EVALUATION OF ACADEMIC TECHNOLOGISTS IN THE SUPERVISED INDUSTRIAL TRIANING SCHEME IN ENGINEERING EDUCATION IN NIGERIA UNIVERSITIES.

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Abstract

The study was carried out in nine Universities in the South East where engineering courses are offered. A total of 80 Academic Technologists comprise the population of the study. Two research questions were raised and two null hypotheses tested at 0.05 and 0.01significance levels guided the study. A structured questionnaire was used for the study and competency test carried out with twenty-five engineering students in nine of the Universities evaluating in each of the universities an average of four academic technologists. The instrument was validated by five experts and modifications were made in the instrument according to their recommendations. A two- way Analysis of variance (ANOVA) was used for the data analysis. The results revealed that the efficiencies of the academic technologistsin participating in the supervised industrial training scheme in engineering (SITSIE) practice with students because at 1% level of significance, the F-cal was 0.04 and F-tab was 8.65 but differ in performances on various systems because at 1% level of significance, the F-cal was 7.38 and F-tab was 7.01. The paper concluded that SITSIE is important for the training of fresh and young engineering graduates as it equips them with skill in their engineering practice with the assistance academic technologists.

Key words: *Industrial Training, Engineering Education, Evaluation, Academic Technologists.*

Introduction

There is a necessitate for further development of the professional engineer after attaining professional status in view of the continuing advancements in science and engineering and the rapid rate of introduction of modern technologies. There is system of professional training of engineers in Nigeria that is known as the Supervised Industrial Training Scheme in Engineering (SITSIE) established by the Council of Registered Engineers in Nigeria for fresh or young graduates. Ogbuanya (2010) stated that the dynamism of every changing technology in different field of science and technology requires sound and adequate training of individual in technical education.

The Academic Technologists (AT) who are in academic departments in the universities, teaching and demonstrates practical courses should promote information and communication technology (ICT) as a tool for enriching the teaching and learning environment in the current global technological advancement. AT serves as the productive technical manpower needed in various laboratories and workshops in the universities for proper training of student engineers and running of the SITSIE. Ezeama & Obe (2016) observed that for effective training service delivery in Nigeria, teachers as well as academic technologists who are abreast of the trends in the theory and practice of engineering and engineering technology should imbibe continuous professional development as a capacity building exercise. SITSIE should be able to ensure appropriate training of graduate engineers before they attain the professional status with the assistance of Academic Technologists. However, universities should mount; encourage the operation and implementation of SITSIE to achieve the purpose.

Industrial training is a process where the recipient gets the competencies required to do a job or carry out a function and fulfilling the skill objectives that goes with experiencing and practice. Mafe (2004) defined training is the process of transferring knowledge, skills, abilities and attitudes (KSAAs) required doing a specific job or carrying out a specific function from one person to another or to a group of persons. Training can be encapsulated in the four steps of ―show, tell, do and check‖. Training equips the recipient with the capability to do or carry out a specific task, job or function. Uvah (2004) observed that the distinctions between Science, Engineering and Technology (SET) Education on the one hand, and Science, Engineering and Technology (SET) Training, will mainly bounder on conceptual principles and practical applications respectively. Theoretical knowledge alone would not usually prepare an educated person for the world of work. Mafe (2004b) stated that the worker or productive individual must not only be knowledgeable but must also be versatile in the application of skills to perform defined jobs or work. A student who has been exposed to both the theoretical underpinnings of driving a car and the hands-on experience of doing so would and should be a better driver. There is need to combine theoretical knowledge with practical skills in order to produce results in the form of goods and services or to be productive is the essence and rationale for industrial training. Both education and training are important because there cannot be effective education without some practical training input and there cannot be effective training without some educational input. Mafe (2004b) stated that the productive individual, particularly in this millennium, must be able to combine and utilize the outcomes from the two forms of learning (Know-How Ability and Do-How Capability) for the production of goods and services. Mafe (2005) identified that Know-How Ability and Do-How Capability as a requirement is particularly crucial for individuals pursuing careers in science, engineering and technology (SET) disciplines.

In Nigeria, some companies have also found it necessary to establish their own factory schools, as exemplified by Unilever Nigeria Plc which established its Engineering Craft Apprenticeship School in 1983. Miller as quoted in Craig (1987) reported that other companies having factory schools include Nigerian Breweries Plc., Nigerite Plc, Bagco Plc., Flour Mills of Nigeria Plc. Government establishments are not left out: Nigeria Railways and Nigerian Ports Authority have Apprenticeship Training Schools. The Industrial Training Fund, although not a company, also has Apprenticeship Training Schools where people preparing themselves for employment in industry can acquire requisite trainings.

By the close of the 19th Century, science, engineering and technical education had been firmly established in several universities and other institutions of higher learning in both the United States and Europe. The graduates of these institutions were equipped, through systematic instruction (i.e. education), with a body of knowledge in science and engineering which was conceptual and generic. They possessed general ideas or notions underlying the workings of various engineering systems but lacked a thorough grounding in the application of knowledge to the execution of specific jobs. It became clear that engineering students needed to supplement their education with practical experience and training in industry for them to be effective and productive workers in the execution of specific jobs after graduation. Allen as quoted in Criag (1987) stated that an innovation in engineering education which took place during the first decade of the 20th Century addressed the need of engineering students for job-related practical hands-on experience when Herman Schneider, Dean of the College of Engineering, University of Cincinnati introduced Cooperative Education.

Allen as quoted in Criag (1987) stated that in Nigeria industrial training also began with the dependence of industry on technical competencies for the operation and maintenance of its resources. Industrial training or work experience had its origins in the practice at the first Nigerian Polytechnic, the Yaba Technical Institute (now Yaba College of Technology) which was founded in 1948. Students were sponsored by government establishments or private firms at the time. They returned to work with their employers during the long vacations. In this way, the students had some form of industrial training or workexperience integrated with their learning at the polytechnic. Allen as quoted in Criag (1987) stated that the need for industrial training of Science, Engineering and Technology (SET) students as identified by Schneider exists till today. Miller as quoted in Craig (1987) has reported that subsequent expansion in higher education in Nigeria and discontinuation of the system of automatic sponsorship by employers, as a result of the increase in the number of institutions and enrolments, led to the demise of this format for industrial training.

National Universities Commission (2004) national needs assessment surveys report stated that the trainings expectations of Nigerian graduates showed observations that were supported by the findings of the study jointly conducted, by the World Bank and the Nigerian Institute for Social and Economic Research (World Bank and NISER, 2000) and the National Universities Commission. Both reports highlight the criticisms of Nigerian SET graduates by employers, particularly with respect to their performance on the job. The main criticism is that employers believe that SET graduates bring sufficient theoretical knowledge to the job but that they generally lack hands-on or practical skills that would make them productive. Although the SPDC‘s approach is commendable since it contributes to the enhancement of availability of technical skills for the economy (particularly for the oil and gas sector), not all employers can adopt this model because of cost implications and likely erosion of their profits. Secondly, only a small number of SET graduates can benefit from such programmes since available places are limited.

Mefe (2009) suggested that these relevant production skills (RPSs) remain a part of the recipients of industrial training as life-long assets which cannot be taken away from them. This is because the knowledge and skills acquired through training are internalized and become relevant when required to perform jobs or functions.

Practical experience is of great importance for an engineering graduate in the world of today and makes him to be competent in the engineering field. Experience gained without a proper instructor or guide could be inadequate or tire some. The roles to be played by the academic technologist are

i) Preparing of the industrial training Implementation schedule

ii) Preparing the report for the COREN upon completion of the industrial training

iii) Compiling the evaluation forms and report for grading.

Consequently, some higher institutions introduced the Student Work-Experience Programme (SWEP) to enrich the curricula of engineering courses. SWEP was designed to enable students understand the practical applications of the basic principles underlying the traditional engineering programmes (Civil, Electrical and Mechanical Engineering). SWEP was conducted during the long vacation in the institutional workshops under simulated industrial conditions for 200 Level students of universities who have just been introduced to engineering and technology courses. Students were allowed to use machines and tools available in the workshops in the production of simple jobs and were introduced to some basic practices which they were likely to encounter during industrial training. Uvah (2004) however, stated that SWEP was not a substitute for real industrial training.

Problem of supervision of students in industry which is a key aspect of the quality assurance of Student Industrial Work-Experience Scheme (SIWES) has not been regularly done. Whereas, students are required to be supervised three times while on SIWES, very few institutions are able to supervise their students even once over the stipulated durations of SIWES. This situation is attributable to the lack of funding and necessary logistics to carry out the supervision exercise. Council for the regulation of engineering in Nigeria observed SIWES problems and mounted a compulsory scheme called Supervised Industrial Training Scheme In Engineering (SITSIE) in 1991, but it seems SITSIE is about experiencing similar problems of inadequate human and technical infrastructure, scarcity of quality placement opportunities, logistics and financial limitations, amongst others as SIWES.

Objectives of the study

The general objective of the study is to appraise the participation of academic technologists in the supervised industrial training scheme in engineering. Specifically, the study set out to:

1. Determine among the academic technologists participation and students compliancy in SITSIE
2. Identify the academic technologists non participation and students non compliance in SITSIE.

Research Questions

The following research questions formed the basis for this research:

(1) How efficient and reliable were the academic technologists involvement in thesupervised industrial training scheme in engineering?

(2) How efficient and reliable were the students participation in thesupervised industrial training scheme in engineering?

Hypotheses

Two null hypotheses were proposed to be tested.

$H0_1$: There is no significant difference between the mean score of activities performed when academic technologists and students involvements in the scheme were evaluated.

$H0_2$: There is no significant difference between the mean scores of competency when academic technologists and students participation in the scheme were evaluated.

Research Method

Design of the study

The design adopted a descriptive survey research to gather data on representative opinions of the respondents on the use of tools and application of Supervised Industrial Training Scheme In Engineering (SITSIE) by academic Technologists for Engineering students.

Population of the Study

The population is all the academic Technologists in the nine Universities (UNN, ESUT, UNIZIK, COUA, FUTO, IMSU, FUAU, AEUNAI, CARITAS

UNIVERSITY) in South East that offer Engineering programmee. These technologists were in involved in teaching of practical courses in their various laboratories and workshops. Also some final year students and over stay student who came around for participation in repeat course/s.

Sample and Sampling Technique The study adopted a purposive and random sampling techniques. Purposive sampling was used to select academic Technologists who have been on the job in 1996-2016 in their various engineering departments (Agric & Bio, Chemical, Computer, Civil, Electrical, Electronic, Mechanical, Material & Metallurgical, Polymer) because SITSIE was mounted in 1991 but enforced properly in 1996. 80 academic Technologists made up of 40 who are on job up to 20 years and 40 who are on the job up to 10 years were randomly selected for the study based on their length of service. Students where randomly selected based on their availability and accessibility to test their competence on the use of tools as assessed by the academic Technologists.

Instrument for Data Collection The instrument for data collection was on a 4-point structured questionnaire designed to elicit from academic technologists on the application of SITSIE. The instrument consists of two parts. Part 1 contains personal data and keys to response category. Part 2 consist of two sections that handle questions 1 and 2 respectively. Research question 1 elicited information on those aspects of efficiency and reliability of academic Technologists in the SITSIE scheme while research question 2 sought to determine competence and level of students participation in the scheme.

Validation and Reliability of the Instrument

The instrument was face validated by five experts (three from the faculty of Vocational and Technical Education and two from the faculty of Engineering, University of Nigeria, Nsukka). Their suggestions were incorporated in the final version of the instrument. The trial test was carried out on the academic Technologists of equivalent status in the school of Engineering in Institute of Management and

Technology, Enugu, Enugu State. The internal consistency was determined with Cronbach Alpha formular which gave a reliability coefficient of 0. 81.

Data Collection and Analysis

The data collected were analyzed using mean and Comparative Effect Index (CEI) to answer the research questions. Analysis of variance (ANOVA) was used to test the hypotheses formulated. Efficiency Need Level (ENL) was determined as follows: the mean (XP) of the performance category was determined for each item; and the efficiency gap (EG) was determined by calculating the correction for the mean, total sum of squares. The F-calculated for the vehicle systems, activities, the experimental errors and auto scan tools error were calculated as the degree of freedoms, sum of squares, mean squares, and F-values were determined. If EG is zero, it means that efficiency level is not needed for that activity because the level at which the auto scan tools perform the activity is equal to the level at which the efficiency is needed. If EG is negative (-), it means efficiency level is not needed for that activity because the level at which the auto scan tools perform the activity is higher than the level at which the efficiency is needed. If EG is positive (+), it means efficiency level is needed because the level at which the auto scan tools perform the activity is lower than the level at which efficiency is needed. In taking decision for performance, any item with mean of 3.50 and above was considered as high performance, 2.50 - 3.49 was moderate performance while any item with mean of less than 1.50 was considered as very low performance. The null hypotheses were tested at 0.05 and 0.01 levels of significance. The decision for the null hypotheses is that if F-calculated value is less than F-critical (tabular) value, accept the null hypotheses but if the F-calculated is more than Fcritical reject the null hypotheses.

Results and Discussion

Table 1: Mean Ratings of academic technologists in the scheme activities in the workshops using equipments (QT_1 and QT_2).

S/N	System Determinations	Equipment/ Tool	Activities 1	2	3	Total
1	System measurements	QT_1	4.18	4.31	2.75	
		QT_2	3.97	4.31	2.75	
	Sub-total		8.15	8.62	5.50	22.27
2	Automatic system defective components	QT_1	3.20	4.92	3.55	
		QT_2	3.31	4.73	3.48	
	Sub-total		6.51	9.65	7.03	23.19
3	Transmission system defective components	QT_1	2.90	1.04	2.06	
		QT_2	2.90	1.07	2.91	
	Sub-total		5.80	2.11	4.97	12.88

4	Electrical wiring to a sensor	QT_1	4.75	4.62	4.50	
		QT_2	4.03	5.00	3.53	
	Sub-total		8.78	9.62	8.03	26.43
5	Processing system faults	QT_1	5.00	5.00	3.96	
		QT_2	3.45	2.41	4.61	
	Sub-total		8.45	7.41	8.57	24.43
6	Grand total		35.59	37.41	34.10	107.20

The data presented in table 1 showed that mean scores of activities performed had minimum value of 2.75 and maximum value of 4.31 for system measurement , had minimum value of 3.20 and maximum value of 4.92 for automatic system defective components, had minimum value of 3.53 and maximum value of 5.00 for transmission system defective components had minimum value of 1.04 and maximum value of 2.91 for electrical wiring to a sensor, and had minimum value of 2.41 and maximum value of 5.00 for processing system faults. The result of the study show that activities performed with (QT_1& QT_2) by academic technologists are reliable and efficient during the scheme that had means value of 1.04 and 1.07 which are less than 1.50 that was considered as very low performance.

Testing of Hypotheses

Table 2: Analysis of variance of data on table 1, showing Sources of variation, degree of freedom, sum of squares, mean squares and F-values (F-calculated & F-tabular or critical).

Source of variance	df	ss	ms	f-cal	F-Tab 5%	F-Tab 1%
Vehicle systems (VS)	4	33.7138	8.1784□□	7.38	3.84	7.01
Activities performed (AP)	2	0.08762	0.0438□□	0.04	4.46	8.65
Experimental Error (EE)	8	8.8664	1.1083□□	2.48	2.64	4.00
Sampling (AST) Error	15	6.7132	0.4475			
Total	29	48.381				

□ = significant at 5% level of probability

□□ = significant at 1% level of probability

Ho_1: There is no significant difference between the mean score of activities performed when academic technologists and students involvements in the scheme were evaluated

Decision rule: F-cal of 0.04 for activities performed show that there is no significant difference between the efficiencies of QT_1& QT_2 in performing the activities because the F-tab of 4.46 and 8.65 at 5% and 1% levels of significances respectively are greater than Fcal thus the null hypotheses is accepted.

Ho_2: There is no significant difference between the mean scores of competency when academic technologists and students participation in the scheme were evaluated.

Decision rule: F-cal of 7.38 for vehicle systems show that there is significant difference between the efficiencies of QT_1& QT_2 in performing the activities because the F-tab of 3.84 and 7.01 at 5% and 1% levels of significances respectively are less than F-cal thus the null hypotheses is not accepted.

Discussion

The findings from ~~t~~ables 1 showed that mean of 3.50 and above was considered as high performance, 2.50 - 3.49 was moderate performance while any item with mean of less than 1.50 was considered as very low performance of the scan tools. The result of the study indicated that tools (QT_1& QT_2) are reliable and efficient during the evaluation. The role of modern automobile technology in advancing knowledge and necessary skills was instrumental in the national policy on education in that for effective functioning in modern world, there is an urgent need to integrate information and communication technologies into Nigeria education system.

The findings from tables 2 showed that null hypotheses which were tested at 0.05 and 0.01 levels of significances on activities performed at 1% level were so indicative with maximum distribution value of 8.65. The decision for the null hypotheses is that if F-calculated value is less than F-critical (tabular) value, accept the null hypotheses but if the Fcalculated is more than F-critical reject the null hypotheses.

Conclusion and Recommendation

The compulsory Supervised Industrial Training Scheme in Engineering (SITSIE) established by the erstwhile Council of Registered Engineers in Nigeria for fresh or young graduates should be adopted as a format for professional training of engineers with assistance academic technologists in Universities. Despite that SITSIE experiences similar problems of inadequate human and technical infrastructure, scarcity of quality placement opportunities, logistics and financial limitations, amongst others in a similar way as SIWES academic technologists who can enhance the professional training of young engineers.

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