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Improving Automobile Ignition System Maintenance Skills through Modular Training for Technical College Students in North-East, Nigeria

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Abstract

The study was designed to develop automobile ignition system maintenance training module for technical college students in North-East, Nigeria. Two research questions were answered and one null hypothesis was tested at 0.05 level of significance. Research and Development (R & D) design was used for the study. The population of the study was 156 (113 teachers and 43 instructors). Since the population is manageable, no sample was used. Pilot test was conducted at Government Technical College Mashi, Katsina State North-Western Nigeria; the reliability coefficient of 0.941 was established using Cronbach alpha formula. The data collected were analyzed using descriptive statistics (mean and standard deviation) while the null hypotheses was tested using inferential statistics (independent sample t-test) at 0.05 level of significance. The findings of the study revealed that all the items in contents and materials were required for developing automobile ignition system maintenance training modules. The result of the null hypotheses tested revealed that, there was no significant difference between the mean responses of teachers and instructors on the contents and materials of the module. The study recommended that National Board for Technical Education to integrate the developed ignition system module for the training of students across technical colleges.

Keywords: Modular Training, Ignition system maintenance, Training modules, Technical Colleges.

Introduction

Technical and vocational education is a planned programme of courses and learning experiences that begins with exploration of career options, supports basic academic and life skills and enables achievement of high academic standards, leadership qualities, preparation for industry define work and advanced and continuing education (Lawal, 2014). Momoh (2012) further defines vocational education as a form of education whose primary purpose is to prepare persons for employment in recognized occupation. In the same vein he defines technical education as a post-secondary education. The goals of technical education in particular according to National Policy on Education (FRN, 2013) include among others, to contribute to national development through high level relevant manpower training, to inculcate both psychomotor and intellectual skills which will enable individuals to be self-reliant and useful members of the society for Nations development.

The automobile industry is a significant contributor to Nigeria's economy, with an estimated growth rate of 10% annually (Adebayo & Adebayo, 2018). However, the industry faces challenges in maintaining modern vehicles due to inadequate skills among technicians (Olaitan, 2017). Technical colleges' play a crucial role in equipping students with practical skills, but there is a gap in the training provided (David, 2015).

The ignition system is a critical component of modern vehicles, and its maintenance requires specialized skills (Osuagwu, 2016). Modular training has been shown to be effective in improving students' skills in technical education (Akanbi, 2017). However, there is a lack of research on the impact of modular training on automobile ignition system maintenance skills among technical college students in North-East Nigeria. Ignition system is the electronic control module in a car that begins the engine by igniting the fuel and air mixture in the engine. The system uses a battery to start the car, and then switches to an external power supply to run the car. The ignition system in a car is responsible for starting the engine. The ignition takes place inside the cylinder at the end of the compression stroke (Saif, 2022). Olaitan in Ihediwah (2017) view maintenance as a set of measure or steps taken to ensure that a given piece of material, equipment or infrastructure is kept in good operational order until it attains its maximum possible life span, for effective training.

However, Nick (2011) described training as the acquisition of knowledge, skills, and competencies as a result of the teaching of vocational or practical skills and knowledge that relate to specific useful competencies. Training module which can also be self-instructional module is an instructional guide developed to help the learner or user acquire mastery of certain technical skills or tasks. Onuka (2018) explained that in a module, the training objective, content and methodology is presented at a glance in a concise form for the use of trainers and trainees to ensure that they participated effectively in training programme. Module is also an organized package of information that includes elements such as objectives, contents, materials, delivery methods, evaluation criteria and validation for effective utilization, training for students in technical colleges.

The Nigerian Technical Colleges are educational institutions established with the aim of training students to acquire appropriate vocational skills, knowledge, attitudes, habits of thoughts and qualities of character that enable them develop their intellectual, social, physical, emotional and economic capabilities, become self-reliant and contribute to economic growth and development of their nations (Balash, 2013). Technical colleges however are regarded as the principal vocational institutions in Nigeria, they give full vocational training intended to prepare students for entry in to various occupation (Okolie, Igwe & Elom, 2019).

Technical and vocational education provides skills, knowledge and attitude for employment as well as acquainting the individual with the skills to live, learn and to work as a productive citizen in a global society, Obioha and Amuche (2016). The National Board for Technical Education (NBTE) is a principal organ of Federal Ministry of Education specifically created to handle all aspects of Technical and Vocational Education falling outside university education (Toscany, 2013). There is a high-level shortage of adequate teaching materials for teaching vocational and technical subjects; Over 70% of technical teachers in the Nigerian technical colleges do not have University degrees as a qualification for teaching the students (Okolie, Elom, Osuji & Igwe 2019).

It has been observed that most of the motor vehicle mechanics work students could not apply their knowledge and skills to solve problems in automobile ignition system (Ogbuanya & Idris, 2014). There appears to be gaps between the training acquired by technical college students and the skills required for new technologies in motor vehicle ignition system. Inti, AbdulLatib, and Rufai (2014) observed that in most technical colleges, classes are mostly conducted in theoretical form and students

do not have the opportunity to apply what they learnt in solving unfamiliar problems. The inadequate skills acquired by technical college students could be because of insufficient time allocated for practical classes, lack of materials, tools and equipment and expertise to conduct practical classes in technical colleges (Shehu, Enemali, Muhammad & Nordin, 2014). Therefore, the problem of this study is that students do not have adequate practical skills required to carry out ignition system maintenance training and repairs. However, with the developed self-instructional module the foregoing issues will be curved.

The maintenance of automobile ignition systems is a critical aspect of the automotive industry, as it directly affects vehicle performance, safety, and efficiency (Osuagwu, 2016). In Nigeria, the increasing number of vehicles on the road has led to a growing demand for skilled technicians who can diagnose and repair complex ignition system faults (Adebayo & Adebayo, 2018). However, technical colleges in North-East Nigeria face challenges in equipping students with the necessary skills to meet this demand, resulting in a shortage of competent technicians in the region (David, 2015).

Despite the importance of automobile ignition system maintenance, there is a dearth of research on the effectiveness of training programs in technical colleges, particularly in North-East Nigeria. Existing studies have focused on other aspects of technical education, such as curriculum development and teacher training, but have neglected the specific needs of automobile ignition system maintenance (Akanbi, 2017; Olaitan, 2017). Moreover, the few studies that have examined modular training in technical education have been conducted in other contexts, making it unclear whether their findings can be generalized to the Nigerian context.

A study on improving automobile ignition system maintenance skills through modular training for technical college students in North-East Nigeria will have significant implications for various stakeholders. Technical college students will benefit from improved training and enhanced employability, while the automotive industry will gain from a more skilled workforce. Additionally, policymakers and educators will be informed about the effectiveness of modular training in addressing the skills gap in the industry, ultimately contributing to the development of the Nigerian economy.

The following research questions were formulated to guide the study.

1. What are the contents of automobile ignition system maintenance training module for technical college students in north-east, Nigeria?

2. What are the materials for implementing automobile ignition system training module for technical college students in north-east, Nigeria?

The null hypotheses formulated was tested at 0.05 level of significance:

H01: There is no significant difference between the mean responses of teachers and instructors of motor vehicle mechanics on the contents and materials of automobile ignition system maintenance training module for technical college students in North-East, Nigeria.

H02: There was no significant difference in the mean responses of teachers and instructors on the materials for implementing automobile ignition system maintenance training modules.

Methodology

The study adopted research and development design. Gall, Gall, and Borg (2007) described research and development design as an industry-based development model in which the findings of research are used to design new products and procedures. The steps of R&D were modified into three major components as follows: Need analysis, Development of the module and validation of the module. The study was conducted in North-Eastern States of Nigeria. Also, accredited National Board for Technical Education (NBTE) technical colleges offering motor vehicle mechanics work in these states was covered. The population for this study was 156, comprising of 113 teachers, 43 instructors out of 39 technical colleges.

The instruments were face validated by 3 experts in Automobile technology. Pilot test was conducted at Government Technical College Mashi, Katsina State, Nigeria; the reliability coefficient of 0.941 was established using Cronbach alpha statistics. The researcher personally administered copies of the questionnaire to the respondents with the help of six research assistants. Research questions 1 and 2 was analyzed using descriptive statistics (mean and standard deviation), while the null hypotheses formulated were tested using inferential statistics (independent sample T-test) at 0.05 level of significance.

A decision rule for research questions was benchmarked based on four point rating scale. As a decision rule any p-value less than the confidence level of 0.05 indicated a significant difference and the null hypothesis was rejected, and any p-value above 0.05 indicated that there was no significant

difference, and therefore the null hypothesis was retained. The criterion mean is 2.50. Therefore, any mean rating from 2.50 and above was required or highly required and where otherwise was not required or slightly required. When a researcher is sing 4 point or 5 point Likert scale, 2 or 3 will be the mid-point.

Respondents Profile

S/N	States	No of Technical Colleges	Teachers	Instructors	Percentages
1	Adamawa	4	10	4	14/156 (9.0)%
2	Bauchi	10	34	15	49/156 (31.4)%
3	Borno	4	8	5	13/156 (8.3)%%
4	Gombe	5	19	5	24/156 (15.4)%
5	Taraba	8	12	6	18/156 (11.5)%
6	Yobe	8	30	8	38/156 (24.4)%
	Total	**39**	**113**	**43**	**100%**

Results

Research Question 1: *What are the contents of automobile ignition system maintenance training module for technical college students in North-East, Nigeria?*

Table: 1 Contents of Automobile Ignition System Maintenance Training Module

S/N	Items	Teachers		Instructors		Grand		Remark
		Mean	SD	Mean	SD	Mean	SD	
1	Major components of ignition system and their functions	3.79	0.41	3.71	0.46	3.75	0.43	Highly Required
2	symptoms of major faults in ignition system and spark plug (Troubles)	3.32	0.50	3.29	0.67	3.31	0.58	Required
3	Safety precautions in using ignition system	3.41	0.52	3.51	0.56	3.46	0.54	Required
4	Safety precautions in maintaining ignition system	3.53	0.58	3.43	0.56	3.48	0.57	Required
5	Requirements needed for ignition system	3.24	0.51	3.37	0.65	3.29	0.59	Required

6	Skills in battery construction of ignition system task	3.51	0.60	3.34	0.73	3.43	0.66	Required
7	Steps in construction and installation of electronic ignition system task	3.17	0.61	3.40	0.74	3.29	0.67	Required
8	Steps in maintenance of ignition system	2.99	0.76	3.31	0.58	3.15	0.67	Required
9	Skills in checking and changing spark plug	3.26	0.63	3.57	0.70	3.42	0.67	Required
10	Skills in servicing distributor cap rotor	3.24	0.69	3.37	0.81	3.31	0.75	Required
	Grand Mean	**3.35**	**0.58**	**3.43**	**0.65**	**3.41**	**0.61**	**Required**

Source: Field work, 2022

Table 1, to answer research question 1, items 1-10 of the questionnaire were considered, comparison of means and standard deviation analyzed are presented in Table 1. 10 contents of automobile ignition system maintenance training module were required by the respondents. Their mean responses range from 2.99 to 3.79 and standard deviation 0.406 to 0.764 respectively.

Research Question 2: *What are the materials for implementing ignition system training module for technical college students in north-east, Nigeria?*

Table: 2 Materials for Automobile Ignition System Maintenance Training Module

S/N	Items	Teachers		Instructors				
		Mean	SD	Mean	SD	Grand Mean	Grand SD	Remark
11	Set up screw driver for screwing	3.76	0.49	3.74	0.56	3.75	0.52	Highly Required
12	Long nose pliers for holding tiny object in hidden place	3.37	0.56	3.57	0.50	3.47	0.53	Required
13	Cutting pliers for cutting flexible objects	3.53	0.58	3.06	1.03	3.29	0.34	Required
14	Digital power supply system	3.29	0.67	3.51	0.51	3.40	0.59	Required

15	High tension cables to check that connections are clean and secure	3.15	0.69	2.89	0.90	3.02	0.79	Required
16	Engine diagnostic computer	3.41	0.76	3.20	0.81	3.31	0.78	Required
17	Voltmeter checks on primary circuit	3.45	0.68	3.31	0.58	3.38	0.65	Required
18	Oscilloscope along with analog and digital meters	3.44	0.71	3.17	0.66	3.30	0.69	Required
19	Test lamp method to determine where contact breaker opens	3.24	0.63	3.29	0.71	3.27	0.65	Required
20	Dwell meter method accounts for the wear on the distributor bushes and cam eccentricity.	3.47	0.62	3.54	0.61	3.51	0.61	Highly Required
21	Feeler gauge method, typical gap is 0.35-0.412mm.	3.56	0.73	3.43	0.85	3.45	0.77	Required
22	Spanner is needed to loose and tight nuts.	3.36	0.58	3.09	0.78	3.23	0.66	Required
	Grand mean	**3.42**	**0.64**	**3.32**	**0.71**	**3.37**	**0.63**	**Required**

Table 2, to answer research question 2, items 1-12 of the questionnaire were considered, comparison of means and standard deviation analyzed are presented in table 2. 12 materials for implementing automobile ignition system maintenance training module were required by the respondents. They have a mean score of 3.0 above. The mean score of items in the materials of teachers' response ranges from 3.15 to 3.76 and standard deviation 0.49 to 0.76 respectively. The mean score of items in the materials of instructors' response ranges from 2.89 to 3.74 and standard deviation 0.50 to 1.03 respectively. The variables also had a grand mean 3.37 and standard deviation 0.63 of teachers' and instructors responses on the materials, which is above the benchmark of four point rating scale.

Hypothesis 1: *There was no significant difference in the mean responses of teachers and instructors on the contents of automobile ignition system maintenance training modules.*

Table: 3 Analysis of Independent Sample T-test of the Mean Responses of Teachers and Instructors on the Contents of Automobile Ignition System Maintenance Training Modules.

Groups	N	Mean	S.D	T-Value	P-Value	Decision
Teachers	113	3.41	0.61			
				-1.223	0.224	Accepted
Instructors	43	3.42	0.63			

Table 3 presents the result of independent sample t-test analysis. The t-test yield $t_{111} = -1.223, p = .224 (> .05)$. The statistical evidence revealed that the result was statistically significant based on the p-value of 0.224, and degree of freedom (df) 111. Analysis of independent sample t-test was conducted in testing the null hypotheses one, to compare the mean responses of teachers and instructors, data presented in table 3 showed that contents had 3.35 as grand mean 0.58 as S.D score of teachers, and 3.43 as grand mean and 0.65 as S.D score of instructors. Has T-value of -1.223 and P-value of 0.224 which was greater than 0.05 at degree of freedom 111. The null hypothesis of mean responses of teachers and instructors indicated that there was no significant difference and therefore, the null hypotheses accepted for the fifty three items.

Hypothesis 2: *There was no significant difference in the mean responses of teachers and instructors on the materials for implementing automobile ignition system maintenance training modules.*

Table 4: Independent Sample T-test of Respondents on the Materials for Implementing Automobile Ignition System Maintenance Training Modules

Groups	N	Mean	S.D	T-Value	P-Value	Decision
Teachers	113	3.41	0.61			
				1.512	0.133	Accepted
Instructors	43	3.42	0.63			

Table 4 presents the result of independent sample t-test analysis. The statistical evidence revealed that the result was statistically significant based on the p-value of 0.133, and degree of freedom (df) 111. Analysis of independent sample t-test was conducted in testing the null hypotheses three, to compare

the mean responses of teachers and instructors, data presented in table 5 showed that materials had 3.42 as grand mean 0.64 as S.D score of teachers, and 3.32 as grand mean and 0.71 as S.D score of instructors. Has T-value of 1.512 and P-value of 0.133 which was greater than 0.05 at degree of freedom 111. The null hypothesis of mean responses of teachers and instructors indicates that there was no significant difference and therefore, the null hypotheses accepted for the fifty three items.

Discussion

The study found out that contents/tasks arranged in ten clusters were required for development of ignition system maintenance training modules for technical college students. The finding also agreed with the opinion of Jain (2010) that the higher the absence of low loading items the more important and suitable the content. The finding was in agreement with the opinion of Kapoma and Namusokwe (2011) that content is a list of subjects, skills, topics, themes, concepts or works to be covered in a programme. Content is relevant when it meets the need of a society such as unemployment; by teaching what is relevant or related to societal issues at hand through practical and theoretical concepts (Urevbu, 2019). It was found out that 12 materials are required for maintenance of ignition systems. The finding was in consonance with the findings of Rohman et al. (2020) which suggested that with the ignition system practice, learning media in the form of video tutorials and job sheets, students are expected to be able to learn about ignition system practice material anywhere and anytime. The practical learning media in the form of video tutorials and job sheets is very easy to use, which can be played or opened via a computer or smartphone, which in today's era almost all students have them, thus with this media students are expected to more easily to study about that material (the ignition system), so that during the practical exam they will be better prepared and can get good results (pass the exam). The findings was also in agreement with the findings of Alex et al. (2022) that the innovative Sparkplug Tester revealed in the study was Project Design; the design was heavy and not portable for its size. The Sparkplug Tester uses battery as main source to operate the sparkplug tester. Also the sparkplug tester has a limit of 3 sparkplug chord terminals for testing.

Result for testing hypothesis one was presented in table 3 which shows that, the p-value obtained indicated that there was no significant difference between the mean responses of teachers and instructors on the contents and materials of ignition system training modules for technical college students.

Conclusion

Based on the findings presented in the result, it was concluded that, contents of the module were required and utilized for the development of the module. It was also concluded that the materials should be used for the module development.

Recommendations

Based on the findings of the study, the following recommendations were made

1. National Board for Technical Education to integrate the developed ignition system module for the training of students across technical colleges.
2. Automobile education researchers should also incorporate the use of the materials for modules developed for the effective improvement of student's knowledge towards the subject.

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