



Impact of Students' Industrial Work Experience Scheme (SIWES) in Air-Conditioning Skills and Entrepreneurship Development amongst Technical and Vocational Education Students in Tertiary Institutions in Rivers State

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Abstract

The study investigated students' industrial work experience scheme (SIWES) on air-conditioning skills acquisition for entrepreneurship development of students of technical and vocational education in tertiary institutions in Rivers State. Descriptive survey design was adopted. The population of the study was 820 which comprises of 205 Lecturers/Instructors and 615 students in three tertiary institutions in River state Nigeria. The purposive random sampling technique was used in selecting 75 Lecturers/Instructors and 245 students making a sample size of 320 that was used as respondents for the study. A structured questionnaire was developed and used as instrument for data collection. The instrument was face validated by three experts, one coordinator of SIWES unit and two others from department of industrial technical education FCE (T) Omoku, Rivers State. The reliability of the instrument was achieved using Cronbach Alpha formula which yielded a reliability index of 0.97. Mean and standard deviation was used to answer the research questions and t-test was used to test the null hypotheses at 0.05 level of significance. The study found that to a high extent students in technical and vocational education acquired relevant air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State. Furthermore, no statistical significant difference exists in the mean responses of instructors and students on relevant air-conditioning skills acquired by students. It therefore, recommended among others that SIWES units in our technical and vocational tertiary institutions should vigorously empower their student with skills by providing facilities and equipment they need to infuse in the students the necessary skills for entrepreneurship development.

Keywords: SIWES, Automobile Air conditioning, Industrial Air conditioning, Entrepreneurship Development, Technical and Vocational Education

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I. Introduction

The world today has become private sector driven, which requires people that are capable of establishing businesses that would help cushion the adverse effects of high unemployment and poverty rate in the society. In other words, the economic prosperity of this 21st century requires the possession of technical as well as entrepreneurial skills to function. That is why the Nigerian government tends towards redirecting its production sector to the private operatives. Of which, with the present pace of privatization and investments in the private sectors in Nigeria's economy this should be increasing demand for skilled personnel thereby creating more employment opportunities for youths who possess the relevant employable skills. Furthermore, with the level of development of Nigerian industries, there should be need for the acquisition of new skills and adaptation of these skills to industrial structure. This therefore calls for an education system that would make our skills training programme more relevant, because the need for her products is always there. But this

expectation is often cut short and posing serious concern when the quality of products from our technical and vocational institutions is a mismatch with skills needs of the industries. According to Okorie (2010) most Nigerian educational institutions of learning do not provide their students with adequate training in skills that will help them fit for productive work. Rather they have remained too academic, with major emphasis upon pure knowledge and western cultural values and less stress on technical and vocational training and practical skills. Okorie (2010) further noted that those who lack sufficient skills live on the subsistence level, and often out of desperation and frustration, constitute nuisance to the society. Therefore, the need to make our education programme meaningful, functional and relevant to the demands of the present-day industrial sectors is emphasized. Furthermore, educational institutions need to give their students a system of education which should not just be job-oriented, but should emphasize entrepreneurship development which can be achieved by the combined effort of Industrial Training Fund (ITF) and the educational institutions through student's industrial work experience scheme (SIWES) programme.

There is no doubt, Technical and vocational education institutions in Nigeria were established to prepare youths for employment and 'self reliant'. In order words, 'entrepreneurship' implied, acquainting the recipients with the relevant technical skill that will earn them a living in either wage employment or self employment. Technical and vocational institutions had thus shouldered the responsibility of manpower development Nigeria (Federal Republic of Nigeria FRN, 2013). Therefore, Technical and Vocational Education could be described as the provision of skills, knowledge, attitude and values needed for a specific occupation. That is to say, TVE is a programme of study that is meant to prepare learners for careers based on manual and practical activities, understanding of laws of science and technology as applied to modern design and production (Osuala, 2016). In Nigeria, this special education programme is offered in technical colleges and vocational training centre as well as skills acquisition centre.

The curricular of the technical and vocational education programme in Nigeria are designed to produce craftsmen at all levels and with different specializations. Hence the National policy on education stated the goals of establishing technical and vocational educations institutions as to:

- i. Provide trained manpower in the applied sciences, technology and business particularly at craft, advanced craft and technical levels;
- ii. Provide the technical knowledge and vocational skills necessary for agricultural, commercial and economic development;
- iii. Give training and impact the necessary skills to individual who shall be self-reliant economically (FRN, 2013).

To achieve the above goals in technical and vocational education institutions in Nigeria, the school curriculum has to be structured such that it will enable individuals acquire vocational and technical skills in different trades. Hence FRN (2013) further stipulates the range of courses offered in the technical and vocational institutions to include mechanical trades which has direct bearing with metal welding/forming and or servicing/repairs of machines or machine related equipment and appliances. The trades in this group include agricultural implement and equipment mechanics work, auto body repair and spray painting, auto electrical work, auto body mechanics works, auto mechanics works, auto body building, auto parts merchandising, mechanics works, mechanical engineering craft practice, foundry craft practice, instruments mechanics work, marine engineering craft, welding and fabrication engineering craft practice and air-conditioning and refrigeration (Ogundola, Popoola & Oke, 2010 and FRN, 2013). The acquisition of appropriate skills and competencies in both mental and physical is equipment for the individual to life and also contribute to growth of the society.

Students in mechanical engineering trade in the technical and vocational institutions undergo theoretical and practical aspects of refrigeration and air-conditioning course. These courses are generally designed to produce skilled craftsmen with good knowledge of the working principles of refrigeration and air conditioning system as well as the techniques and safety practices involved in its maintenance. Specifically, the goal of Air conditioning training according to National Board for Technical Education NBTE (2008) is to give the trainee competence in the trade, such that on completion of the training the graduate should be able to: 1. Install, analyze, diagnose and repair refrigeration equipment using proper hand-tools, meters, gauges and test instruments; 2. Demonstrate proper refrigerant handling techniques in recovery, recycling and reclamation when installing, repairing and removing refrigeration equipment; 3. Analyze systems and components for proper installation, operation and efficiency; 4. Analyze prints and drawings including mechanical and electrical schematics and pictorials for job specifications, equipment location and diagnostics; and 5. Diagnose and facilitate repair to the smallest repairable unit on a refrigeration unit. Therefore, acquiring skills and competency in air conditioning would enable a student on graduation to set up and run an enterprise that will contribute to the development of the nation's economy. This is evident in a study by Thomas & Ameachi (2019) they found that air – conditioning skills are needed for entrepreneurship development of graduates of technical education institutions in Rivers State.

A skill is observable competence to perform a learned behavior, regarding the relationship between mental activity and body movements (Okorie 2010 and Thomas & Amaechi, 2016). Which means possessing a skill is the ability to demonstrate that habit of acting, thinking and behaving in a specific activity in such a way that the process becomes natural to the individual through repetition or practice (Okeke, 2012 and Thomas & Amaechi, 2016). Competent on the other hand, means that the individual has acquired the knowledge, skills and attitudes required in order to perform successfully at a specified proficiency level in a given work (Nwokolo, 2009). That is the "individual's ability to use, apply and demonstrate a group of related awareness, knowledge, skills and attitudes in order to perform tasks and duties successfully and which can be measured against well-accepted standards (levels) required in employment as well as assessed against provided evidences at work location. The competency affects both individual's job responsibility and performance on the job and usually fall into two categories, namely technical and behavioral" (Wahba, 2013). It also indicate a satisfactory state of knowledge, skills and attitudes and the ability to apply them in a variety of situations (EU Commission (OpenCred study), 2016). Skill and competence in air conditioning can easily be acquired during SIWES programme in technical and vocational education. And giving the individual skill in air conditioning will lead the beneficiaries' to self-employment, economic self-sufficiency, and employment generation through short or long-term training.

Students' industrial work experience scheme (SIWES) on the other hand, is a skill training programme that is designed to expose and prepare students in institutions of higher learning for industrial work situations they are likely to meet after graduation (Okorie, 2010). It is also a kind of co-operative arrangement between the school and industries for students undergoing courses that call for exposure in industrial activities during their training in schools. The programmes of SIWES are designed to achieve the following objectives:

1. Provision of avenue for students to acquire industrial skills and experience during their course of study
2. To prepare students for the work situation they are likely to meet after graduation
3. To expose students to work methods and techniques in handling equipment and machineries that they may not be available in the universities
4. To make the transition from the university to the world of work easier and thus enhance students contacts for later job placement.
5. To provide students with an opportunity to apply their theoretical knowledge in real work situations, thereby bridging the gap between theory and practice

The students' industrial work experience scheme gives the student the opportunity to utilize some of his/her academic knowledge and skills in a real-life industrial job environment. Where the trainee is exposed to practical aspects of his chosen trade and the industries routine operations management that are related to his/her academic discipline in other to give him/her on the job experience. Okorie (2010) concluded that the students' industrial work experience scheme could be managed and handled such that it will effectively function as avenue for acquiring both industrial work experience and enterprise skill development. It was in order to bridge skills gap that the students' industrial work experience scheme was introduced in the technical and vocational education. Chiorlu, Ogundu & Obed (2016) emphasized that the SIWES environment should expose students to the use of air conditioning equipment in a way that will lead students to acquire relevant knowledge and skills. It is expected that students' industrial work experience scheme should serve as a tool for youths to develop appropriate work skills and practical work experience as well entrepreneurship skills. Therefore, workshops, laboratories and the overall vocational education environment must be adequately equipped so as to reflect the actual working environment beyond the classroom (Amadi, Obed & Orlu, 2016).

Entrepreneurial skills development allows the beneficiaries to explore the various occupational possibilities the work required, available rewards, necessary training and relative advantages and disadvantages of each (Nwoye, 2011). Entrepreneurship skill development is therefore a planned effort undertaken by an individual or individuals, institutions or agencies to develop the required skill competencies in people that will enable them contribute to the economy of the nation. According to Maigida, Saba & Namkere (2013) entrepreneurial traits (skills) are characteristics that give individuals the potential or propensity to run a successful business. These traits includes creativity, need to achieve, need for autonomy, intuition among others are the ingredients of good leadership and requirements for effectiveness in any vocational area. Marjor-Ritta (2009) added the mastering of technical skill, marketing ability, knowledge of business creation, knowledge of business plan, knowledge of action planning, knowledge of record keeping, knowledge of quality control and Knowledge of new techniques of production as entail skill to run an enterprise. It is expected that graduates who may not have paid employment opportunities can effectively utilize the entrepreneurship skill acquired to establish and run a small and medium enterprise that can compete with their mates who are in high-paying employment.

Finally, for a country in recession like Nigeria, where high rate of unemployment is being prevalent, which is likely brought by the system failure, coupled with inability of government to create job for the its populace (Muhammed, 2010). Entrepreneurship which involves the acquisition of skills, ideas and managerial

abilities necessary for personal self-reliance cannot be overemphasized. It is therefore believed that in addition to the possession of entrepreneurial traits as identified by (Maigida, Saba & Namkere, 2013; and Marjor-Ritta, 2009). The possession of competent practical skill in air conditioning is also a prerequisite for graduates that would enable an individual to create a business in automobile.

Statement of the Problem

The curricular of the technical and vocational education programme in Nigeria are designed to produce craftsmen at all levels and with different specializations, who shall be self-reliant economically (FRN, 2013). It is therefore, expected that these craftsmen will set up a business of their own called small and medium enterprises (SMEs) where they can apply the knowledge and skills they acquired from technical college after graduation for production of goods and services (Ile, 2001).

However, the country is still faced with the burdens of surplus unemployable manpower irrespective of the objective of setting up the TVE institutions. Which according to Olaitan, Igbo, Nwachukwu, Onyemachi & Ekong as cited by Maigida, Saba & Namkere (2013) is as a result of the institutions spend time theorizing at the expense of developing practical skills among youth because of lack of materials and facilities needed to infuse in youths, the necessary skills likely to be required for employment. Furthermore this skills gap among graduates of technical and vocational education has equally resulted absence of entrepreneurship among graduates. This is evident in most of the beneficiaries of TVE after graduations go about the streets hunting for employment. When they could not find any, they became frustrated and often time resort to doing whatever possible just to earn a living.

The above backdrop underlies the need for this inquiry to determine to what extent students' industrial work experience scheme SIWES programme enhance the acquisition of skills in air conditioning that are required in entrepreneurship development of graduates of technical and vocational education. Therefore, the problem of this study is; to what extent will the students' industrial work experience scheme (SIWES) be a pivot to entrepreneurship skills development of graduates in refrigeration and air-conditioning in technical education institutions in Rivers State.

Purpose of the Study

The general purpose of the study is to examine students' industrial work experience scheme (SIWES) on air-conditioning skills acquisition for entrepreneurship development of students of technical and vocational education in tertiary institutions in Rivers State. Specifically, the study sought to identify the extent to which:

1. Relevant automobile air-conditioning skills are acquired during students' industrial work experience scheme (SIWES) for entrepreneurship development of students of technical and vocational education in tertiary institutions in Rivers State.
2. Relevant industrial air-conditioning skills are acquired during students' industrial work experience scheme (SIWES) for entrepreneurship development of students of technical and vocational education in tertiary institutions in Rivers State.

Research Questions

Two research questions were raised which guided the study:

1. To what extent do students of technical and vocational education acquire relevant automobile air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State?
2. To what extent do students of technical and vocational education acquire relevant industrial air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State?

Hypotheses

Two hypotheses were formulated to guide the study and were tested at 0.05% level of significance;

1. There is no significant difference in the mean responses of Instructors and students on the extent to which students of technical and vocational education acquire relevant automobile air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State.
2. There is no significant difference in the mean responses of Instructors and students on the extent to which students of technical and vocational education acquire relevant industrial air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State.

II. Method And Materials

The study was carried out in three tertiary institutions in Rivers state which is located in the South-South geo-political zone of Nigeria. The State has tertiary institutions offering Technical and Vocational Education programmes at various degree levels. The survey research design was adopted for the study. The population of the study was 820 made up of 205 technical Instructors and 615 students in three tertiary institutions in River state Nigeria. The purposive random sampling technique was used in selecting 75 Instructors and 270 students who have experienced in industrial attachment making a sample size of 345 that was used as respondents for the study.

A structured questionnaire with 21 items was developed and used as instrument for data collection from the respondents. The instrument was divided into two sections A & B: Section A sought information on the personal data of respondents. While Section B sought information from the Instructors and students on the skills in air conditioning acquired during SIWES for entrepreneurship development of graduates in Rivers State. The instrument was face and content validated by three experts, one coordinator in SIWES unit and two lecturers in department of technical education FCE (T) Omoku, Rivers State. A five point anchored scale of Very High Extent (VHE), High Extent (HE), Moderate Extent (ME), Low Extent (LE), Very Low Extent (VLE), were written against each item with a corresponding assigned values of 5, 4, 3, 2, and 1 respectively. The reliability of the instrument was achieved using Cronbach Alpha formula, by analyzing response of 20 respondents who are not part of the sample and it yielded a reliability index of 0.97 which was considered very sufficient for the study. According to Okoli, (2009) a reliability coefficient of 0.70 and above is desirable.

The assistance of the office of the Head of Department in these institutions was used in data collection. Through the help of these heads of department the researchers were able to account for 93% return rate of the instrument distributed to the respondents. Data collected were analyzed on statistical package for social sciences SPSS version 20, using mean and standard deviation to answer the two research questions and t-test was used to test the null hypotheses at 0.05 level of significance. A criterion mean of 3.50 was set as bench marks for the acceptance or rejection. Hence, the grand mean of items were used to answer the two research questions, to consider as High Extent if the calculated grand mean of that item is equal to or greater or equal to 3.50, while mean of any item below 3.50 was considered as not Low Extent. Likewise their corresponding t-test result, items whose t-cal is greater than t-crit were rejected while the other wise were accepted.

III. Results

Research Question 1

To what extent do students of technical and vocational education acquire relevant automobile air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State?

Ho1: There is no significant difference in the mean responses of instructors and students on the extent to which students of technical and vocational education acquire relevant automobile air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State.

Table 1 t-test analysis of the mean responses of instructors and students on the extent to which relevant automobile air conditioning skills are acquired during SIWES for entrepreneurship development.

S/N	Relevant skills in automobile air conditioning for entrepreneurship development.	\bar{X}_1	\bar{X}_2	\bar{X}_G	Remark	t-cal	Result
1	Check belt tension and adjust if necessary	4.83	4.73	4.75	HE	1.518	NS
2	Check blower motor operation at all speeds	4.09	3.99	4.02	HE	1.010	NS
3	Discharge the system of refrigerant	4.09	3.99	4.02	HE	1.010	NS
4	Evacuate the system of refrigerant	4.16	4.15	4.16	HE	-1.113	NS
5	Using the appropriate refrigerant and equipment, charge the system to the manufacturer's specifications.	4.09	3.99	4.02	HE	1.010	NS
6	Perform leakage test to determine that the system is not leaking. Use electronic leak detector	4.02	3.93	4.00	HE	-.878	NS
7	Detect internal leaks using electronic equipment	4.31	4.25	4.30	HE	-.614	NS
8	Adjust thermostat valve	4.31	4.25	4.30	HE	-.614	NS

Note: X_1 = mean Instructors, X_2 = mean of students, X_G = grand mean, $N = 320$, $df=318$, $t_{critical} = 1.960$

Data in Table 1, showed that both respondents agreed in all the items with grand mean ranges from 4.02 to 4.75. This indicate that to a high extent students in technical and vocational education acquired relevant automobile air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State. Also in Table 1 shows that all the items had their t-calculated less than t-critical of 1.960, hence we accept the stated null hypothesis at 0.05 level of significance. This means that there is no significant difference in the mean responses of instructors and students

on the extent to which students of technical and vocational education acquire relevant automobile air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State.

Research question 2

To what extent do students of technical and vocational education acquire relevant industrial air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State?

Ho2: There is no significant difference in the mean responses of instructors and students on the extent to which students of technical and vocational education acquire relevant industrial air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State.

Table 2 *t*-test analysis of the responses of instructors and students on the extent to which relevant industrial air conditioning skills are acquired during SIWES for entrepreneurship development.

S/N	Relevant skills in industrial air conditioning for entrepreneurship development.	\bar{X}_1	\bar{X}_2	\bar{X}_G	Remark	t-cal	Result
1	Describe the principles of operation of both direct and indirect systems of air-conditioning	4.58	4.57	4.58	HE	-0.096	NS
2	Identify the different components of a central air conditioning system and explain their functions	4.57	4.54	4.55	HE	.494	NS
3	Read and interpret the layout diagram of an air conditioning system	4.58	4.57	4.58	HE	-0.096	NS
4	Explain the principles of operation of direct and indirect systems of air-conditioning	4.57	4.54	4.55	HE	.494	NS
5	Identify various components in a central air conditioning plant such as compressor, condenser, air handling unit, fan, coil unit, chiller and other auxiliary components like diffusers, ductings, electrical panel, thermostatic expansion valve, Solenoid valve, Anemometer, cooling towers.	4.57	4.54	4.55	HE	.494	NS
6	Interpret the layout diagram of air-conditioning Systems such as direct and indirect systems diagrams and electrical circuit.	4.64	4.64	4.64	HE	-0.010	Not Sig
7	Install and commission a central air-conditioning system.	4.72	4.49	4.55	HE	3.288	Sig
8	install and commissioning a central air-conditioning	4.61	4.34	4.41	HE	2.779	Sig
9	Accurately diagnose faults in the system and effect repairs with confidence	4.72	4.49	4.55	HE	3.288	Sig
10	Effectively maintain the system and adjust the various controls	4.51	4.38	4.41	HE	1.909	NS
11	Diagnose faults in the electrical circuit in electrical panel	4.69	4.67	4.69	HE	-0.414	NS
12	Effect repairs on all types of faults such as faulty compressor, motor open circuit, short circuit and single phasing.	4.51	4.38	4.41	HE	1.909	NS
13	Diagnose faults within refrigerant circuits, such as low level of refrigerant, incomplete charging faulty expansion valve and erratic air-conditioning.	4.84	4.58	4.64	HE	3.089	Sig

Note: \bar{X}_1 = mean Instructors, \bar{X}_2 = mean of students, \bar{X}_G = grand mean, N = 320, df=318, $T_{critical} = 1.960$

Data in Table 2: shows that both respondents had grand mean ranges from 4.41 to 4.69 in all the items listed. This indicates that to a high extent students of technical and vocational education acquire relevant industrial air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State.

Also data in table 2 shows that items 9, 10, 11, 12, 13, 14, 18, 19 & 20 had their t-calculated values less than t-critical of 1.960 at 0.05 level of significance. This implies that there is no significant difference in the mean responses of instructors and students on the extent to which students of technical and vocational education

acquire these relevant industrial air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State. However, items 15, 16, 17 & 21 had their t-cal greater than t-critical of 1.960 at 0.05 level of significance, which means significant difference exist in the mean response of instructors and students with respect to these items.

IV. Discussion of Findings

The findings of the study revealed that to a high extent students in technical and vocational education acquired relevant automobile air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State. Furthermore, no statistical significant difference exists in the mean responses of instructors and students on relevant automobile air-conditioning skills acquired by students. This finding is in agreement with Thomas & Ameachi (2019) who found in their study automobile air – conditioning skills are needed for entrepreneurship development of graduates of technical education institutions in Rivers State. Its also in line with Chiorlu, Ogundu & Obed (2016) who posited that the SIWES environment should expose students to the use of automobile air conditioning equipment in a way that will lead students to acquire relevant knowledge and skills.

The findings also revealed that to a high extent students of technical and vocational education acquire relevant industrial air-conditioning skills during students' industrial work experience scheme (SIWES) for entrepreneurship development in tertiary institutions in Rivers State. This is in agreement with Thomas & Ameachi (2019) who found in their study that industrial air – conditioning skills are needed for entrepreneurship development of graduates of technical education institutions in Rivers State. This is also in line with Amadi, Obed & Orlu, (2016) who postulated that the workshops, laboratories and the overall vocational education environment must be adequately equipped so as to reflect the actual working environment beyond the classroom.

V. Conclusion

Instructors and students of technical and vocational institutions expressed their views on the impact of students' industrial work experience scheme in entrepreneurship skills development of graduates of technical and vocational education in Rivers state. These cannot be undermined in light of entrepreneurship skills development in technical and vocational education It is worthwhile to note therefore, that there is no skill-acquiring project that is without challenges, it is imperative that government through ITF and technical institutions in Nigeria should consider a proper implementation of students' industrial work experience scheme programme to reduce these challenges and also improve entrepreneurship skills development of graduates of technical and vocational education in Nigeria.

VI. Recommendations

1. SIWES units in the technical and vocational tertiary institutions should vigorously empower their student with skills by providing facilities and equipment they need to infuse in the students the necessary entrepreneurship skills.
2. The government should ensure that her policy statement regarding the establishment of students' industrial work experience scheme is effectively implemented and make available the necessary facilities for technical institutions to equip their students with entrepreneurship skill.
- 3 ITF should sanction corporate industries that refuse to accept and fund industrial work experience scheme.

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