CITC GLOBAL
Construction in the 21st Century
*11th International Conference (CITC-11)*
*September 9-11, 2019, London, UK*

Springer
SPRINGER NATURE

# Expectations from the welding curriculum based on the perspective of engineering technology graduates in Nigeria

Eghosa Eguabor[1] Clinton Aigbavboa[2]

1 Postgraduate School of Engineering Management, Faculty of Engineering and the Built Environment;
Professor and Vice Dean: Postgraduate Studies, Research and Innovation Environment;
caigbavboa@uj.ac.za

**Abstract.** Welding engineering technology is a key driving force in the growth and development of industrial activities, with its application dominant in a wide range of industrial sectors including structural engineering, transportation, agriculture, healthcare and aviation. Welding activities demand adequate skills from welding personnel due to the high level of accuracy and precision required to produce quality results in finished products as well adhering to strict safety regulations involved in its processes. The quality of skilled welding personnel lies in their training and re-training to meet the continually evolving technology space. Students of higher education in welding are expected to be well equipped with the theoretical and practical skills to fit into the constantly evolving work space, a feat which can partly be attributed to the content of its curriculum. This research aims at highlighting the outcome and expectations of graduates, from welding engineering technology curriculum in Nigeria based on their experience and highlight the expectations from the welding curriculum and its effect on graduate employability. The survey results from 122 respondents who are graduates of welding engineering technology from the Petroleum Training Institute Effurun, Nigeria was analyzed with the mean item score (MIS) and factor analysis. Results from the analysis revealed that graduates expect to be employment ready and also get immediate employment from industry based on their acquired skills. The outcome of this research is expected to add to the body of knowledge aimed at improving the welding curriculum to meet the demands of industry.

**Keywords**: Curriculum, Graduates, Fabrication, Industry, Welding

## 1 Introduction

Employability is described by many authors as complex and ambiguous to define [1] This is evident because it can be viewed from different perspectives as it concerns the

government, the employers, students, graduates and the providers of higher education. The complexity, however, will be slightly ignored in this literature as the focus is on the expectations of welding graduates and the content of the welding curriculum. In essence, it is about the employability of welding graduates and the potential of becoming gainfully employed after acquiring formal education. Knight and Yorke, [2] defined employability as "…a set of achievements, skills, understandings and personal attributes that make graduates more likely to gain employment and be successful in their chosen occupations which benefits themselves, the workforce, the community and the economy".

In other for graduates to fit into work positions on employment, they are expected to have the required knowledge that compliments the dynamic trends in technology [3]. Based on research findings, internships, part-time employment and related professional association membership are initiatives that can be employed by institutions to help improve graduate employability [3]

However, it is becoming a growing concern globally and Nigeria in particular that graduates are not ready for work. While some graduates lack the additional soft skills to fit into working environments, others lack the upgraded knowledge from their curriculum to fit into the requirements of employers [4]. Higher educational institutions are now integrating employability skills into their academic curricula.

The Nigerian labour market is certainly affected by the low level of employable graduates. Leigha, [5] describes the majority of graduates from higher institutions in Nigeria as "unemployable". He further stresses the need for the academia-industry partnership to strengthen the quality of graduates from higher institutions of learning.

As far as it concerns welding and fabrication, the quality of graduates has been a great concern to government and industry. In recent times, the Petroleum Technology Development Fund (PTDF) engaged in the re-training of welding and fabrication graduates to the International Institute of Welding standards. Oil and gas companies also have to re-train welding graduates to meet the requirements of projects [6].

The need to produce qualified graduates who are employable and meet the requirements of the industry and economic needs of a nation is now a global issue. There is no defined index to measure the employability of graduates but it is important to produce graduates with the right practical exposure, career training, ethics and professional conduct, and communication skills: in other words, ready-to-deliver graduates in the work place [7]. It is expected that course material should effectively assess the employability skills through its learning objectives, taking into consideration the specific discipline for which the training is designed.

The National Policy on Education of 1977 which is now in its sixth edition in 2013 has pioneered the reforms in education curriculum in Nigeria to promote the advancement of technical education to meet the socio-economic needs of the Nigerian polity [8].

## 2 Research methodology

This research is a survey study and adopted a questionnaire approach. Target respondents were graduates of the Petroleum Training Institute in Effurun Nigeria - a pioneer institution for the training and re-training of weding engineering technologists, to meet the demands of the oil and allied industries. Respondents were asked to indicate to what degree they agreed or disagreed on the expectations of industry form welding and fabrication graduates using a five point Likert scale (strongly agree = 5, agree = 4, neutral, = 3, disagree = 2, strongly disagree = 1). One hundred and twenty- two respondents completed the questionnaires out of a total of one hundred and fifty initially distributed via emails and hard copies, signifying an 80% response rate. Based on the distribution of the respondents, it was observed that the majority of respondents have between five to fifteen years post graduation work experience and also graduated between the year 2000 and 2009.

## 3 Welding and fabrication curriculum

The welding and fabrication curriculum is designed to meet the necessary training needs for the competencies needed to achieve a welder status at prescribed levels [9]. The curriculum is expected to set the requirements of the expected results on completion of training as well as influence the choice of both theoretical and practical learning activities in the course of training [10]. Teaching the art and skill of welding involves the physical and mental aspects of the trade, understanding when to use a particular welding process and why such a process should be used as opposed to another [11].

A welding curriculum should be created to evaluate and approve competency in the long run as this will ultimately determine the quality of welded product and the adherence to standards and procedures [12]. Competency levels need to be properly validated in the set-up of a welding curriculum and the process for the evaluation of students (trainees) competency level should be in place to check performance [13].The student should be seen to understand welding related terms and their application in the work place in which welding and fabrication is to be applied [14].

The welding curriculum at higher education level consists of various areas of study. These areas include, but are not limited to, welding processes, materials, design and non-destructive testing. The process aspect of welding curriculum consist of science of welding for processes such as manual metal arc welding (MMAW), oxy-fuel welding and other major welding processes. The welding curriculum also covers the physics of welding as well as other mechanical engineering science modules. The inclusion of general studies such as mathematics, entrepreneurial studies and citizenship education in a technical curriculum is also a major cause of discussion by some writers but its source of inclusion can be traced to government educational regulation and the type of institution

It is, however, pertinent to take into consideration the dynamic nature of welding and fabrication technology in the creation and update of its curriculum [15]. Trick, [16] highlighted the need for curriculum update which may very well include tutorials

and programmes on DVD and in the near future, subscription of curriculum via the Internet. This stresses the need for a near real time update of welding and fabrication curricula [17].

# 4 Presentation of findings

## 4.1 Mean item score for graduates' expectation of the welding and fabrication curriculum

Employment offers from the Oil and Gas Industry [C8.1] was ranked first with a MIS of 4.55 and SD of .834 while quality education/qualification in welding and fabrication engineering technology that is globally accepted [C8.2] was ranked second with a MIS of 4.09 and SD of .68; ranked third was exposure to a variety of career opportunities in Non-Destructive testing and related fields [C8.3] with a MIS of 4.02 and SD of .630 while employment from other industries in specific need for welding and fabrication graduates [C8.4] with a MIS of 4.02 and SD of .530 was ranked forth; in fifth ranking was graduates seeking the curriculum to provide familiar principles and concepts in work environment [C8.5] with a MIS of 3.98 and SD of 0.603 while employment into a position that suits their qualification [C8.6] was ranked sixth with a MIS of 3.98 and SD of .596; exposure to a variety of career opportunities in welding and fabrication [C8.7] was ranked seventh with a MIS of 3.93 and SD of .694 while ability to adapt to work environment on employment [C8.9]was ranked eighth with a MIS of 3.93 and SD of .632; employers satisfaction with output as an entry level employee [C8.9] was ranked ninth with a MIS of 3.89 and SD of .706 and in tenth ranking was career growth and development on employment [C8.10] with a MIS of 3.89 and SD of .592; graduates expect to be prepared to meet the challenges of the labour market [C8.11] was ranked eleventh with a MIS of 3.88 and SD of 0.663 while sufficient practical skills on employment [C8.12] with a MIS of 3.87 and SD of .802 was ranked twelfth; competitive advantage in the labour market [C8.13]was ranked thirteenth with a MIS of 3.85 and SD of .688; immediate Job preparedness on graduation [C8.14] with a MIS of 3.77 and SD of .907 was ranked fourteenth; sufficient theoretical skills on employment [C8.15] with a MIS of 3.75 and SD of .816 was ranked fifteenth and lastly ability to function on the job without further training [C8.16] with a MIS of 3.66 and SD of 0.933.

## 4.2 Results from Factor Analysis

Using factor analysis, variables were grouped and reduced-to a manageable scale- by identifying the relationships among variables, in other to generate theoretical constructs. A factorability of 0.3 indicates that approximately 30 per cent of the variables share a lot of variance and the test of correlation becomes impractical. Average communality of the variables after extraction is as shown below (Table 2)

**Table 2**: Communalities

| **Communalities** | | |
|---|---|---|
| | Initial | Extraction |
| C8.1 | .742 | .683 |
| C8.2 | .813 | .622 |
| C8.3 | .822 | .678 |
| C8.4 | .986 | .914 |
| C8.5 | .958 | .831 |
| C8.8 | .958 | .853 |
| C8.9 | .986 | .808 |
| C8.10 | .978 | .793 |
| C8.11 | .982 | .655 |
| C8.12 | .946 | .859 |
| C8.13 | .974 | .947 |
| C8.14 | .958 | .889 |
| C8.15 | .970 | .936 |
| C8.16 | .932 | .839 |

Extraction Method: Principal Axis Factoring.

To further verify the strength of inter-correlation among selected variables, the Barlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy are used [10].

KMO value of 0. 831 was obtained and Bartlett's test of sphericity has an approximate chi-square value of 3204.415 (considering 95% level of significance, $\alpha = 0.05$) and degree of freedom of 91 and a significant value of 0.00 which is $< 0.05$ [18]. The KMO statistic of 0. 831 was considered appropriate ($> 0.50$). Therefore, factor analysis is considered as an appropriate technique to further analyze the data.

Using varimax rotation with Kaiser normalisation, two factors were extracted from fourteen variables used in this study. These two extracted factors cumulatively explained 80.770 per cent of the variability on the aspect of the study relating to the graduates' expectation from the welding curriculum. Also, the combined percentages show 83.7 per cent of the total variance before rotation and 80.7 per cent of total variance after rotation, which was sufficient to explain the composite items of these variables. (See Tabe 2 beow) The following variables that were found to be highly correlated with Factor 1, but negligibly correlated with factor 2: Ability to adapt to work environment on employment (91.1%), prepared to meet the challenges of the labour market (88.6%), competitive advantage in the labour market (86.1%), exposure to a variety of career opportunities in welding and fabrication (80.9%), familiar principles and concepts in work environment (79.8%), career growth and development on employment (73.5%), exposure to a variety of career opportunities in non-destructive testing and related fields (72.8%), employment from other industries in specific need for welding and fabrication graduates (72.2%), quality education/qualification in welding and fabrication engineering technology that is

globally accepted (66.0%) and sufficient theoretical skills on employment (65.6%). These variables were jointly named: **"Ready-for-work" graduates.**

**Table 5**: Rotated Factor Matrix[a]

| **Rotated Factor Matrix[a]** | | |
|---|---|---|
| | Factor | |
| | 1 | 2 |
| C8.13 | **.911** | .343 |
| C8.4 | **.886** | .359 |
| C8.5 | **.861** | .301 |
| C8.9 | **.809** | .392 |
| C8.14 | **.798** | .502 |
| C8.16 | **.735** | .547 |
| C8.10 | **.728** | .513 |
| C8.3 | **.722** | .396 |
| C8.1 | **.660** | .497 |
| C8.11 | **.656** | .473 |
| C8.12 | .399 | **.837** |
| C8.2 | | **.758** |
| C8.15 | .617 | **.746** |
| C8.8 | .567 | **.729** |
| Extraction Method: Principal Axis Factoring. | | |
| Rotation Method: Varimax with Kaiser Normalization.[a] | | |

Also, the following variables based on the factor loading scores were considered as Factor 2, but negligibly correlated with Factors 1. Sufficient practical skills on employment (83.7%), employment offers from the oil and gas Industry (75.8%), employers' satisfaction with output as an entry level employee (74.6%) and employment into a position that suits their qualification (72.9%). These variables were thus named: **Immediate employment from oil and gas companies**

## 5 Discussion of results

Findings from the questionnaire survey results revealed that graduates expect immediate employment form the oil and gas companies as it was ranked highest among the factors in this section. Literature revealed that higher institutions across the globe are modifying their academic curricula to produce ready-to work-graduates rather than graduates with generic skills [17]. Also, Ojimba [8] highlights the need for specific training for specific industry needs while Pitan and Adedeji [15] highlight the need for Nigerian students in higher institutions to be well-grounded with relevant soft skills throughout the curriculum to facilitate employability on graduation. The quest by graduates to get immediate employment form the oil and gas industry is an

expected outcome form this survey considering that the respondents are inclined to receiving welding education to meet the demands of the oil and gas sector in Nigeria.

## 6 Conclusion

Graduates - and by extension industry- expectations from welding engineering curriculum is to provide the required knowledge in theory and practical necessary for employment. This can be achieved by creating a framework that enables the evaluation and continuous improvement of welding curriculum content to meet the constantly evolving welding technology space, as well as meet specific industry project needs. Future research may focus on such a framework that involves the key stakeholders in the industry as well as the academia.

## 7. References


1. 1.Tymon, A.. The student perspective on employability. *Studies in Higher Education,* 38(6):841-856. (2013)
2. Knight, P.T. and Yorke, M. Employability and good learning in higher education. Teaching in Higher education, 8(1), pp.3-16 (2003)
3. Kinash, S., Crane, L., Judd, M. & Knight, C. Discrepant stakeholder perspectives on graduate employability strategies. *Higher Education Research &Development,* 1-17. (2016)
4. Umunadi, E.K. Relational study of technical education in Scotland and Nigeria for sustainable skill development. *International Journal of Higher Education*, 3, (1): 49-57.(2014)
5. Leigha, M.B. Improving university education quality and graduate employability for industrial incorporation. *Development research (jecdr),* 2(3):108-116 (2014)
6. Ovadia, J.S. 2014. Local content and natural resource governance: The cases of Angola and Nigeria. *The Extractive Industries and Society,* 1(2):137-146
7. Datta, G.L. "Skill Development and Education Options in Welding Technology in India" in *Design, Fabrication and Economy of Metal Structures* Springer, pp. 615-620 (2013)
8. Ojimba, D.P. Vocational and technical education in Nigeria: Issues, problems and prospects' dimensions (IPP). *Journal of Educational and Social Research,* 2(9):23-30. (2012)
9. 9.Yeomans, S.R. & Atrens, A. A methodology for discipline-specific curriculum development. *International Journal of Engineering Education,* 17(6):518-528. (2001)
10. McCauley, C. *Forming Hartford Union High School's welding curriculum to meet local industries'needs.* Doctoral dissertation, University of Wisconsin – Stout (2000)
11. Joseph, S.Curriculum politics in higher education: What educators need to do to survive.*International Journal Of Higher Education*, 4(3): 14-20 (2015)
12. 12. Mathers, 10.3 Welder approval.In *Welding of Aluminium and Its Alloys.* Woodhead Publishing (2002)

13. Rojewski, J. W. Preparing the workforce of tomorrow: A conceptual framework for career and technical education. *Journal of Vocational Education Research*, 27(1): 7-35 (2002)
14. Cutshall, S. Welding done well. *Techniques:Connecting Education & Careers,* 76(3): 18- 19. (2001)
15. Pitan, O.S. &Adedeji, S. Skills mismatch among university graduates in the Nigeria labor market. Availabile online from <https://eric.ed.gov/?id=ED530695> [Accessed 11 August 2017] (2012)
16. Trick,K. *Proceedings of the 2014 AWS Welding Education, Skills, and Certificatio Conference*Hobart Institute of Welding Technology. p. 23 (2014)
17. Oliver, M.B., Jones, M.S., Ferns, M.S. and Tucker, M.B. Mapping curricula: ensuring work-ready graduates by mapping course learning outcomes and higher order thinking skills. In *A conference for university teachers* (p. 103) (2007)
18. Pallant, J. 2007. SPSS survival manual: A step by step guide to data analysis using SPSS. (3rd Edition) Mc-Graw Hill