.83	.38
3	Fuel injection analyzers	30	3.73	.52
4	Engine analyzers	30	3.57	.57
5	Transmission testers	30	3.63	.56
	Valid N (listwise)	***30***		

Table 3 shows that MVMW teachers reported a relatively high competency level in using oscilloscopes ($M = 3.93$, $SD = 0.37$) and exhaust gas analyzers ($M = 3.83$, $SD = 0.38$). The competency levels were lower for transmission testers ($M = 3.63$, $SD = 0.55$) and engine analyzers ($M = 3.57$, $SD = 0.57$). The analysis show standard deviation values that ranges from 0.37 to 0.55, indication a low variation in the mean response of MVMW teachers.

Hypothesis 1: There is no significant difference in the mean proficiency level of MVMW teachers in using On-Board Diagnostics II (OBD) systems for vehicle diagnosis based on their location.

Table 4: ANCOVA Test on Level of Proficiency in Using On-Board Diagnostics II (OBD) Systems for Vehicle Diagnosis.

Dependent Variable: level of pr oficiency in using On -Board Diagnostics II (OBD) systems for vehicle diagnosis					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5.174[a]	2	2.587	29.949	.000
Intercept	386.069	1	386.069	4469.231	.000
Location	5.174	2	2.587	29.949	.000
Error	2.332	27	.086		
Total	403.540	30			
Corrected Total	7.507	29			
a. R Squared = .689 (Adjusted R Squared = .666)					

Table 4 indicates a statistically significant effect of location on the proficiency level of MVMW teachers in using OBD systems, F (2, 27) = 29.949, p < .001. The significance level (p = .000) is less than the .05 threshold, suggesting that the location factor has a meaningful impact on teachers' proficiency levels. Specifically, teachers in Zone B have significantly higher proficiency levels than those in both Zone A (mean difference = .538, p = .001) and Zone C (mean difference = 1.018, p = .000). Conversely, teachers in Zone A demonstrated significantly higher proficiency than those in Zone C (mean difference = .480, p = .006); thus indicating that the proficiency levels are highest among teachers in Zone B, followed by Zone A, and lowest in Zone C. As a result, the analysis rejects the null hypothesis, confirming that there are significant differences in the proficiency levels of MVMW teachers based on their location. Teachers in Zone B exhibit the highest proficiency in using OBD systems, while those in Zone C demonstrate the lowest proficiency. This may suggest that Zone B have better training or access to resources for OBD system usage compared to the other zones.

Hypothesis 2: There is no significant difference in the extent which MVMW teachers can utilize advanced diagnostic software in teaching MVMW based on their location.

Table 5: ANCOVA Test on the Extent to Which Motor Vehicle Mechanics Work Teachers Utilize Advanced Diagnostic Software in Teaching MVMW.

Dependent Variable: The extent to which motor vehicle mechanics work teachers utilize advanced diagnostic software in teaching MVMW					
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2.376[a]	2	1.188	11.307	.000
Intercept	368.633	1	368.633	3509.098	.000
Location	2.376	2	1.188	11.307	.000
Error	2.836	27	.105		
Total	381.160	30			
Corrected Total	5.212	29			
a. R Squared = .456 (Adjusted R Squared = .415)					

Table 5 indicates that location significantly affects the extent to which MVMW teachers use advanced diagnostic software, F (2, 27) =11.307, p < .001. Since the p-value is less than the .05 threshold, null hypothesis is rejected, thus the findings suggest a significant effect of location on software utilization. The results indicate that Zones A and B have similar utilization levels, both

of which are higher than Zone C. Specifically, teachers in Zone B demonstrated a significantly higher extent of utilization compared to those in Zone C (mean difference = .685, p=.000), while teachers in Zone A also utilized advanced diagnostic software to a significantly greater extent than those in Zone C (mean difference = .467, p = .015).

Hypothesis 3: There is no significant difference in the competency level of MVMW teachers in teaching with specialized diagnostic equipment.

Table 6: ANCOVA test on the competency level of MVMW teachers for teaching with specialized diagnostic equipment.

Dependent Variable: The competency level of MVMW teachers for teaching with specialized diagnostic equipment

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.626[a]	2	.313	3.731	.037
Intercept	414.393	1	414.393	4938.001	.000
Location	.626	2	.313	3.731	.037
Error	2.266	27	.084		
Total	422.520	30			
Corrected Total	2.892	29			

a. R Squared = .217 (Adjusted R Squared = .158)

Table 6 shows a statistically significant effect of location on the competency levels of MVMW teachers in using specialized diagnostic equipment, F (2,27) = 3.731, p =.037. With a p-value less than the .05 threshold, the findings suggest that location influences competency levels. The results for Hypothesis 3 reject the null hypothesis, indicating that location has a statistically significant, but small, effect on competency levels for teaching with specialized diagnostic equipment. However, the lack of significant pair-wise differences suggests that the competency levels across Zones A, B, and C are relatively comparable. Further investigation may be needed to understand the factors contributing to these subtle variations in competency across locations.

Discussion of Findings

Findings arising from the data collected and analysed shows in the first place that acceptable proficiency levels in using OBD-II systems are found among MVMW teachers. However, MVMW teachers in Zone B showed the highest proficiency followed by Zone A, while teachers in Zone C reported the lowest. This has been confirmed by hypothesis one that there are significant differences between the locations in terms of mean proficiency levels.

This suggests that teachers in Zone B have better training or access to resources for OBD system usage compared to the other zones, where Zone C makes the list. This is consistent with the surveyconducted by Johnson et al. (2020) on MVMW teachers, examining their familiarity with OBD-II systems, where results indicated that most teachers were comfortable performing basic diagnostic tasks, such as reading fault codes and resetting error messages. Similarly, the result of the hypothesis aligns with Smith and O'Connell (2022) that disparity exist between teachers based on location as established that teachers in urban schools, where advanced diagnostic tools were readily available, demonstrated higher proficiency in diagnosing vehicle issues compared to those in underfunded rural schools, where outdated technology was more common.

The study found that MVMW teachers indicated moderate utilization of advanced diagnostic tools, while the teachers in Zone B demonstrated the highest utilization but teachers in Zone C lagging behind significantly. Hypothesis two further confirmed the finding which suggests a significant effect of location on software utilization a moderate effect size, indicating that Zones A and B have similar

utilization levels, both of which are higher than Zone C. This finding is reasonable with the study conducted by Parker et al. (2021) in which a group of vocational teachers participated in a professional development programme with a focus on advanced diagnostic software, whereas the pre- and post-training assessments demonstrated significant improvements in teachers' ability to utilize the software in both diagnosing vehicles and teaching students how to interpret diagnostic data. Additionally, resource disparities between schools play a significant role in determining how effectively these tools can be integrated into teaching. However, the finding defers from Mayekiso (2018) whose study established that most motor mechanics teachers in South Africa have challenges in integrating scan tools in their teaching due to access and lack of expertise.

The study gathered that MVMW teachers indicate a general competency in using specialized equipment, with Zone B being the highest and Zone C reporting lower competency. Hypothesis three further suggests that location influences competency levels but with small effect size, indicating that the competency levels across Zones A, B, and C are relatively comparable. This finding is further in agreement with Survey-based studies conducted by Johnson et al. (2020) which revealed that while 70% of teachers felt confident in using basic diagnostic equipment, less than 40% considered themselves competent in teaching with more specialized diagnostic equipment that require higher technical expertise. Meanwhile, Johnson et al. (2020) indicated significant variability in teacher performance. In addition, disparities in resource availability across schools contribute significantly to differences in competency levels, thereby highlighting the importance of investment in technological infrastructure for vocational education. This finding also agrees with Smith and Broun (2020) that the use of scan tools for teaching motor vehicle is very essential for teachers to adopt, and urged all technical colleges to acquire them for enhanced teaching.

Conclusion

The study concluded that while MVMW teachers have a basic level of competence in using modern diagnostic systems, there are significant disparities across zones, with Zone B teachers consistently outperforming those in Zones A and C. The research recommended targeted training programmes, especially in Zone C, to ensure all teachers have the skills necessary to teach modern auto diagnosis effectively. Addressing these regional skill disparities will be essential in raising the overall competence level of MVMW teachers in Benue State.

Recommendations

Based on the findings, the following recommendations are proposed to improve the competence of Motor Vehicle Mechanics Work (MVMW) teachers in teaching modern auto diagnosis:

1. Specialized training for MVMW teachers should be provided by the government. This programme should focus on the specific areas where Zone C MVMW teachers are lagging, ensuring they acquire the necessary skills to meet modern diagnostic standards.
2. Enhanced access to advanced diagnostic tools in all zones in Benue State should be guaranteed by the government. Providing MVMW teachers with regular access to such equipment will allow them to practice and become more proficient, ultimately benefiting their teaching and student outcomes.
3. Collaborative learning and experience sharing between zones should be organized by the government. Peer-to-peer learning programmes, such as workshops, exchange programmes, and mentoring systems, should be established to facilitate knowledge transfer and experience sharing between zones.

References

Baba Z., Jacob, N. & Issifu I. (2018) Assessing the skills of roadside mechanics in diagnosing and fixing problems of modern electronic managed vehicles in Ghana (Tamale Metropolis) *American Scientific Research Journal for Engineering, Technology, and Sciences* (ASRJETS) 45(1), 207-225.

Igwe, N., Ikenwa, M. O., & Jwasshaka, S. K. (2017). Competences in on-board diagnostic actuators for effective teaching of petrol engine maintenance in technical colleges in Nigeria. *IOSR Journal of Computer Engineering, 19*(2), 11-15.

Johnson, D., Parker, J., & Lee, S. (2020). Self-assessed proficiency levels of vocational educators in using OBD-II systems for vehicle diagnosis. *Vocational and Technical Education Journal*, 39(2), 112-124.

Mayekiso. M. (2018). An investigation to the effectiveness of scan tools in automobile diagnosis. *International Journal of Advanced Research in Computer and Communication Engineering.* 7(1), 123-129.

Namburu, S., Wilcutts, M., Chigusa, S., Liu, Q., Choi, K., & Pattipati, K. (2006). Systematic data-driven approach to real-time fault detection and diagnosis in automotive engines. *IEEE Autotestcon, 64*(2) 59-65. https://doi.org/10.1080/00051144.2022.2142924

National Board for Technical Education. (2020). *MVMW Program*. Retrieved from https://www.nbte.gov.ng/mvmw-program/

Okwelle, P. C., & Okeke, B. C. (2015). An assessment of the adequacy of teaching facilities for technical education programmes: A case study of Federal College of Education (Technical), Omoku. *International Journal of Education Learning and Development, 3*(7), 32-45.

Parker, R., & Lee, C. (2021). Access to modern diagnostic tools and its impact on teacher training effectiveness. *Journal of Automotive Education*, 39(1), 167-183.

Smith, J., & Brown, A. (2020). Application of Scan tools in automobile diagnosis among motor mechanics teachers in Technical colleges: A review of empirical studies. *International Journal of Automotive Technology*, 15(2), 45-62.

Smith, R., & O'Connell, M. (2022). Resource disparities and teacher proficiency in vehicle diagnostics: A comparative study of rural and urban vocational schools. *International Journal of Vocational and Technical Education*, 51(2), 354-369.