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Electrical Measurement and Control Skills for Manpower Development in Nigeria

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ABSTRACT: *The study was conducted to ascertain the electrical measurement and control skills needed for manpower development in Nigeria. Purposive sampling technique was used in the study whose sample is composed of 82 subjects (24 electrical graduates and 58 supervisors). One research question guided the study. The instrument for data collection was a structured questionnaire by the researchers titled 'Electrical Measurement and Control Skills for Development Questionnaire (EMCSDQ)'. EMCSDQ was designed on a 5-point Likert Scale. Three experts validated the instrument whose reliability was ascertained via Cronbach's Alpha which yielded a reliability coefficient of 0.83. A total of 89 copies of the questionnaire were administered to the respondents by the researchers and one other research assistant. From the total questionnaire distributed, only 82 (representing 92.1%) was recovered and used for data analysis. Mean was used to answer the research question and standard deviation was used determine the closeness and homogeneity in the responses of the respondents. The finding of the study revealed that electrical measurement and control skills of instrument calibration, system servicing, troubleshooting and maintenance, electronic system simulation among others are needed for manpower development. Consequently, it was recommended among others that the government and polytechnic administrators should ensure adequate provision of training facilities in polytechnics workshops and laboratories; effective students industrial work experience scheme (SIWES); engage experienced lecturers and instructors in polytechnics for quality manpower development of graduates.*

KEYWORDS: Electrical measurement and control skills, polytechnic, manpower development, graduates.

INTRODUCTION

Polytechnics are tertiary institutions established to train students to become technicians and technologists in their chosen disciplines or vocations having acquired relevant core skills. A polytechnic as described by Oni (2007) is a technical institution of higher learning which equips an individual for employment and self-reliance by providing learners with the necessary skills for

agricultural, industrial and commercial roles, capable of accelerating the economic development of a nation. A polytechnic can be described as a non-university, institution of higher learning, saddled with the responsibility of offering different courses in technical subjects, technology, industrial production, agriculture, commerce and communication together with the provision of knowledge and skills associated with the handling of relevant tools and equipment, and to develop students through both theoretical and practical experience (Oluwole & Lateef, 2015). The United Nations Education, Scientific and Cultural Organization (UNESCO) (2002) saw polytechnic education as a segment of the general education that prepares individuals for occupational fields and for effective participation in the world of work, life-long learning for responsible citizenship preparation, sustainable development promotion, a best method of facilitating poverty alleviation, and enable individual to develop technical and entrepreneurial skills and attitudes. Polytechnic education is a planned programme of courses that begins with an exploration of career options, support for basic academic and life skills and achievement of higher academic standards, leadership, industrial work preparation and advanced continuing education (Dike, 2009). Thus, polytechnic education involves knowledge accumulation and application which have become major factors in economic development. Ojerinde (2015) opines that polytechnic education would be of immense help in providing local manpower to the nation's industries thereby cutting down on over-dependence on foreigners for the industrial development of Nigeria. Thus, a polytechnic is an institution of higher learning that runs technical vocational education and training programmes in Nigeria.

Technical vocational education and training (TVET) as defined by UNESCO (2002) is a comprehensive term referring to those aspect of educational process involving in addition to general education, the study of technologies and related sciences, and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life. Similarly, Ayonmike and Okeke (2015) describe TVET as that branch of education that uses information technology and globalization to impart technical and vocational skills to prospective industrial workers. TVET ensures the provision of skills and knowledge which serve as tools for the socio-economic development of any nation (Goel, 2010). Again, Afeti (2010) opines that Technical vocational education and training is very crucial in the training and development of skilled entrepreneurial workforce required for the ever-changing technological work environment. In addition, one of the goals of TVET as contained in the national policy on education of the Federal Republic Nigeria (FGN) (2013) is to provide trained manpower in the applied sciences, technology and business particularly at craft, advanced craft and technical levels. In essence, human capacity building in skill-based technological areas can be achieved through quality technical vocational education and training.

In Nigeria, the Federal government having realized the gains of technical education established the National Board for Technical Education (NBTE) in January, 1977 as a principal organ of the Federal Ministry of Education to handle all aspects of technical and vocational education falling outside university education. NBTE's vision and mission are to uphold the ideas of a free, united

and egalitarian society and promote good quality technical and vocational education; a system which is flexible and accessible to all for the purpose of producing competent and relevant technical manpower needed for sustainable national development. Again, to promote the production of skilled and semi-skilled and professional manpower, to revitalize, and sustain the national economy, reduce unemployment and poverty through the setting and maintenance of high standards, provision of current and reliable information for planning and decision making, sourcing and distribution of funds and adequate linkage with industry. In addition to providing standardized minimum guide curricular for technical and vocational education and training (TVET), the board supervises and regulates through an accreditation process, the programmes offered by polytechnics in Nigeria.

According to the Federal Republic of Nigeria's National Policy on Education (NPE) (2013), the objectives of Polytechnic education are to:

- Provide full time or part-time courses of instruction and training in engineering, other technologies, applied sciences, business and management, leading to production of trained manpower.
- Provide the technical knowledge and skill for agricultural, commercial and economic development of Nigeria.
- Give training and impart the necessary skills for the production of technicians, technologists and other skilled personnel who shall be enterprising and self-reliant.
- Train people who can apply scientific knowledge to solve environmental problems for the convenience of man.
- Provide exposure to professional studies in these technologies.

The policy also states that, in pursuance of these goals, government shall adopt measures to:

- Develop and encourage the ideals of Polytechnic Education through students' industrial work experience scheme.
- Improve immediate and long-term prospects for polytechnic graduates and other professionals with respect to their status and remuneration.

The main essence of polytechnics is to champion the technological development of Nigeria. Polytechnic education in Nigeria is tailored toward the development of middle level indigenous manpower that would help in the advancement of the nation's industries through the acquisition of lifelong skills relevant to their chosen trade or vocation. Thus, acquiring relevant electrical measurement and control skills by polytechnic electrical engineering graduates promotes manpower development for the world of work. As a result, manpower development serves as a condition for economic development since skilled workers are the prime movers of industrial development in every nation across the globe. Building the capacities of the workforce enhances economic transformation. In other words, quality teaching and learning in educational institutions such as universities and polytechnics tends to develop the capacity of the individual learner for productivity.

Basically, manpower development is aimed at improving the knowledge and skills of employees for increased productivity and organizational efficiency thereby making them more responsible in the work environment and society at large. Manpower development entails the enlargement of people's choices as they acquire more capabilities and enjoy more opportunities to use these capabilities. From the foregoing, acquiring electrical measurement and control skills from polytechnics in Nigeria for manpower development is seen as the process of helping electrical engineering professionals to develop technical proficiency for productive work. Consequently, Manpower development in the polytechnic sector is achievable through effective TVET.

Statement of the Problem

Unemployment is a major problem affecting young people across the globe. In Nigeria, unemployment and its consequences degenerates to numerous social vices including armed robbery, kidnapping, drug abuse, prostitution, cultism among others (Owo, 2017). Previous studies revealed that one of the reasons for rising rate of unemployment in Nigeria is that many young people do not possess skills essential for self-reliance or paid employment in the world of work. Similarly, Ojerinde (2015) opines that the failure of Nigerian graduates to possess core technical and engineering skills is the cause of unemployment in the country. Furthermore, Ismail and Mohammed (2015) state that Nigerian electrical/electronic technology graduates do not possess relevant employability skills for job placement in industries operating in Nigeria and as such remain unemployable. According to Pitan (2016), the industries generally look forward to hiring graduates who are technically proficient and also acquired pertinent complementary soft skills. Employees can only access and maintain jobs by developing their employability skills via education and training (Hari, Kencanasari, Reni & Kasda, 2020). Poor skills acquisition among young people in Nigeria affects sustainable development which also cripples the economic growth of the nation. One area of electrical/electronic engineering in which skills can be acquired for development is electrical measurement and control. Consequently, this observed menace of poor technical skills acquisition among youth inspired the researchers to conduct this study titled 'Electrical Measurement and Control Skills for Manpower Development in Nigeria'.

Purpose of the Study

The main purpose of this study is to assess the electrical measurement and control skills needed by polytechnic electrical/electronic graduates for manpower development in Nigeria.

Objective of the Study

Specifically, the study was conducted to:

Determine the electrical measurement and control skills needed by polytechnic electrical/electronic engineering graduates for manpower development in Nigeria.

Research Question

What are the electrical measurement and control skills needed by polytechnic electrical/electronic engineering graduates for manpower development in Nigeria?

LITERATURE REVIEW

Manpower Development of Polytechnic Electrical/Electronic Engineering Graduates

One way of boosting the proficiency of industrial technologists is through quality manpower development. The United Nations Development Programme (UNDP) (2015) describes human (manpower) development as the development of the people realized by building their capacities which in turn makes them actively participate in the processes that shape their lives.

According to Obadara and Oyebolu (2013), manpower development entails any organized education activities administered in an organized setting for performance improvement and/or personal growth leading to individual and/or organizational improvement on the job. Corroborating this assertion, Olanrewaju and Folarin (2013) posit that manpower development entails the training and development of employees in skills acquisition and knowledge for proficiency in the establishment. Ekpo as cited in Omodia (2009) sees manpower development as the existence of unskilled and/or skilled humans in need of training or retraining to perform specific job role in the society. In the same vein, Hamlin (2004) describes manpower development as any activity deliberately undertaken to improve a person's skill on a job. Hamlin further maintained that manpower development does not only improve an individual's skills on the job but also brings about personal development in the area of knowledge acquisition. Furthermore, Onasanya (2005) describes manpower development as a form of specialized education aimed at giving the trainee a specialized knowledge, skill and attitude needed to perform optimally in a given job role. Manpower development is a two-way responsibility between the organization and the individual (Madubueze, Ananti, Onyekwelu & Okpalibekwe, 2015). According to Romer (1986), the economic growth of any country depends on knowledge (skills) acquisition and that the amount of knowledge gained by the human resources of a given country determines the economic development of that nation. Manpower development therefore is very vital for the economic advancement of Nigeria as the workforce acquire relevant skills needed for enhanced productivity.

Concept of Graduate Skills Development among Technical and Engineering Graduates

In Career management, Feldman (as cited in Dagogo, 2014) posited that individual's accomplishment and fulfillment in a given career is associated with the ability to discover an occupation having peculiar features and prospects. Hence, being acquainted with industry setting gives an individual, a huge task which calls for a better understanding of one's skills and anticipations as well as understanding of the different work sites (Greenhaus, Callanan & Godshalk, 2000). The consideration of an individual's personal proficiencies compared with the different work sites, delivers an avenue for an evaluation to determine the possible to fit in such work environment (Greenhaus *et al.,* 2000). Similarly, Comyn (2009) contends that practical-based learning cannot be achieved through classroom knowledge alone rather it demands specific

participation and commitment of industries in related field. Developing job-ready skills, behaviors and attitudes can be naturally achieved when you engaged in real life industrial work as experiences gathered from such environments are monumental (Munro & Stuckey, 2013). Companies, personalities and educational institutions have been preoccupied with research employability skills of graduates capable of drawing employers' attention which should be developed by educational institutions. Hence, there is great need for institutions to work collaboratively with industries to chart a new course for the impartation of employability skills to young people (Curtis & McKenzie, 2001). Furthermore, Rae (2007) posits that good partnership with the industrial world boosts graduates' employability through industrial learning and work-based programmes. Thus, active participation of students in industrial attachment programmes enhance their competence in any given job role upon graduation (Osman, Omar, Kofli, Mat, Darus & Rahman, 2008).

Electrical Measurement and Control Skills required of Polytechnic Electrical/Electronic Engineering Graduates

Electrical measurement and control is an aspect of electrical engineering that deals with the measurement of electrical quantities as well as the regulation of the processes involved in obtaining a steady state output from the input signal. Electrical instruments as a course enhances the ability of electrical engineers to measure the changes in variables such as current, voltage and resistance (Theraja & Theraja, 2012). Furthermore, the National Board for Technical Education [NBTE] (2001:5) stipulates that the main objectives of electrical measurement and control course in polytechnics HND curriculum include:

- To empower the graduates through effective training to assemble and install instrument and control systems.
- To design simple instrumentation and measuring systems.
- To analyse and solve practical problems in analytical instruments and control systems.

Hence, HND graduates of electrical engineering are anticipated to acquire appropriate skills and knowledge necessary to build, install, operate and design electrical instruments for any engineering applications. The graduates also need to acquire skills in using the instruments to measure, analyse and control electrical systems through feedback mechanisms as applicable in the industries (Theraja & Theraja, 2012). In the same vein, Bhattacharya and Bhattacharya (2015) posit that electrical engineering students studying electrical measurement and control in tertiary institutions should be able to acquire skills to detect sub-systems of a complete instrumentation system and explain the functions of each, select the accurate transducer for measuring system input, clarify the basic signal conditioning processes, describe data transmission techniques, data storage and display devices, understand the working principles of control devices applicable in motor and process control system, represent a control system in a simplified block diagram using transfer function, determine the stability conditions of a system using stability study criteria, give details of different types of controllers among others. The focal areas in electrical measurement and

control are transducers, signal conditioning, digital instruments such as display and pilot devices applicable in control circuits and control systems (Bhattacharya & Bhattacharya, 2015). Similarly, Weiss (1993) submitted that electrical measurement and instrumentation as a field of technology is always recording rapid development and as such new discoveries are uncovered from time to time making it impossible to review all the areas in the field as well as the skills required by specialists in one study. However, accuracy and stability of reference sources, application of digital instrumentation, microelectronics, computers and measurement systems, electromagnetic compatibility and interference, sensors and transducers development and application as well as other sophisticated measuring instruments and systems are salient areas of electrical measurement and instrumentation which electrical engineering graduates need to acquire skills for industrial engineering applications (Weiss, 1993). Consequently, electrical engineering graduates of polytechnics are to develop electrical measurement and control skills applicable in temperature control, thermometer calibration, thermocouple calibration, installation of temperature measuring devices, converting units of pressure, selection and usage of appropriate measuring instruments, installing pressure measuring instruments, measure fluid flow in closed and open pipes, install different types of orifice plates, install level measuring devices like ammeter, voltmeter and power factor for measuring three phase loads, translate sequences of operation from logic circuits to electrical circuits, carry out practical tests on short circuit and open circuit faults on cables, calibrate recorders, carry out thickness measurement using capacitive transducers, carry out displacement measurement using capacitive transducers, determine earth resistance of electrical items, determining strain gauge bridge parameters among others (NBTE, 2001).

Likewise, measurement and sensor control technology impart learners with skills for determining basic electrical quantities like current, voltage, resistance, frequency, among others. Thus, electrical engineering graduates apart from developing skills in measuring current, voltage, resistance, power, frequency and other electrical quantities, equally needed advanced knowledge of working principles and applications of sensors. Consequently, electrical measurement and control as a course of study as indicated in the Electrical Engineering Technology Curriculum of Nigerian Polytechnics is aimed at providing electrical engineering technologists with relevant technical skills crucial for future industrial applications in instrumentation and control. Skills acquisition by electrical engineering graduates therefore aids the implementation of the local content policy of the Nigeria's Federal Government.

Theoretical Framework

This study was anchored on the principle of human capital theory. The human capital theory according to Schultz (1961) and Becker (1964) maintains that education increases individuals' productivity which results in enhanced job performance. Accordingly, education provides marketable skills and abilities relevant to job performance through formal training. Therefore, the more highly educated people are, the more successful they become in terms of incomes and work opportunities in the labour market. In essence, this theory basically reasons that education

increases productivity and job performance. It further emphasized on acquiring knowledge for development instead of mere skills acquisition for career success in the world of work. Human capital theory posits that adequate knowledge of theory and technical know-how are keys to effective performance in any job role. Thus, the theory considers higher education as an avenue for self-development as necessary background knowledge and skills are acquired by graduates via quality education. Understanding the transformations between foreign and domestic education, a division between country particular and general human capital was established (Chiswick & Miller, 2003; Wiers-Jenssen, 2008). Human capital theory clarifies that some aspects of human development like language, culture and professional skills of a nation were designed and amended in the higher education curriculum in line with the national requirements (Wiers-Jenssen, 2008). However, within the labour market, there is a high level of uncertainties in the processes of knowledge acquisition, character traits variability, uncertainty about the quality of schooling, and imperfect knowledge of future demand and supply conditions of the industry (Levhari & Weiss, 1974).

In this study therefore, human capital theory finds direct relevance in the sense that graduates of electrical/electronic engineering from Nigerian polytechnics do not only need technical skills to secure and maintain employment in the industry but additionally, they need quality knowledge of the major concepts of employability, transferrable skills, green skills, technical skills, generic soft skills, personal attributes among others to gain job placements. These employability skills sometimes appear to be more applicable in some labour markets than others (Støren & Wiers-Jenssen, 2010). Hence, as electrical engineering graduates acquire more skills relevant to the needs of the industry through unflinching quest for personal development, the more their chances of securing better employment in the industry. This will undoubtedly reduce the unemployment rate and boost the economic growth of the nation.

Research Framework (Scope)

In this study, electrical measurement and control skills required by polytechnic electrical/electronic graduates for manpower development are featured. These skills are extracted from the course specifications for Electrical measurement and Control course designed by the National Board for Technical Education (NBTE) for Electrical Engineering Technology Curriculum for Higher National Diploma (HND) programme in Nigerian Polytechnics. Electrical supervisors and graduates who are already working in the industry are used for the study since they have the requisite experience and skills needed for development. Skills in unit conversion, instrument calibration, instrumentation abbreviation interpretation, device installation, system maintenance, simulation, among others were covered in this study.

MATERIALS AND METHOD

Research Design

This study adopted descriptive survey design. A descriptive survey study is a type of study in

which data from a large sample drawn from a given population were collected and certain features of the sample as they are at the time of the study and which are of interest to the researcher were described without altering any independent variable of the study (Nwankwo, 2016). Thus, in descriptive design, as in this study, there was no manipulation of the independent variables.

Sample and Sampling Techniques

Purposive sampling was used to obtain from 89 electrical/electronic technologists consisting of (27 supervisors and 62 graduates) working in Green Energy International Ltd., AMNI and Total Production and Exploration companies. Purposive sampling according to Nwankwo (2016) is a type of sampling technique that entails the identification and utilization of individuals who possess specific attributes which the study needs. In purposive sampling, the probability of selecting an individual among the population is centred on the judgment of the researcher in accordance with the rationale for the study (Amadi, 2020). Thus, Electrical/electronic supervisors and graduates are selected and used for the study since the study focused on electrical measurement and control skills needed by electrical/electronic technologists for manpower development.

Data Collection Instruments

The instrument for data collection was a self-structured, 62-item questionnaire titled "Electrical Measurement and Control Skills for Development Questionnaire (EMCSDQ)". The questionnaire was designed on a 5-point Likert Scale of Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD) conforming to numerical values of 5, 4, 3, 2 and 1 respectively. The questionnaire was made up of two parts. Part one elicits information on the personal data of respondents as well as their categories (supervisors and graduates), while part two contains direct structured items on electrical measurement and control skills needed for manpower development in Nigeria.

Validity of the Instruments

The questionnaire was face and content-validated by two experts in electrical/electronic engineering who work as electrical supervisors in oil and gas industry and another expert in measurement and evaluation from Rivers State University Port Harcourt. The researchers submitted the questionnaire to the valuators with copies of specific objective of the study and research question. The instrument was vetted in terms of appropriateness; relevance and professional language used and their valid recommendations were incorporated into the final version of the instrument before distributing it to respondents.

Reliability of the Instrument

The reliability of the instrument was established using Cronbach alpha method. A total of 24 copies of the questionnaire were distributed to 6 electrical supervisors and 18 electrical graduates of

Integrated Oil and Gas Limited located at No. 14 Itapeju Street, Apapa, Lagos, Nigeria. Cronbach alpha method was used to test the instrument for internal consistency and a reliability coefficient of 0.83 was obtained which confirmed that the instrument was very reliable.

Data Collection Procedures

A total of 89 copies of the questionnaire were administered to the respondents by the researchers and one other research assistant. The research assistant was properly educated on how to support the researchers in the administration and retrieval of the instrument from the respondents after it has been responded to. From the 89 copies of the questionnaires distributed, 82 (representing 92.1%) was recovered and used for data analysis.

RESULTS

Data for answering the research question were analysed using the Mean and standard deviation. The decision to accept or reject any item in the questionnaire was based on the Mean rating of the item. Any item in the questionnaire with a calculated Mean value equal to or greater than 3.00 was accepted, while any item with a calculated Mean value less than 3.00 was rejected. Standard deviation values that were close or wide apart were used to determine homogeneity in the responses of the respondents.

Research Question 1: What are the electrical measurement and control skills needed by polytechnic electrical/electronic engineering graduates for manpower development in Nigeria?

Table 1: Mean Responses on Electrical Measurement and Control Skills Needed by Polytechnic Electrical/Electronic Graduates for Manpower Development

S/N	Item Statement	Supervisors (N_1= 24)			Graduates (N_2 = 58)		
		$\overline{X}_1$	SD_1	RMK	$\overline{X}_2$	SD_2	RMK
1	Skills for converting from one system of units to another.	4.00	0.50	Agreed	4.22	0.64	Agreed
2	Skills in calibrating thermometer using sand batch standard calibrator.	4.18	0.64	Agreed	4.19	0.71	Agreed
3	Skills in calibrating thermometer using olibath standard calibrator.	4.12	1.05	Agreed	4.36	0.64	Agreed
4	Skills in calibrating thermocouple using sand batch calibrator.	4.24	1.03	Agreed	4.72	.57	Agreed
5	Skills in interpreting instrumentation and control abbreviations.	4.12	0.70	Agreed	4.75	0.44	Agreed

6	Skills in installing temperature measuring devices.	3.65	1.17	Agreed	4.58	0.65	Agreed
7	Skills in converting one pressure unit to another.	4.30	0.60	Agreed	4.81	0.40	Agreed
8	Skills in identifying and using various calibrating devices.	4.30	0.60	Agreed	4.50	0.70	Agreed
9	Skills in calibrating pressure measuring devices.	4.12	0.60	Agreed	4.69	0.52	Agreed
10	Skills in installing pressure measuring devices.	4.06	0.75	Agreed	4.64	0.60	Agreed
11	Skills in servicing pressure measuring devices.	4.18	0.88	Agreed	4.75	0.50	Agreed
12	Skills in maintaining pressure measuring instruments.	4.41	0.71	Agreed	4.83	0.45	Agreed
13	Skills in dismantling and assembling pressure measuring instruments.	4.30	.69	Agreed	4.69	0.53	Agreed
14	Skills in selecting and using pressure measuring devices.	3.80	0.73	Agreed	4.50	0.61	Agreed
15	Skills in measuring fluid flow in closed pipes.	3.94	0.75	Agreed	4.67	0.54	Agreed
16	Skills in installing different types of orifice plates.	3.94	0.83	Agreed	4.31	0.67	Agreed
17	Skills in employing D+D tapping for orifice plate installation.	3.82	.73	Agreed	4.44	0.65	Agreed
18	Skills in employing flange tapping for orifice plate installation.	3.88	.70	Agreed	4.56	0.74	Agreed
19	Skills in employing corner tapping for orifice plate installation.	4.00	.80	Agreed	4.42	0.77	Agreed
20	Skills in carrying out orifice plate sizing using diameter ratio (d/D).	3.77	.66	Agreed	4.39	0.69	Agreed
21	Skills in carrying out orifice plate sizing using Reynold's number.	3.77	.83	Agreed	4.11	0.62	Agreed
22	Skills in carrying out orifice plate sizing using J-value.	3.77	.66	Agreed	3.75	1.16	Agreed
23	Skills in installing Rotameters.	3.77	0.75	Agreed	3.64	1.05	Agreed
24	Skills in maintaining Rotameters.	4.18	0.64	Agreed	4.22	0.93	Agreed
25	Skills in installing magnetic meters.	4.06	0.56	Agreed	4.14	0.54	Agreed
26	Skills in maintaining magnetic meters.	4.00	0.80	Agreed	4.53	0.61	Agreed
27	Skills in installing turbine positive displacement.	3.82	0.81	Agreed	4.44	0.74	Agreed
28	Skills in maintaining turbine positive displacement.	3.59	0.87	Agreed	4.25	0.81	Agreed

29	Skills in installing Doppler.	3.71	0.77	Agreed	4.08	0.70	Agreed
30	Skills in maintaining Doppler.	4.06	0.56	Agreed	4.50	0.66	Agreed
31	Skills in applying weirs and meters in measuring fluids in open channels.	3.77	1.03	Agreed	4.31	0.82	Agreed
32	Skills in selecting level measuring devices.	4.00	.94	Agreed	4.56	0.74	Agreed
33	Skills in applying Parshall flumes meter in measuring fluids in open channel.	3.77	1.03	Agreed	4.56	0.77	Agreed
34	Skills in selecting level measuring devices.	4.00	.61	Agreed	4.61	0.65	Agreed
35	Skills in installing level measuring devices.	3.88	.86	Agreed	4.64	0.64	Agreed
36	Skills in drawing instrumentation symbols.	4.35	0.79	Agreed	4.61	0.55	Agreed
37	Skills in using tag numbers to identify component parts of a control system. .	4.12	0.93	Agreed	4.56	0.65	Agreed
38	Skills in identifying loop drawing in instrumentation diagrams using symbols and tag numbers.	4.29	0.77	Agreed	4.42	0.77	Agreed
39	Skills in identifying diagrams and ash tags numbers.	4.41	0.71	Agreed	4.28	0.74	Agreed
40	Skills to identify loop drawings in the instrument diagram using symbols and tag numbers.	4.12	0.60	Agreed	4.42	0.60	Agreed
41	Skills in installing temperature measuring devices using appropriate technique.	4.30	0.59	Agreed	4.44	0.81	Agreed
42	Skills in translating sequences of operations from logic circuit.	4.47	0.51	Agreed	4.42	0.77	Agreed
43	Skills in using ammeter, voltmeter and power factor to measure three phase loads.	4.41	0.51	Agreed	4.44	0.77	Agreed
44	Skills in determining the resistance of various electrical items such as circuits and appliances.	4.53	0.51	Agreed	4.42	0.87	Agreed
45	Skills in testing short circuit faults on cables using Blanier's test.	4.47	0.51	Agreed	4.53	0.81	Agreed
46	Skills in testing open circuit faults on cables using Blanier's test	4.18	0.53	Agreed	4.33	0.86	Agreed
47	Skills in carrying out short circuit faults testing on cables using Murray-Loop test.	4.06	0.66	Agreed	4.42	0.84	Agreed
48	Skills in carrying out open circuit fault testing on cables using Murray-Loop test.	4.18	0.73	Agreed	4.31	0.79	Agreed
49	Skills in carrying out short circuit fault testing on cables using Varley-Loop test.	4.00	0.80	Agreed	4.47	0.88	Agreed
50	Skills in carrying out open circuit fault testing on cables using Varley-Loop test.	4.00	0.80	Agreed	4.36	0.64	Agreed
51	Skills in determining the parameters of strain guage bridges.	4.06	0.75	Agreed	4.44	0.65	Agreed

52	Skills in determining the parameters of Thermistor bridges.	4.00	0.50	Agreed	4.31	0.62	Agreed
53	Skills in determining experimentally, the parameters of Thermocouple bridges.	3.82	0.53	Agreed	4.42	0.65	Agreed
54	Skills in carrying out liquid level measurement using capacitive transducers.	3.82	0.73	Agreed	4.17	0.81	Agreed
55	Skills in carrying out displacement measurement using capacitive transducers.	4.06	0.83	Agreed	4.36	0.80	Agreed
56	Skills in carrying out thickness measurement using capacitive transducers.	3.82	0.73	Agreed	4.31	0.80	Agreed
57	Skills in carrying out composition measurement using capacitive transducers.	4.13	0.50	Agreed	4.31	0.80	Agreed
58	Skills in calibrating digital voltmeters.	4.06	0.66	Agreed	4.12	0.89	Agreed
59	Skills in calibrating recorders.	4.24	0.75	Agreed	4.25	0.80	Agreed
60	Skills in constructing thermocouple.	4.12	0.58	Agreed	4.36	0.90	Agreed
61	Skills in locating simulated fault on cables.	4.18	0.64	Agreed	4.17	0.74	Agreed
62	Skills in determining by experiment, the coefficient of resistance.	4.18	0.64	Agreed	4.47	0.61	Agreed
	Average Mean/SD	**4.06**	**0.72**		**4.41**	**0.71**	

Source: *Researchers' Field Result; 2022.*

The result in Table 1 reveals the responses of electrical supervisors and graduates on electrical measurement and control skills needed by polytechnic electrical/electronic graduates for manpower development in Nigeria as well as their level of decision on a particular item. The result reveals further that electrical supervisors and graduates' responses denote all the items as electrical measurement and control skills needed by polytechnic electrical/electronic graduates for manpower development in Nigeria with a mean value of 4.06 and 4.41 for electrical/electronic supervisors and graduates which are greater than 3.00 as the cut-off point. The standard deviation values from 0.00 to 0.99 indicates that the respondents were close in their responses while standard deviation values from 1.00 and more implies that the respondents (electrical supervisors and graduates) were far apart in their opinion.

DISCUSSION

Electrical Measurement and Control Skills Needed for manpower Development

The finding of the study as shown in Table 1 reveals that electrical measurement and control skills are needed by polytechnic electrical/electronic graduates for manpower development in Nigeria as perceived by the supervisors and graduates. This finding agrees with the views of Weiss (1993) who specifies that the application of digital instrumentation, microelectronics, computers and measurement systems, electromagnetic compatibility and interference, sensors and transducers

development and application as well as other sophisticated measuring instruments and systems are salient areas of electrical measurement and instrumentation which electrical engineering graduates needed to develop skills for industrial applications. In like manner, the finding agrees with Bhattacharya and Bhattacharya (2015) who posits that the focal areas in electrical measurement and control including transducers, signal conditioning, digital devices, display devices, pilot devices are applicable in control circuits and control systems used in industrial world and therefore graduates seeking employment in the industry need to develop relevant technical skills in these areas. The study finding also corroborates the submissions of Aluko (2014) who sates that industrial employers expect graduates to acquire technical and professional aptitudes from higher education programmes as most of these graduates do not possess requisite skills for engagement in the industry. However, the finding disagrees with Munro and Stuckey (2013) who submit that developing employability skills can be accomplished while engaging in industrial work as experiences gained from such environments are monumental instead of expecting the tertiary education programmes that are being run with no industrial devices, machines and systems to inculcate such technical skills in graduates.

CONCLUSION AND RECOMMENDATIONS

The economic growth of any nation is anchored on knowledge acquisition for human capital development. In other words, how much knowledge the human capital possesses and put to effective use within a country actually determines the economic growth of the nation. Knowledge development through skills acquisition in electrical measurement and control engineering enables the skilled electrical engineering workforce to contribute meaningfully to the economic development of the nation as the technical expertise serves to proffer solution to some observed issues impeding industrial development.

Thus, from the finding of the study, it was recommended that government and polytechnic administrators should encourage the acquisition of electrical measurement and control skills by polytechnic electrical engineering students through adequate provision of training equipment, machines and tools in all polytechnic electrical measurement and control workshops and laboratories; engage competent lecturers and instructors for effective training of students in polytechnics; ensure effective students industrial work experience scheme among others so as to achieve all-round development of electrical manpower needed for the industrial transformation and economic development of Nigeria.

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