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Relevant Instructional Strategies for Effective Teaching of Automobile Emission Control System in Colleges of Education (Technical) in Nigeria

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ABSTRACT

Determining relevant strategies for effective teaching of automobile emission control system (AECS) at Colleges of Education level in Nigeria is necessary to equip pre-service automobile teachers and prospective service technicians with requisite competencies for effective maintenance of AECS system. This is in line with the global effort to promote sustainable transportation and automotive repair practices. This paper identified relevant instructional strategies for effective teaching of AECS at Colleges of Education in Nigeria. Descriptive survey was adopted, where responses of 108 respondents were sought. These comprised 46 automobile teachers from Colleges of Education and 62 purposely selected industry based workshop supervisors of service industries in North east Nigeria. A structured questionnaire with reliability coefficient of 0.83 Cronbach's Alpha was used for data collection. The data was analysed using mean, standard deviation and t-test statistics. Finding of the study revealed that Demonstration method, flexible scheduling, competency based method, institution-industry partnership, problem solving method, problem based learning, computer animations, service learning among others, are relevant strategies for effective teaching of AECS in Colleges of Education in Nigeria. The finding suggests that effective teaching of AECS at Colleges of Education level can result from application of many instructional strategies including small group instruction, multimedia application and industry partnership. The study recommended that automobile teachers at Colleges of Education levels in Nigeria should make use of the identified instructional strategies in planning instructions and delivery of contents related to AECS.

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INTRODUCTION

Colleges of Education (technical) train teachers who will be capable of imparting required skills and relevant content knowledge to learners leading to ward of Nigeria Certificate in Education (NCE). The general Philosophy of the NCE (Technical) program, as provided in the reviewed Minimum standards (2020), is to provide basic technology teachers with intellectual and professional background adequate for teaching basic technology subjects. These include components of woodwork technology, metalwork, electrical/electronic technology, building technology and automobile technology. In addition to the teaching aspect, the trainees specialize in a chosen trade so that they can be self-reliant after graduation. According to Adamu (2015), students enrolled to specialize in automobile technology education are trained to acquire relevant competencies related to maintenance, repairs,

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and services of all vehicle systems and components. These include skills for maintenance of the ever-increasing technological developments in the automotive system with special emphasis on those components embedded to manage and control automobile emissions.

Automobile emission control system is one of the most important technological developments in automotive system, because it plays vital roles in the control of automobile emissions, which include Carbon monoxide (CO), Hydrocarbon (HC), Nitrogen Oxides (NO and NO_2), Sulphur Oxides (SO_X,) Carbon Dioxide (CO_2), Volatile Organic Compounds (VOC), and Particulate Matter (PM). The emission control devices comprise three way catalytic converter, evaporative emission control system, positive crankcase ventilation, exhaust gas recirculation system, air injection system and diesel particulate filter peculiar to diesel engines. These components of the emission control system serve three main purposes according to Abubakar (2024); these are to promote more complete combustion in order to reduce the by-products of combustion, to redirect unburnt hydrocarbon into the engine for proper combustion and to create more area for oxidation and combustion to take place.

Conversely, despite the fact that auto manufacturers rely on emission control system technology to reduce automobile emissions, in Nigeria the system suffers disrepair and mismanagement among automotive service technicians. Additionally, Adamu (2022) also reported that automobile students graduating from Colleges of Education (Technical) in Nigeria lack skills to diagnose and repair faults in automobile emission control system, especially when the fault requires the use of diagnostic equipment. Moreover, the current curriculum for automobile training programme at Colleges of Education level in Nigeria did not capture contents related to automobile emission control system (Abubakar, 2024). Hence, considering the importance attached to the control of automobile emission and abstract nature of the system coupled with operational procedure for achieving desired emission reduction, there is need to develop materials/tools and as well to identify relevant strategies for effective teaching of the subject matter at Colleges of Education level Nigeria.

Instructional strategies entail all teacher and learner activities in or outside the classroom situation, planned, organized and directed by the teacher or facilitator in order to achieve desired learning objective. Although, there are various instructional strategies but selecting appropriate one should be guided by content to be delivered and instructional objectives (Enemali, 2010). The teaching of automobile emission control system too as other technical subject may be favored when certain instructional strategies are employed. This underscores the importance of both knowledge of automobile emission control system and appropriate methods of imparting it among automobile teachers. According to Adamu (2022), automobile teacher should be specialist in the subject matter and teaching methodology because clear selection of instructional method is a key to imparting relevant content knowledge to students. In view of the above, this paper identified relevant strategies for effective teaching of automobile emission control system in Colleges of Education in Nigeria.

Purpose of the Study

The purpose of the study is to determine relevant instructional strategies for effective teaching of automobile emission control system in Colleges of Education in Nigeria.

Research Question

1. What are the relevant instructional strategies for effective teaching of automobile emission control system in Colleges of Education in Nigeria?

Hypothesis

HO_1 There is no significant difference in the mean responses of automobile teachers and workshop supervisors on relevant instructional strategies for effective teaching of automobile emission control system in Colleges of Education in Nigeria.

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METHODOLOGY

The study employed a descriptive survey design to describe the opinions of automobile teachers and industry based workshop supervisors on relevant instructional strategies to be used for effective teaching of automobile emission control system in Colleges of Education (Technical) in Nigeria. The population of the study was 128 respondents which comprised 51 automobile teachers from Colleges of Education and 77 workshop supervisor purposely selected from service industries in the North east region. A structured questionnaire with four response options of Highly Not Relevant, Not Relevant, Relevant and Highly Relevant was used for data collection. The instrument was validated by experts and trial tested at Kano state having reliability coefficient of 0.83 Cronbach's Alpha. Data collected was analysed using mean and standard deviation to answer the research question. Items with mean ranging from 2.5 and above were considered relevant while below 2.5 were considered not relevant. For testing the null hypothesis t-test statistics was used. The hypothesis was tested at 0.05 level of significance. In taking decision about the hypothesis a p-value ≤ 0.05 was the basis for rejecting the null hypothesis. The analysis was done using Statistical Package for Social Sciences version 23.

RESULTS

Research question: What are the relevant instructional strategies for effective teaching Automobile Emission Control System in Colleges of Education in Nigeria?

Table 1: Mean and Standard Deviation of Automobile Teachers and Workshop Supervisors on Relevant Instructional strategies for effective Teaching Automobile Emission Control System in Colleges of Education in Nigeria

S/N	ITEM	$\overline{X}_T$ n=46	$\overline{X}_{WS}$ n=62	$\overline{X}_G$ n=108	δ_G	Remark
1.	Teaching through demonstrating activities (demonstration method)	3.41	3.91	3.66	0.59	Relevant
2.	Teaching through lecture and presentations	3.63	3.01	3.32	0.62	Relevant
3.	Teaching through grouping students into small groups due to large number or facility shortage (Flexible scheduling)	3.36	3.85	3.62	0.54	Relevant
4.	Teaching through collaboration, where students in small group work on a given project or assignment (collaboration method)	3.13	3.75	3.44	0.58	Relevant
5.	Teaching through creating real life problem scenario for students in small groups to provide solution (problem based learning)	3.25	3.49	3.37	0.76	Relevant
6.	Teaching through the use of computer animations and simulation	3.28	3.38	3.33	0.74	Relevant
7.	Teaching through the use of YouTube resources	3.38	3.13	3.19	0.70	Relevant
8.	Teaching through solving problems with students (problem solving method)	3.12	3.72	3.42	0.67	Relevant
9.	Teaching through giving students video clip or other resources to study prior to the lesson (flipped classroom)	3.39	3.21	3.30	0.67	Relevant
10.	Teaching through partnering with industries for resources sharing	3.19	3.67	3.43	0.67	Relevant

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11.	Teaching through assigning students to assist others (peer assisted learning)	3.24	2.94	3.19	0.65	Relevant
12.	Teaching practical tasks through competency-based approach	3.28	3.53	3.48	0.68	Relevant
13.	Teaching through Field trip/excursion	3.53	3.59	3.56	0.59	Relevant
14.	Teaching through engaging students in solving real community problems (service learning)	3.47	3.17	3.32	0.68	Relevant
	Grand	**3.33**	**3.45**	**3.40**	**0.38**	Relevant

Note: n = Number of Respondents, $\overline{X}$= Mean, δ = Standard Deviation

The results of descriptive statistics in the Table 1 indicated that all the items on instructional strategies for effective teaching of automobile emission control system were rated by automobile teachers and workshop supervisors as relevant ($\overline{X}_T$ = 3.33, δ_T = 0.41; $\overline{X}_{WS}$ = 3.45, δ_{WS} = 0.35; $\overline{X}_G$ = 3.40, δ_G = 0.38). These strategies include; collaboration method, flexible scheduling, use of computer animation and simulation, YouTube resources, peer assisted learning, institution-industry partnership, field trip and excursion and service learning among others. The result suggests that both automobile teachers and workshop supervisors agree that the 14 instructional strategies proposed are relevant for teaching automobile emission control system in Colleges of Education in Nigeria.

Null Hypothesis: There is no significant difference between the mean ratings of automobile teachers and automobile industry based workshop supervisors on relevant instructional strategies for effective teaching of automobile emission control system in Colleges of Education in Nigeria. Independent sample *t-test* was conducted to test this hypothesis as presented in the table below.

Table 8: Independent Sample *t-test* of Automobile Teachers and Workshop Supervisors on relevant instructional strategies for Effective Teaching Automobile Emission Control System in Colleges of Education in Nigeria

Groups	N	Mean	SD	Df	t -value	p-value	Decision
Automobile Teachers	46	3.33	0.41	45	-1.622	0.108	Retained
Workshop Supervisors	62	3.45	0.35	61			

The statistical evidence of independent sample *t-test* presented in table 8 indicated that there was no significant difference in the mean ratings of automobile teachers ($\overline{X}_T$ = 3.33, δ_T = 0.41) and automobile industry based workshop supervisors ($\overline{X}_{WS}$ = 3.45, δ_{WS} = 0.35), t (106) = -1.622, p = 0.108. Therefore, null hypothesis three was also retained. This implies that there is no significant difference between the responses of automobile teachers and automobile industry based workshop supervisors on relevant instructional methods for AECS in Colleges of Education in Nigeria.

DISCUSSION OF FINDINGS

Finding of the study revealed 14 relevant instructional strategies for effective teaching of automobile emission control system in Colleges of Education in Nigeria. The instructional methods are demonstration, flexible scheduling, field trip/excursion, competency based method, collaboration, institution industry partnership, problem solving method, problem based learning, use of computer animation and simulations, flipped class room, service learning, lecture and presentation, YouTube resources and peer assisted learning strategies. The findings further revealed no statistically significant difference in

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the responses of the two groups of the respondents with regard to the 14 relevant instructional strategies for teaching automobile emission control system in Colleges of Education in Nigeria. This is ideal and a clear pointer that both automobile teachers and automobile industry based workshop supervisors acknowledge the importance of using the 14 instructional methods in teaching automobile emission control system.

The finding agreed with the results of a study conducted by Adamu et al. (2021) who revealed that practical demonstration, computer animations, project methods, video clips from YouTube/flipped classroom among others are relevant instructional strategies for effective teaching and learning of diagnosis and repair of modern automobiles among polytechnic pre-service technicians in North east Nigeria. Diagnosis of modern automobile entails addressing emission related concerns which may be as a result of malfunction in the emission control system. Demenongu (2014) also found that multimedia technique is effective in improving auto mechanic students' achievement. In a similar way Cyril (2013) revealed that both Computer Assisted Instruction (CAI) and demonstration methods are good in improving automobile technology students' achievement. Peter et al. (2021) reported that field trip and excursion as well as multimedia instruction, and institution-industry partnership sustain students' interest in technology-led courses. Students' interest plays vital role in achieving effective instruction. Therefore, partnering with industries for human resource and facility sharing as well as taking students to the industries can play a vital role in teaching automobile emission control system were many costly facilities are required. Accordingly, Khasawneh (2024) stated that integrating real-world application and industry partnerships into instructional plans can address the discrepancy between classroom learning and professional practice.

Conclusion

Drawing on the findings, it was concluded that the 14 instructional strategies are relevant for effective teaching of automobile emission control system at Colleges of Education level in Nigeria. The strategies can be applied independently or in combination depending on the content, context and instructional objectives of the lesson to be delivered.

RECOMMENDATIONS

The following recommendations were made based on the findings of the study for onward implementation by the relevant stakeholders:

1. Automobile teachers, training centre instructors and industry workshop supervisors should use each of the 14 relevant instructional strategies in planning instruction and delivery of contents related to automobile emission control system at all levels.
2. Curriculum planners should consider the 14 instructional strategies during review of Colleges of Education curriculum for automobile technology in Nigeria.

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