FABRICATION AND WELDING TRADE SKILLS NEED OF TECHNICAL COLLEGE STUDENTS IN AKWA IBOM STATE, NIGERIA

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ABSTRACT

The study determined the fabrication and welding trade skills need of technical college students in Akwa Ibom State. Two specific purposes, two research questions and two null hypotheses were formulated to guide the study. Survey research design was adopted for the study. The population of the study comprised 235 fabrication and welding trade students in senior technical two (ST 2) and 14 instructors in technical colleges in Akwa Ibom State. Purposive Sampling technique was used since the population was not too large. A total of 205 copies of the questionnaire were completely filled and used for data analysis. Fabrication and Welding Trade Skills Need Questionnaire (FWTSNQ) was used for data collection. The instrument was validated by two experts of Fabrication and Welding Trade and one Expert of Test and Measurement in the Faculty of Education, University of Uyo. The reliability of the instrument was .84 which was established using Cronbach Alpha method. Mean, standard deviation and independent t-test were used for data analysis. Findings of the study revealed that technical college students need arc welding and soldering skills to a great extent. And there is no significant difference in the mean responses of technical college students and instructors on the extent to which technical college students need arc welding and soldering skills. It is recommended among others that fabrication and welding workshops should be equipped with modern tools, machines, equipment and materials.

KEYWORDS: Fabrication and welding trade, skills need, technical college students, Nigeria

Introduction

The need for effective skills acquisition leads to the establishment of technical colleges. One of the primary concerns of technical education according to Okoro (2006) is to bring about economic and technological development through adequate training of students who would be able to acquire the skills, knowledge and values that are needed for effective performance in the world of work. Fabrication and welding trade involves theoretical and practical aspects. The learning process primarily takes place in the workshop and laboratory. Laboratory sessions provide hand-on training on fabrication and welding equipment to reinforce the lesson taught in the class.

Practical skills (psychomotor/manipulative) are those skills performed by hands or human intervention using tools, machine/equipment. Practical skills primarily require manual dexterity although an understanding of principles, process and sequence are also essential

especially for more complex practical skills. Iyare (2014) defined skill as the human capability to technical work efficiency with dexterity and competence. He further described skill as the ability to perform an act expected. It is the expertness, practical ability or proficiency displayed in the performance of task.

Fabrication, according to Akpan (2010), is the art of construction, building, forming or assembling of an object or an article. Metal fabrication is a process of blue print reading, layout, cutting and preparing metallic materials for assembly of welding (Spokane Community College, 2013). Welding is the process of joining pieces of metals together by the use of heat produced at the tip of electrode if electric welding is used or by heat produced by gas flame if gas welding or oxy-acetylene is used to melt the edges or parts of metals together (Akpan, 2010). There are over forty different welding processes but only a few are widely practised in Akwa Ibom State. These welding processes include: gas (oxy-acetylene) welding and arc welding.

In arc welding process, according to Parmer (2010), coated electrodes are used for producing an arc to act as a heat source, the covering on burning provides the necessary shield to protect the molten metal from the ill effects of oxygen and nitrogen from the surrounding atmosphere. Arc welding is the process of joining metals by using heat of an electric arc but without pressure. It is the process in which metal pieces are joined by heating the metals to a suitable temperature of about 5000^0C to cause the pieces to meet and fuse together into a single piece.

In arc welding, the intense heat needed to melt metal is produced by an electric arc. The arc is formed between the actual work and an electrode that is manually or mechanically guided along the joint. The electrode can either be a rod or wire that not only conduct the current but also melts and supplies filler metal to the joint. Most welding in the manufacture or steel products uses the second type of electrode. An arc is created across the gap when the energized circuit and the electrode tip touch the work piece and is withdrawn, yet within close contacts (Kopeliotch, 2014; Hart, 2014).

One of the first lessons to be mastered when learning arc welding is to produce an arc between the metal electrode and the base metal. To strike an arc, according to Althouse, Turnquist and Bowditch (2015), the electrode must first touch the base metal, and the end must then be withdrawn to the correct arc distance or length. The authors maintained that arc should be started by drawing a rather long arc momentarily to pre-heat the base metal before deposition of filler material (electrode) starts to insure through fusion when beginning to weld. This may also be accompanied by moving a short arc rapidly backward and forward over a limited area at the start.

Before attempting to weld any type of seam in any position, practices laying are beads on a similar piece of metal of the same thickness as that to be welded. The students must be able to lay several excellent arc beads before proceeding to make the various types of welds (Althouse, Turnquist and Bowditch (2015). An arc bead is produced by first creating the arc. The arc is made by touching the end of the electrode lightly to the metal and withdrawing it to the proper distance (gap). The gap varies with the size and type of electrode used.

Welds made in the flat position are the easiest to make. However, it is often necessary to make welds in various other positions. The recognized positions are flat position welding, horizontal position welding (fillet weld), vertical position welding and over head position welding. In arc welding, there are five basic types of joints or ways of arranging the base

metals to be joined in relation to one another. These include: butt joint, lab joint, corner joint, T-joint, edge joint. The edge preparation and method of welding may vary with each joint classification (Althouse, Turnquist and Bowditch, 2015).

Soldering is a process of joining metal pieces usually in the form of overlapping joints by making a filler metal flow into the gap between them by capillary action. The filler used is called a solder and has a melting point lower than 450^0C (Parmer, 2010). Soldering is a term applied to fastening two metals, either like or unlike, together with another metal entirely different from either or both of the base metals. Soldering fastens two metals together without melting either of them. The theory of soldier is that using clean surfaces the binding or joining metal, upon becoming molten, adheres to the parent metal by means of molecular attraction (Althouse, Turnquist and Bowditch, 2015).

According to Thompson (1992), making a soldered joint can be divided into five steps:

1. Shaping the metal parts so that they fit closely together;
2. Cleaning the surfaces to be joined with a special substance;
3. Applying the soldering flux;
4. Applying molten solder; and
5. Removing surplus solder and cooling the joint.

Thompson (1992) explained that the reason for cleaning the surface is to expose the bare metal and make it free from grease or oxide which would otherwise prevent the solder from adhering to the metal. To set the surface really clean, it is necessary to apply some substance which will remove any remaining particles of foreign matter.

Althouse, Turnquist and Bowditch (2015) contended that several things need to be done in order to produce successful soldering. These are:

1. Metals to be soldered together must be chemically clean. All the oxides, grease and dirt must be removed.
2. Metals to be soldered together must be heated;
3. Metals to be soldered must be firmly supported during the soldering operation;
4. The proper flux must be used;
5. The solder should be melted only by the heat in the metals to be soldered together;
6. The soldering operation should be done as quickly as possible;
7. An excess of solder is useless and unsightly;
8. The solder flux should be removed from the joint as thoroughly and as soon as possible after the soldering operation is completed.

Fabrication and welding trade is very demanding everywhere in the world, as such students need indepth knowledge of fabrication and welding skills. Those skills according to Akwa Ibom State Technical Schools Board (2011) among others include arc welding skills, soldering skills, cutting skills, measuring skills and metal surfacing skills. The researcher observed that if these skills are well imparted to the students, their manipulating skills will become enhanced and they would graduate as qualified welders utilizing knowledge and skills gained.

Performance in this study relates to students' performance in practical skills taught in Akwa Ibom State Technical Colleges. The quality of students' performance in Akwa Ibom State Technical Colleges led to the following questions: Do the colleges alert their students to the fabrication and welding skills need for employability in the world of welding occupations? Do the instructors really follow the NBTE minimum guide in equipping the students? Is there

any school-industry relationship with respect to welding and fabrication skills needed by students for employability in the world of work? There are no ready answers to the above questions. The absence of readily obtained answers to the questions has constituted the theoretical rationale for this investigation.

Statement of the Problem

The researcher observes that unemployment was not a serious issue among graduates of technical colleges in the 1980's. During this period anyone who possessed West African Examination Council (WAEC), technical certificate or its equivalent from any technical college would get paid employment. These graduates were absorbed by various companies because they were equipped with relevant skills for employment. However, it is observed that many graduates of technical colleges now do not acquire sufficient skills needed for gainful employment and job creation. Employers consistently complained about poor performance among these graduates. A close look at technical colleges in the state shows that the environment in which the students are trained is not a replica of the working environment which they will subsequently serve. Most of the fabrication and welding equipment in these colleges are limited in number to cater for the needs of the students. The students lack arc-welding and soldering skills that are suitable in the world of work. It is on these bases that the researcher conducted the study to determine the fabrication and welding trade skills need in arc-welding and soldering by technical college students for job creation in Akwa Ibom State.

Purpose of the Study

The purpose of the study was to determine the fabrication and welding trade skills need by technical college students for job creation in Akwa Ibom State. specifically, the objectives are:

1. To determine the extent to which technical college students need arc welding skills in fabrication and welding trade.
2. To examine the extent to which technical college students need soldering skills in fabrication and welding trade.

Research Questions

The following research questions were answered in the study.

1. To what extent do technical college students need welding skills in fabrication and welding trade?
2. To what extent do technical college students need soldering skills in fabrication and welding trade?

Null Hypotheses

The following null hypotheses were tested at .05 significant level.

H_{01}: There is no significant difference in mean response of technical college students and instructors on the extent to which technical college students need arc welding skills in fabrication and welding trade.

H_{02}: There is no significant difference in mean response of technical college students and instructors on the extent to which technical college students need soldering skills in fabrication and welding trade.

Significance of the Study

The findings of this study would be of benefit to the students, instructors, parents, educational researchers, curriculum developers and the society. The acquisition of sufficient skills, arc welding and soldering will prepare the students for economic self reliance and job creation. The instructors of fabrication and welding would see the need for correct teaching approach to impart these skills, knowledge and competences need for job placement and entrepreneurship.

Research Method

Design of the Study

Survey design was employed for the study. The design was considered suitable because the study sought to observe the difference in the mean response of technical college students and instructors on the fabrication and welding skills need.

Population of the Study

The population of the study was 249. It comprised 14 instructors of fabrication and welding trade and 235 senior technical two (ST 2) students of fabrication and welding trade from six technical colleges of Akwa Ibom State.

Sample and Sampling Technique

Purposive sampling technique was adopted since the population was not too large. There was no sampling. The total population was 249 but the total of 205 copies of questionnaire were completely filled and used for the data analysis.

Instrumentation

The researcher-developed instrument captioned "Fabrication and Welding Trade Skills Need Questionnaire (FWTSNQ)" was used to collect data for the study. The instrument consisted of section A and B. Section A was meant to gather information on personal data of the respondents while section B contained 18 structured items to elicit information on arc welding and soldering skills need. The instrument was rated on a five point scale of Very Great Extent (VGE), Great Extent (GE), Moderate Extent (ME), Little Extent (LE) and Very Little Extent (VLE) with the assigned score of 5, 4, 3, 2, and 1 respectively.

Validation and Reliability of the Instrument

The instrument for the study was face validated by two experts of fabrication and welding and one expert of test and measurement in the Faculty of Education, University of Uyo. The input and suggestions made by these experts were used to modify the instrument. The instrument was administered on 30 students who did not participate in the actual study. Cronbach Alpha was used to estimate the reliability coefficient of the instrument which was .84.

Method of Data Analysis

Thes data collected for the study was analysed using mean and standard deviation to answer research questions while t-test was used to test hypotheses at .05 alpha level.

Decision Rule: Decision on the extent to which a specific fabrication and welding skills was needed by students of technical colleges was based on the real limits of the response values as follows:

Response options	Value	Real limits
Very Great Extent (VGE)	5	4.50 – 5.00
Great Extent (GE)	4	3.50 – 4.49
Moderate Extent (ME)	3	2.50 – 3.49
Little Extent (LE)	2	1.50 – 2.49
Very Little Extent (VLE)	1	0.50 – 1.49

In order to test the null hypotheses, if the calculated t-value is greater than the critical t-value, the null hypothesis is rejected but if the calculated t-value is less than the critical t-value, the null hypothesis is maintained.

Results and discussions

Answering of Research Questions

Research Question 1

To what extent do technical college students need arc welding skills in fabrication and welding trade?

Table 1: Mean analysis of the extent to arc welding skills need in fabrication and welding trade

$n_1 = 13$ $n_2 = 192$

S/N	Items	$\overline{X}$	SD	$\overline{X}$	SD	Combined Mean	Extent of Skill Needed
1	Select suitable electrode for the materials	4.23	.83	4.29	.82	4.26	Great Extent
2	Strike an arc	4.44	.52	4.06	1.02	4.25	Great Extent
3	Run a straight bead	4.31	.63	3.97	1.03	4.14	Great Extent
4	Arc weld a lap joint	4.15	.80	3.99	.98	4.07	Great Extent
5	Arc weld a joint in a vertical downward position	4.31	.63	4.05	1.10	4.18	Great Extent
6	Arc weld a joint in a vertical upward position	4.38	.65	4.35	.79	4.36	Great Extent
7	Arc weld a joint in a horizontal position.	4.31	.63	4.30	.92	4.30	Great Extent
8	Arc weld a joint in an overhead position	4.23	1.17	4.27	.90	4.25	Great Extent
9	Arc weld in a flat position	4.23	.65	4.18	.98	4.28	Great Extent
	Grand Mean	4.29		4.16			Great Extent

n_1 = number of instructors; n_2 = number of students

Data analysis in Table 1 indicates that the mean values of the responses of instructors and students for item 1 to 9 fall within the mean range of 3.50 – 4.49. The grand mean values of the responses of instructors and students are 4.29 and 4.16 respectively. The results also show their corresponding values of the standard values. Differences exist in the mean value for instructors and students. The analysis of data indicates that technical college students need arc welding skills in fabrication and welding trade to a great extent.

Research Question 2

To what extent do technical college students need soldering skills in fabrication and welding trade?

Table 2: Mean analysis of the extent of soldering skills need in fabrication and welding trade

		$n_1 = 13$		$n_2 = 192$			
S/N	**Items**	$\overline{X}$	**SD**	$\overline{X}$	**SD**	**Combined Mean**	**Extent of Skill Needed**
10	Clean materials to be soldered thoroughly with wire brush	4.23	.06	4.09	.87	4.16	Great Extent
11	Select correct soldering iron for hard soldering	4.38	.51	4.05	.88	4.21	Great Extent
12	Heat the soldering iron to the required temperature (600^0C to 750^0C) with Bunsen flame	4.08	.86	4.13	.94	4.10	Great Extent
13	Select correct flux for hard soldering	4.23	.93	4.28	.88	4.25	Great Extent
14	Apply flux to remove the oxide that forms on the heated surfaces	4.31	.95	4.18	.99	4.24	Great Extent
15	Support the materials to be soldered firmly	4.31	.63	4.03	.99	4.17	Great Extent
16	Shape the metal parts to closely fit together	4.23	.60	3.89	.92	4.06	Great Extent
17	Remove surplus solder from the joint	4.15	.90	4.14	.83	4.14	Great Extent
18	Cool the soldered joints with water	4.31	.94	4.23	.91	4.27	Great Extent
	Grand Mean	4.25		4.11			Great Extent

n_1 = number of instructors; n_2 = number of students

Data analysis in Table 2 shows that the mean values of the responses of instructors and students for item 10 to 18 are between the mean range of 3.50 – 4.49. The grand mean values of the responses of instructors and student are 4.25 and 4.11 respectively. The results show their corresponding values of the standard deviation. Differences exist in the mean values for instructors and students. The analysis of data reveals that technical college students need soldering skills in fabrication and welding trade to a great extent.

Testing of Hypotheses

Hypothesis 1

There is no significant difference in the mean responses of technical college students and instructors on the extent to which technical college students need arc welding skills in fabrication and welding trade.

Table 3: t-test Analysis of Difference on the Extent to which Technical College Students Need Arc Welding Skills N = 205

Variable	N	$\overline{X}$	SD	df	t_{cal}	t_{cri}	Decision
Instructors	13	41.09	13.38				
				203	1.43	1.96	NS
Students	192	35.69	9.62				

NS = Not significant at .05 alpha level

Data analysis in Table 3 reveals that the calculated t-value of 1.43 is less than the critical t-value of 1.96 at df of 203 and .05 level of significance. Hence, the null hypothesis is upheld. Therefore, there is no significant difference in the mean responses of technical college students and instructors on the extent to which technical college students need arc welding skills in fabrication and welding trade.

Hypothesis 2

There is no significant difference in the mean responses of technical college students and instructors on the extent to which technical college students need soldering skills in fabrication and welding trade.

Table 4: t-test Analysis of Difference on the Extent to which Technical College Students Need Soldering Skills N = 205

Variable	N	$\overline{X}$	SD	df	t_{cal}	t_{cri}	Decision
Instructors	13	43.18	6.27				
				203	1.10	1.96	NS
Students	192	40.06	9.62				

NS = Not significant at .05 alpha level

Data analysis in Table 4 indicates that the calculated t-value of 1.10 is less than the critical t-value of 1.96 at degree of freedom of 203 and .05 level of significance. Hence, the null hypothesis is accepted. Therefore, there is no significant difference in the mean responses of technical college students and instructors on the extent to which technical college students need soldering skills in fabrication and welding trade.

Findings of the Study

Analysis of data indicates that:

1. Technical college students need arc welding skills in fabrication and welding trade to a great extent. In addition, There is no significant difference in the mean responses of technical college students and instructors on the extent to which technical college students need arc welding skills in fabrication and welding trade.
2. Technical college students need soldering skills in fabrication and welding trade to a great extent. Besides, there is no significant difference in the mean responses of technical college students and instructors on the extent to which technical college students need soldering skills in fabrication and welding trade.

Discussion of Findings

Findings of the study indicated that technical college students need arc welding skills in fabrication and welding trade to a great extent. Besides, there is no significant difference in the mean responses of technical college students and instructors on the extent to which technical college students need arc welding skills in fabrication and welding trade. In support of the findings of the study, Hart (2014) asserted that intense heat needed to melt metal is produced by an electric arc. This is formed between the actual work and an electrode that is manually or mechanically guided along the joint. Arc welding may be done with direct current or with the electrode either positive or negative or alternating current. The choice of current and polarity depends on the process, the type of electrode and the metal being welded. Althouse, Turnquist and Bowditch (2015) maintained that the arc should be started by drawing a rather long arc momentarily to pre-heat the base metal before deposition of filler material starts to insure through fusion when beginning to weld.

Results of data analysis revealed that technical college students need soldering skills in fabrication and welding trade to a great extent. In addition, there is no significant difference in the mean responses of technical college students and instructors on the extent to which technical college students need soldering skills in fabrication and welding trade. The findings of the study is in line with the work of Althouse, Turnquist and Bowditch (2015) who maintained that metals to be soldered together must be chemical clean, metals to be soldered together must be heated, metals to be soldered must be firmly supported during the soldering operation, the solder should be melted only by the heat in the metals to be soldered together.

Educational Implications of the Findings

The educational implications of the findings of this study are that the identified fabrication and welding trade skills are essential to industries in Akwa Ibom State. Industries has found that welding is the most effective and economical means of fabrication and repairing of metal product.

Technical college students in fabrication and welding trade should be trained in the way they would be able to plan, layout work from drawing and specification and understanding of different kind of welding joint, position and their welding symbols. The recommendation made in this study when implemented would improve to a great extent the acquisition of skills in fabrication and welding as well as produce employable graduates who would be dynamic and keep abreast with emerging technologies and be in term with global best practices.

Conclusion

Based on the findings of the study, it is concluded that there is no significant difference in the mean responses of technical college students and instructors on the extent to which technical college students need arc welding and soldering skills in fabrication and welding trade. It could be inferred that fabrication and welding students in technical colleges needed fabrication and welding trade skills in a great extent in Akwa Ibom State to qualify them for gainful employment.

Recommendations

Based on the findings of the study, the following recommendations are made.

1. The fabrication and welding trade teachers and instructors in technical colleges in Akwa Ibom State should be trained and re-trained in line with emerging technologies and contemporary manpower requirements in the global workforce.
2. The school workshops should be well equipped with modern tools machines/equipment and materials for practical purpose by government and organisations for effective utilization for the attainment of programme objective.
3. The curriculum of fabrication and welding trade should be reviewed to include the new skills that have developed which are equally useful in the world of work.

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