International Journal of Research in Social Sciences
Vol. 8 Issue 4, April 2018,
ISSN: 2249-2496 Impact Factor: 7.081
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A

INCLUSION OF INNOVATIONS INTO THE NIGERIAN AUTOMOBILE ENGINEERING PROSPECTUS

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Abstract

The improved number of new sub-systems in modern automobiles intended to improve upon their safety, economy and comfort among other things have made them more sophisticated and complex to maintain. The prospectus for the training programmes of their maintenance personnel in Nigerian Universities has however, remained rigid for several decades from now behind the state-of-the- art of automobile engineering. This study thus, identified some innovations perceived as important to be included into the Nigerian prospectus to enhance its relevance and adequacy. A researcher-designed structured questionnaire was used to survey the opinions of Automobile Staff (AS) of Peugeot Assembly of Nigeria (PAN) plant and the Automobile Lecturers (AL) in three purposively selected states of Nigeria, being Adamawa, Borno and Kaduna states. Data obtained from 56 respondents were analyzed. Three null hypotheses were tested using the t-test statistics. It was found that 41 innovations including Anti-lock Braking System (ABS), Electronic Fuel Injection (EFI), Variable Valve Timing Intelligence (VVT-I), On-board Diagnostic System (OBD), were perceived as important to be integrated into appropriate modules of the tertiary institutions prospectus. Interventions to upgrade both human and material resources in order to facilitate the teaching and learning of skills related to these innovations were recommended.

Keywords: Innovations, automobile, prospectus, maintenance, modules, programmes.

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Introduction

The automobile is a generic term for a self-propelled, trackless, non-articulated, four-wheeled land vehicle that encompasses passenger cars, recreational vehicles, taxies and buses used to transport people in cities, on highways or across country [1] Anglin, 1997). The development of the automobile was undoubtedly a prime mover in the phenomenal collapse in time and space of travel, an important element of what has come to be known as globalization. The automobile has now become an indispensable means of transportation in modern societies. At the early stage of development, there were several experimental cars but the work of Karl Benz, a German Mechanic in 1885 was regarded as the first practical and reliable automobile [2] Clarke, 1978). According to [3] Egbuchulam (2000), the Benz car and many other early automobiles were however, simple, not very reliable, limited in speed and distance of travel and less comfortable. Technological dynamism coupled with the emergence of new technologies has however, influenced the modern automobiles. There have being a continual evolution in design intended to achieve faster, more reliable, more streamlined, cleaner and safer vehicles with enhanced comfort, fuel economy and longevity. Harnessing new technologies into the vehicles have made the modern automobiles an assemblage of a group of sophisticated technologies [4] (Schwaller, 1993). The introductions of electronic controls have particularly brought even greater changes in designs and operations of many of their sub-systems.

The demand for automobiles in Nigeria have continued to increase, especially following the collapse of the rail transport system in the midst of undeveloped inland water ways and a very high cost of air transport which is also plagued by high rates of mishaps. Assorted brands and models of automobiles therefore abound today on the Nigerian roads, used for either public or convenience and luxury of personal transportation. However, most of these automobiles were imported completely built-up as either new vehicles or fairly used ones popularly called 'Tokunbo or Cotonou'. Others were imported as completely knocked down parts, which are then assembled in the country with little local input in parts [5] (Nna, 2001). The automobiles therefore came in with a wide range of classical and new technologies. A recent national policy banning the importation of automobiles that are more than ten years from their dates of manufacture has however, restricted their importation to mostly

those into which new technologies have been incorporated. These vehicles when in use in Nigeria must be serviced and properly maintained to keep them in roadworthy conditions. Service personnel must therefore be equipped with the relevant knowledge and skills for these purposes.

In Nigerian institutions, the programmes for the education and training of engineers and master artisans for the maintenance of all types of motor vehicles are carried out in technical colleges at the National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC) levels, Polytechnics and Universities respectively, (National Board for Technical Education – [6] NBTE, 2004; National University Commission (NUC). However, several studies conducted all revealed that the products of these programmes lacked the basic skills needed for gainful employment in today's automobile industry [7] Agbata, 2000). The curriculums were blamed for not being adequate and relevant to offer enough of the skills needed to meet the challenges that are involved in the maintenance of modern automobiles on Nigerian roads.

Incorporation of new technologies with new sub systems and system components into modern automobiles have changed their configurations and made their maintenance a more complex task, even though some of the new systems make them easier to maintain [8] Nice, 2001). The curriculum for the technical college programmes that train the service personnels for maintaining these vehicles before getting into tertiary institutions however, remained rigid since 1985, and thus far removed from the recent technological innovation in automobiles. The gaps created between the curriculums and the new technological innovations have made the needed skills for effective maintenance of these new breed automobiles to continue to avoid the products of these programmes. The result has being that, the graduates of these programmes are often unemployable or under employed while most automobiles with these new innovations either suffer disrepair or have the new systems replaced by the classical substitute systems that the new ones were meant to improve upon. Yet some are even completely grounded just barely into their expected service lives because of lack of competent personnel for their effective maintenance.

As a measure to keep education and training in tune with the knowledge and skills needed in the world of work, automobile curriculum courses must be reviewed, enriched and updated regularly in line with the changes that are taking place in the industries. Thus, it was imperative to investigate and incorporate the new technological innovations in automobiles with the view to identifying those that posed new challenges to the maintenance personnel in Nigeria for incorporate into the curriculum for their training programmes. The study is therefore designed to identify the new technological innovations used in the construction of the operative systems of modern automobiles, which were not included in the curriculum for automobile programmes. Specifically, the study tried to identify the innovations in the following sub systems of automobiles: the engine, the transmission, suspension, steering and braking systems and the electrical/electronics and auxiliary systems.

Table 1. The t-test analysis of mean responses of AS and AL on the innovations in automobile engines.

	AS		AL		TGP			
	X1		X2		X1	X2	X	t-
Innovations in Engines								
Electronic fuel injection	4.28	0.80	3.96	1.02	4.13	1.30	VI	
Gasoline direct injection	3.69	1.00	3.89	0.97	3.79	0.76	VI	
Dual fuel system	3.35	0.97	3.74	0.98	3.54	1.49	VI	
Electronic Ignition system	4.28	0.80	4.44	0.75	4.36	0.77	VI	
Variable value timing	3.93	0.70	3.89	0.85	3.91	0.19	VI	
Super charging	3.72	0.75	3.74	0.94	3.72	0.09	VI	
Turbo-inter cooling	3.79	0.82	3.81	0.68	3.80	0.10	VI	
Emission control systems	4.21	0.90	3.89	0.93	4.05	1.30	VI	
Central power locking	3.79	0.90	3.96	0.94	3.88	0.69	VI	
(engine immobilizer)								
On-board diagnostic system	4.41	0.57	3.93	1.00	4.18	2.19*	VI	

Remark: df =54; critical-=2.00; TGP=two group pooled; VI=Very Important

Data Collected.

Enugu and Kaduna states on their parts each housed a functional automobile assembly plant in addition to tertiary institutions offering motor vehicle programmes in Nigeria. There are

therefore availed both technical instructors and the industrial worker respondents to the instrument. The population of the study thus, comprised of 81 subjects made up of all mechanical staff of the two automobile plants and all the subject teachers in the automobile instructors in these selected states.

The instrument for data collection was a researcher-designed structured questionnaire generated from literature. Section one of the instrument-elicited information on the occupational statuses of the respondents. Section two, which was structured in the form of a five-point rating scale, elicited information on the opinions of the respondents about the new technological innovations in the operative systems of automobiles. The rating scale indicated the degrees of importance of the items to be checked by the respondents as extremely important, very important, just important, unimportant and very unimportant. The respondents were asked to check the degrees they perceived each item important to be integrated into the curriculum for the tertiary institution programmes. The instrument was face validated by three experts of automobile in vocational industrial technical education from the university and industrial colleges. Data obtained from 56 (about 69%) returned copies of the questionnaire were analyzed. The response categories of the rating scale were assigned numerical values of 5, 4, 3, 2 and 1, respectively, which were used for calculating the mean responses. The true limits of numerical values were used for deciding the suitable category for each mean response. On a 0.05 level of significance and df of 54, the critical-t value for accepting or rejecting the null hypotheses was 2.00.

Results

Data obtained from the study were presented in tables relative to the hypotheses as follows:

Hypothesis 1

There is no significant difference in mean responses of IW and AL on new technological innovations in automobile engines. Table 1 show that the pooled mean responses for all the items are above 3.50 which indicate a very important perception by respondents for all the new innovations to be integrated into the curriculum. The table also shows that the null hypothesis was accepted for all the items except the on-board diagnostic

system (OBD), which has the calculated t- value of 2.19, which is greater than the critical t-value of 2.00 at 0.05 levels of significance and so, was rejected.

Hypothesis 2

There is no significant difference in mean responses of IW and AL on the new technological innovations in automobile transmission, suspension, steering and braking systems. Table 2 shows that all the items were perceived as important to be integrated into the curriculum. It also shows that there is no statistically significant difference in mean responses of industrial workers and automobile instructors on the indicated innovations in the transmission, suspension, steering and braking systems. The null hypothesis was therefore accepted for all the items at 0.05 levels of significance.

Hypothesis 3

There is no significant difference in mean responses of industrial workers and automobile instructors on the new technological innovations in automobile electrical/electronics and auxiliary systems. Table 3 shows that all the listed items were perceived as important to be integrated into the curriculum. The table also shows that there are differences in the mean responses of industrial workers and automobile instructors on four of the listed innovations whose calculated t- values are more than the critical t-value of 2.00. The null hypothesis was thus rejected for these items, which include safety airbags and airbag curtains, automatic front windscreen wiper, automatic headlight brightness switch and multiplex wiring.

Table 2. The t-test analysis of mean responses of IW and AL on the innovations in automobile transmission, suspension, steering and braking systems

Table 2: Innovations in Transmission, Suspension, Steering and Braking

	AS		AL		TGP		
	x1	S1	x2	S2	x	t-cal	
Remarks							
All wheel drive system	3.21	1.01	3.63	1.04	3.41	1.53	JI
Auto-active automatic transmission	3.79	1.01	3.78	0.80	3.79	1.04	VI
Trans- axle transmission	3.31	0.76	3.48	0.94	3.39	0.74	JI

Continuously variable transmission	3.41	0.98	3.33	1.04	3.380.30	JI
Cruise control system	3.86	0.88	3.52	0.85	3.701.48	VI
Anti-lock braking system	4.31	0.60	4.07	0.78	4.201.28	JI
All wheel steering system	3.00	1.20	2.89	0.93	2.950.39	VI
Deformable steering wheel and steering	3.79	0.77	3.59	1.25	3.700.72	VI
Active suspension with electronic variable	3.93	0.75	3.78	0.85	3.860.70	VI
Electronic stability programme and traction	3.93	0.70	3.63	0.74	3.791.55	VI
Drive- by- wire systems	2.93	1.13	2.85	1.06	2.890.27	JI

df= 54; Critical-t=2.00; TGP= two groups pooled; JI= Just Important; VI= Very Important

Findings

1. A total of 41 new innovations comprising 10 in the engines; 11 in the transmission, suspension, steering and braking systems; and 20 in the electrical/electronics and auxiliary systems were rated as important to be integrated into the curriculum. Prominent among these new innovations are electronic fuel injection (EFI), electronic ignition system, variable valve timing intelligence (vvt-i), super charging, emission control systems, OBD, All Wheel Steering System (AWS), and All Wheel Driving System (AWD). Others include Anti-lock Braking System (ABS), active suspension with electronic variable damping, safety airbags and airbag curtains, global positioning and telematic information system, multiplex wiring, etc.

2. There were significant differences in the mean responses of industrial workers and the automobile lecturers on five of the identified new technological innovations in automobiles, for which the null hypotheses were rejected. These items are OBD, safety airbags and airbag curtains, automatic front windscreen wiper, automatic headlight brightness switch and multiplex wiring.

Discussion

A new curriculum has validity of limited duration. From this view point, [9] Pratt (1991) likened the curriculum to open systems that maintain their equilibrium by monitoring their own internal states and making adjustments to adapt to destabilizing perturbations. Pratt further emphasized that curriculum and instruction can be conceptualized as open systems

interacting with the environment and maintaining equilibrium by transformation of energy and exchange of information among the component sub-systems. In the same viewpoint, work, skills and training can be conceptualized as sub-systems of an open system; then new innovations and changes in technology demanding new work skills being the common perturbations that often destabilize the contents of school curricula and instructional activities. There must therefore be a continuous interaction and exchange of information between the schools and industries where the new innovations and changes in technology are emanating from.

The findings of this study represent the opinions of major stakeholders in the automotive technology development and education in Nigeria. It shows that all the identified new technological innovations have implications for the works of today's automobile maintenance personnel. The large number of the new innovations that were yet to be integrated into the curriculum reflects the long period the 1985 edition of the curriculum has being in use without any review. Also, the large number of these new innovations also account for the findings of the empirical studies by [10] Elobuike (1999) and [7] Agbata (2000) that the products of the technical college motor vehicle mechanics work programmes lacked the relevant skills for gainful employment in today's automobile industry. The areas of the new innovations in automobiles identified in this study correlates well with the areas of students' difficulties found by [11] Jimoh (1997). Jimoh identified the areas of difficulty for the final year students of NTC motor vehicle mechanics work programmes to include the engine, particularly the cooling and lubricating systems; the transmission system comprising the gearbox and final drive assembly as well as the suspension, steering and braking systems among others. These areas of difficulty identified by [11] Jimoh (1997) bears most of the new innovations found in this study as shown in Tables 1 and 2, which were yet to be taught to students. In Table 3, the rating of a large number of new

Table 3: T-Test Analysis of Mean Responses of AS and AL on the Innovations in Electrical/Electronics and Auxiliary Systems.

Innovations in electrical / electronics and auxiliary systems	AS		AL		TGP		Remark
	x1	x2	x1	x2	x	t-cal	
Safety airbags and airbag curtains	4.55	0.69	3.85	1.13	4.21	2.77*	VI
Power seats, doors and windows	3.62	0.86	3.56	1.22	3.59	0.21	VI
Electronic controlled air conditioning system	3.83	0.81	3.89	0.97	3.86	0.25	VI
Air conditioning refrigerant recovery and recycling	3.69	0.81	3.44	1.09	3.57	0.97	VI
Automatic front wind screen wiper	3.66	0.86	4.37	0.63	4.00	3.55*	VI
Automatic headlight brightness switch	3.79	0.86	4.48	0.58	4.13	3.54*	VI
Adaptive headlights	3.59	0.68	3.26	1.20	3.43	1.26	JI
Active rearview mirrors	3.79	0.77	3.67	0.92	3.73	0.53	VI
Daytime driving lights	2.93	1.07	2.59	1.22	2.77	1.11	JI
Automatic hazard warning light	4.04	0.91	4.33	0.73	4.18	1.32	VI
Speed limit alarm	4.31	0.85	4.37	0.97	4.34	0.25	VI
Rear-mounted sensor parking assistance	3.76	0.79	3.63	1.12	3.70	0.50	VI
Tire pressure monitoring system	4.14	0.88	4.11	0.89	4.13	0.13	VI
Central power locking system (doors)	3.69	0.89	3.93	1.04	3.80	0.93	VI
Anti-theft security alarm	4.31	0.93	4.37	0.95	4.34	1.83	VI
Global positioning and telemetric information system	3.24	1.12	3.48	1.12	3.36	0.80	JI
Electrically controlled glass sunroof	3.14	0.88	3.41	0.89	3.27	1.15	JI
Electrically controlled radio antenna	3.21	0.70	3.52	1.01	3.39	1.02	JI
Multiplex wiring	3.72	0.88	3.04	0.98	3.39	2.72*	JI
Hybrid automobiles	3.07	1.07	3.07	1.00	3.07	0.00	JI

df= 54; Critical-t=2.00; TGP= two groups pooled; JI= Just Important; VI= Very Important

Innovations in the electrical/electronic and auxiliary systems as important to be integrated into the curriculum is in line with the current trend towards training a total technician who will be responsible for the complete automobile [12] (MB-ANAMMCO, 2003). This trend is because of the increasing electronic control of more and more mechanical systems of modern automobiles whereby mechanical works cannot be distinctly separated from the electrical/electronic subsystems thus, making independent mechanics and electricians irrelevant. The implications of the increased electronic control of mechanical systems of modern automobile are that a mechanical Craftsman who was trained without adequate knowledge of the electrical/electronic subsystems of the vehicles will be grossly ineffective in their maintenance services, vice versa for an electrician.

Conclusion

After more than two decades of implementation, the curriculum for motor vehicle mechanics work programmes in Nigerian Technical Colleges can be said to have lost its validity [6] (NBTE, 1985). The technological innovations identified in this study, which are the technologies for today and future automobiles are so many and common on Nigerian roads to be so neglected by school programmes that purport to train the workforce for the maintenance of all types of motor vehicles [13] Shelley, 2000; [14] Beer, 2001; [8] Nice, 2001; [15] Byme, 2002. The need for their integration into the curriculum for the education and training programmes for maintenance craftsmen in Nigerian Technical Colleges is long over-due. A prompt intervention is now indispensable if the occupational future of the large number of youths being rolled out of the programmes will be saved and secured.

Recommendations

Having established the need imperative of the aforementioned subsystems to enrich and update the curriculum for automobile programmes in Nigerian Tertiary institution through the large number of the technological innovations in modern automobiles, it is yet to be included in the national curriculum. It is therefore, recommended that:

1. Further studies should be conducted to identify all the other elements of the new innovations needed for the development of comprehensive curricular contents, including the skills and theoretical contents entailed in their study as well as the new tools and equipment needed.

2. The curriculum for teachers' training programmes should also be reviewed to include these innovations in order to prepare teachers who will be able to implement the curriculum with the new contents for the technical college programmes.

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