Innovative Skills in Foundry Technology Required for Mechanical Engineering Graduates Entrepreneurship Development in Tertiary Institutions Amidst COVID-19 Pandemic in Rivers State

AMAECHI, O. JOSEPH (PHD)[1], THOMAS, CHINUJINIM GODSTIME[2]
[1] *Department of Industrial Technology Education, Faculty of Technical and Vocational Education, Ijnatius Ajuru University of Education, Port Harcourt, Rivers State*
[2] *Department of Industrial Technical Education, Schools of Technical Education, Federal College of Education (Technical), Omoku, Rivers State*

Abstract- ***The study investigated innovative skills in foundry technology required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state. Four research questions were raised and one null hypothesis formulated guided the study. The study adopted the descriptive design. The population was 329 comprised of 198 technicians and 131lecturers/instructors in six tertiary institutions in Rivers State. A questionnaire structured on 4-point rating scale was used for data collection. The instrument was validated by three experts one from School of secondary Technical Education, Federal College of Education (Technical) Omoku, and two other from faculty of education, Rivers State University, Port Harcourt. The reliability coefficient of .80 was obtained using Crombach Alpha formula. The data collected from the respondents were analyzed using descriptive mean and standard deviation to answer the research questions and z-test used to test the null hypothesis at 0.05 level of significance. The findings reveled that to a high extent, practical skills in pattern making, core making, moulding process, melting, molten metal handling and treatment skills were required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state. Hence recommendations were made.***

Indexed Terms- ***Foundry technology, Practical skills, Technical institutions, Entrepreneurship, COVID-19 pandemic.***

I. INTRODUCTION

Though, before the outbreak of the corona virus (COVID-19) pandemic, the outlook of the world economy was fragile, especially developing countries like Nigeria, as global gross domestic product (GDP) growth was estimated to be only 2,5 percent in 2020. Nigeria was ranked 21st among 181 countries in the 4th quarter of 2020, with an unemployment rate of about 33.3% and youth unemployment/underemployment rate of 42.5% (National Bureau of Statistics, NBS, 2021). The country was also rated as the poverty capital of the world with an estimated 87 million people living on less than $2 a day threshold. The corona virus (COVID-19) pandemic puts the world economy in state of jeopardy as economic activities were disrupted and restrictions of movement were imposed even as measures to contain the spread of the virus. Yet till date many countries, in fact, the world economies continues to battle for recovery from the dreaded effect of the pandemic.

Entrepreneurship education increases self-reliance of populations and makes them less dependent on an increasingly unpredictable job market. Entrepreneurship skills refers to the skills acquired from the type of training giving to individuals to start and nurture dynamic businesses that provide high value addition to the benefit of both the individuals and the society at large (Okwelle and Owo, 2017). Such skills when acquired, with innovations would help prospective self-employed individuals to start and grow their businesses that would not only add value to

their quality of life in this present economic situation but in the future.

Graduates need broad based innovative and technical skills that can help them adapt to the rapidly changing economic requirements as well as appropriate basic entrepreneurial skills which can enable them to benefit not just from the metal work industrial organizations and foundry industries, but also contribute their quota the development of in Nigerian economy (Nwokolo, 2010). In other words, the changing nature of the global economy and the world of work require that the youths should be trained on current employable and saleable skills that are relevant for self-reliance (Thomas and Amaechi, 2020).

Innovative skills are technical skills which are different from the conventional technical skills imparted to the technical college students. According to Cranmer (2014) these are skills ability and capacity acquired through deliberate, systematic and sustained effort to smoothly and adaptively carryout complex activities or job functions involving ideas (cognitive skill) things (technical skills) and/or people (interpersonal skills). In other words, innovative technical skills are skills expertise or technical competence related to the field of the worker, whether engineering or technical (Medina, 2011). Mechanical engineering graduates needed relevant innovative skills to identify symbols, to use measuring instrument, read blue print and perform competently in a giving practical task among others (Ehimen and Ezeora, 2018).

Foundry technology is among courses offered in mechanical engineering trades at the different levels in technical institutions in Nigeria (NBTE, 2016). Foundry technology training comprises of a blend of theory and practical skill contents that involve the use of tools, equipment and metal materials to melting the metals in furnace and moulding them into different shapes or objects (NBTE, 2011 and Park, 2012). It's also called metal casting, which involves the process of pouring molten metal into the mould to form it into a shape on cooling. The melting of metals is carried out in melting furnace of several kinds depending on the materials to be melted (Ludwig et al as cited in Medina, 2010).

According to American Welding Society (2013) some school workshops where little casting is done have a gas-fired furnace which can be used for melting metals such as lead, brass, aluminum and zinc at relatively low temperature. When higher temperature is needed, electric furnace called arc furnace is used. Ojio (2010) expressed that melting metal in a casting process is a systematic procedure which involves many stages and steps to be taken when melting metals. Thus: get the mould finished ready for pouring; place the mould near the melting furnace so that the melted metal can be poured quickly; get a pyrometer ready for measuring the furnace temperature; get a metal bar at least 76mm to be used as a slagging bar and scooped the slag off the top of the melted metal before pouring. Foundry technology provide students with practical skills that lead to production of goods and services among others (Oranu, Nwoke, Ogwo as cited in Emmanuel and Ariyo, 2014). To carry out foundry work processes and steps are involved, depending on the category of castings to be produced. This usually includes casting design, pattern making, material/alloy selection, sand preparation, moulding, melting the metal, casting, fettling, and to heat treatment and quality control processes all these form the production line in foundry operations (Abioye, 2018). Furthermore, the importance of the foundry technology in technological development and economic development of any nation cannot be underscored and the impact on the high value adding possibilities. The foundry industry is a main feeder to major manufacturing sectors that drive technological growth and most world economies usually depend on the stability of foundry and steel industries (Abioye, 2018).

Therefore, in the quest for technological development of any nation, the foundry industry should be considered as a high-value adding possibility. It produces major components for agricultural machines, machine tools, automobile, textile industries, power plants, industrial machinery, oil and gas equipment, cement manufacturing equipment, mining and quarry industry, railway equipment, construction industry and defense equipment (Jimoh & Abhulimen, 2013). Hardly can you think of any major machine or equipment which has no components that have been cast in a foundry. One can therefore rightly say that the

acquisition of foundry technology skill is basic to economic development and self-reliance.

Though in Nigeria, little has been invested to the development of the foundry industry for too long. This is one of the reasons for our over dependence on imported spare parts and machine components for such vital sectors of the economy as ship-building, railways, agriculture, cement industry, food processing, power generations (Jimoh and Abhulimen, 2013). It is an open secret that the few public foundries which are in existence such as the Nigerian Machine Tools, Ajaokuta Steel Company, Aladja Steel Company and Nigeria Railways Corporation are operating below-optimal levels, if they operate at all, because of lack of adequate working capital, trained manpower, stable power supply and infrastructure facilities. Foundry industry, like other enterprises requires adequate orientation and the right attitude towards profit making, financial controls and strategic planning. Foundries must be run-as money-making enterprises and casting must be priced competitively. Absence of strong local institutes which can provide solutions to industrial problems in such vital areas as quality control, new product development and production techniques and inadequacy of educational and training facilities for foundry engineers, technicians and craftsmen inhibits the smooth running of foundry enterprise in Nigeria.

The vitality in technical and vocational education institutions in Nigeria is that it offers its recipients functional, relevant and practical skills that enable the graduates to stand out as employer or be employed. That is why Federal Government of Nigeria enshrined entrepreneurship education as compulsory course for all technological students (FGN, 2013). The aim of the policy was to ginger in the students the entrepreneurial spirit that will help curb the increasing rate of unemployment, develop in the learners the entrepreneurial capacities and mindsets that will help them on graduation to recognize and exploit business opportunities and mobilize resources for self-employment (Akpan and Etor, 2013). However, for an individual to venture into a self-employed enterprise and flourish, they must acquire relevant entrepreneurship, technical and practical skills and competencies for self-employment (Barakabo and Suwari, 2016). Self-employment, entrepreneurship skills, technical and vocational job-specific skills can be acquired through the system of education offered in technical and vocational education institutions in Nigeria (FGN, 2013). This implies that students of technology education in addition to the acquisition of technical and vocational skills also receive entrepreneurship education for self-employment (Okwelle and Owo, 2017).

However, the scourge of unemployment seemed to be assuming a colossal dimension in Nigeria. This is a very worrisome situation that, the rate at which young people leaving school and seeking employment continuously out-paces the capacity of the economy to provide employment (Amaechi and Thomas, 2021). It seems that students who graduate from technical and vocational institutions acquire knowledge and practical skills without entrepreneurial skills that would enable them on graduation, practice what was learnt in school, create jobs for themselves and participate in economic development (Akpan and Etor, 2013). Maybe the technical and vocational institutions are doing little or nothing in giving the training that should enable them acquire relevant knowledge, skills and attitude for paid or self-employment in various occupations in the world of work (NBTE, 2011 and Emmanuel and Ariyo, 2014).

Therefore, for mechanical engineering students to be trained in foundry craft practice for self-reliance, self-sufficiency and self-employment in this post COVID-19 global economy. There is need to launch an investigation to the training and identification of innovative practical skills in this trade that are corresponding to the demands of this age, which when acquired by the graduates will easily leads them to become entrepreneurs.

- Statement of the Problem

Federal Government of Nigeria (FGN, 2013) stated that technical education would provide training and impart the necessary skills to students for self-reliance economically. Those trainees who have completed the technology and engineering programmes should be able to become self-employed and possibly employ others. That is why entrepreneurship, widely regarded as instrumental in creating economic growth. There is the constant need to align competencies with the needs of the labour market; society has started to recognize

the importance of entrepreneurs: men and women of initiative and creativity who make a valuable contribution to society.

On the contrary, the current educational and social aspirations of graduates are often oriented to finding a job in a large company or in the government (Thomas and Amaechi, 2020). Though, the education systems do not systematically form people with an entrepreneurial mentality. But learners can acquire the necessary information and skills about self-employment and the establishment of small enterprises. Without this training, there is a danger that nebulous notions of entrepreneurship may breed unreasonable and unpredictable expectations. Also, graduates of technical institutions who are supposed to be employers of labours may now be job seekers (Ehimen and Ezeora, 2018). Worse still, is the rate at which young people leaving school and seeking employment continuously out-pace the capacity of the economy to provide employment (Thomas and Amaechi, 2020).

It seems that students who graduate from technical institutions acquire knowledge and practical skills without entrepreneurial skills that would enable them on graduation, practice what was learnt in school, create jobs for themselves and participate in economic development (Akpan and Etor, 2013). For the graduates of mechanical engineering trades to develop the know-how and innovative skills that will qualify them as knowledgeable craftsmen, qualified technicians and professional engineers and enable them contribute to the industrial development of this country. The technical institutions must embark on the type of training of students at all levels that will guarantee self-employment and self-reliance upon graduation (Jimoh and Abhulimen, 2013).

Based on the back drop, it becomes pertinent to ask: what are the innovative skills in foundry technology required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state?

- Purpose of the Study

The purpose of the study was to investigate the innovative skills in foundry technology required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state. Specifically the study sought to:

1.
2. Find out the innovative skills in pattern making required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state.
3.
4. Determine the extent to which innovative skills in core making are required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state.
5. Examine the innovative skills in moulding process required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state.
6.
7. Ascertain the innovative skills in melting, molten metal handling and treatment required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state.

- Research Questions

The following research questions guided the study.

1. What are the innovative skills in pattern making required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state?
2. What are the innovative skills in core making required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state?
3. What are the innovative skills in moulding process required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state?
4. What are the innovative skills in melting, molten metal handling and treatment required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state?

- Hypotheses

The following null hypothesis (Ho) was formulated and tested at 0.05 level of significance in the study.

1. There is no significant difference in the mean ratings of metal work industry technicians and lecturers/instructors on the innovative skills in foundry technology that are required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state.

II. METHODOLOGY

The descriptive survey design was adopted for the study and the population was 329 respondents, comprising of 198 technicians from registered metalwork and 131 lecturers/instructors in six tertiary institutions in Rivers State. Foundry Skills for Entrepreneurship Development Survey (FSEDS) was the instrument used for data collection. It was structured based on 4 – point scale. The instrument was validated by three experts one from School of secondary Technical Education, Federal College of Education (Technical) Omoku, and two other from faculty of education, Rivers State University, Port Harcourt. Cronbach Alpha coefficient formula was used to determine the internal consistency of the instrument and the reliability coefficient value.80 was obtained, which represent a high reliability index for the study. Results were analyzed with descriptive mean and standard deviation while hypothesis were tested with z-test statistics at .05 level of significance.

III. RESULTS

Question 1

What are the innovative skills in pattern making required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state?

Table 1: innovative pattern making skills in foundry technology.

s/n	Description of Pattern Making Skills	Metalwork Technicians			Lecturers/ Instructors		
		$\bar{X}$	SD	RMK	$\bar{X}$	SD	RMK
1	Correctly use of protective equipment in the foundry shop.	3.57	.70	HR	3.15	1.06	HR
2	Identify and demonstrate the principle hazards control in the foundry and associated areas	3.65	.65	HR	3.31	.75	HR
3	Demonstrate the use of protective equipment in the foundry shop	3.43	.72	HR	3.15	1.03	HR
4	Demonstrate the use of simple hand tools and devices to produce a simple sand mould, observing safety rules and regulations	3.86	.40	HR	3.26	.76	HR
5	Observe safety regulations	3.43	.60	HR	3.24	.86	HR
6	Recognize tools, select suitable materials and produce different types of patterns for different objects.	3.45	.75	HR	3.23	.73	HR
7	Carry out pattern arrangement and layout on plates for moulding.	3.37	.79	HR	3.31	1.00	HR
8	Carry out calculations relating to pattern and casting weights estimation and cost, contraction allowances using simple mathematical principles.	3.21	.63	HR	3.15	1.06	HR
9	Draw, and design simple and complex patterns.	3.23	.71	HR	2.61	.99	HR
10	Select correctly materials for pattern making.	2.94	1.00	HR	3.37	.92	HR

Keys: No of metal work technicians = 150; No of lecturers / instructors = 116; $\bar{X}$ = Mean; SD = Standard deviation; HR = Highly Required

Data in table 1 showed that metal work technicians had a mean range of 2.94-3.86 and standard deviation range of .40-1.00 while the lecturers/instructors also had a mean range of 2.61-3.75 and standard deviation range of .73-1.06 in pattern making. The standard deviation showed the homogeneity in the respondents' opinion. This indicated that both respondents agreed that innovative skills in pattern making are highly required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state.

Question 2

What are the innovative skills in core making required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state?

Table 2: innovative core making skills in foundry technology

s/n	Description of skills in Core Making	Metalwork Technicians			Lecturers / Instructors		
		$\bar{X}$	SD	RMK	$\bar{X}$	SD	RMK
11	Take precautions against Linseed oil and the fast drying agent	3.02	.62	HR	3.76	.51	HR
12	Carry out simple calculations involving ingredients for mixing volumes used for moulding, test results, losses	3.55	.54	HR	3.63	.59	HR
13	Carry out tests such as: Moisture content, Silica and clay content, Shatter index. Dry strength. Permeability. Green strength and Sieve tests for build-up of fineness.	3.43	.72	HR	3.10	.87	HR
14	Carry out core-making using any of the processes	3.59	.60	HR	3.72	1.06	HR
15	Carry out tests on finished cores in Permeability, Green and Dry compressive strength. Green and Dry hot deformation and Shatter index	3.71	.61	HR	3.53	.61	HR
16	Operate core making machines mentioned and observe safety precautions	3.76	.44	HR	3.21	1.07	HR

Keys: No of metal work technicians = 150; No of lecturers / instructors = 116; $\bar{X}$ = Mean; SD = Standard deviation; HR = Highly Required

Data in table 2 showed that the metal work technicians also had a mean range of 3.02-3.76 and standard deviation range of .44-.72 while the lecturers/instructors had a mean range of 3.10-3.72 and standard deviation range .51-1.07. The standard deviations showed the homogeneity in the respondents' opinion. This indicated that both respondents agreed that innovative skills in core making are highly required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state.

Question 3

What are the innovative skills in moulding process required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state?

Table 3: innovative moulding process skills in foundry technology

s/n	Description of skills in Moulding Process	Metalwork Technicians			Lecturers / Instructors		
		$\bar{X}$	SD	RMK	$\bar{X}$	SD	RMK

17	Carry out simple calculations relating to liquid and metal static pressure and force	3.32	.80	HR	3.53	.67	HR
18	Make simple sketches of essential moulding Machines	3.65	.68	HR	3.71	.54	HR
19	Carry out knock-out operations by manual and mechanical means (use of intermittent and vibrating grits).	3.34	1.02	HR	3.78	.57	HR
20	Recognize and avoid the dangers of premature knock-out	3.26	.57	HR	3.65	.71	HR
21	Observe all safety measures involved in knock-out, cleaning and fettling operations	3.27	.83	HR	3.47	.70	HR
22	Make open and closed moulds	3.15	.80	HR	3.47	.75	HR
23	Make pouring cups, bushes basins, down sprue and sumps, simple slag arrester and simple runners and gates	3.24	.71	HR	3.55	.67	HR
24	Make simple sketches of moulding Arrangement	3.26	1.03	HR	3.53	.75	HR
25	Operate moulding machines of all Types	3.34	.86	HR	3.63	.59	HR
26	Maintain and take care of all moulding equipment in use	3.55	.67	HR	3.86	.49	HR
27	Apply plumbago, blacking, lampblack, talc, refractory materials Aluminium and Telurium paint, resinous coatings and inhibitors as facing materials	3.45	.93	HR	3.60	.61	HR
28	Use tumble barrels, shot blast cabinet and hydro blasts	3.23	.71	HR	3.29	.71	HR
29	Employ cranes, hoists, skips, pallets folk-lifts and conveyors for conveying finished products	3.21	.99	HR	3.00	1.02	HR

Keys: No of metal work technicians = 150; No of lecturers / instructors = 116; $\bar{X}$ = Mean; SD = Standard deviation; HR = Highly Required

Data in table 3 showed that metalwork technicians had a mean range of 3.15-3.65 and standard deviation range of .51-1.03. The lecturers / instructors had a mean range of 3.00 -3.86 and standard deviation range of .49-1.02. The standard deviations showed the homogeneity in the respondents' opinion. This indicated that both respondents agreed that innovative skills in moulding process are highly required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state?

Question 4

What are the innovative skills in melting, molten metal handling and treatment required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state?

Table 4: innovative melting, molten metal handling and treatment skills in foundry technology

s/n	Description of Melting, Molten Metal Handling and Treatment skills	Metalwork Technicians			Lecturers/ Instructors		
		$\bar{X}$	SD	RMK	$\bar{X}$	SD	RMK
30	Describe the construction and function of different furnaces mentioned	3.16	.81	HR	3.55	.61	HR
31	Distinguish melting losses and gains and be able to effect them by adding and removing during charge preparations	2.71	.79	HR	3.41	.77	HR
32	Carry out basic mathematical calculations involving	2.50	.97	HR	3.57	.57	HR

33	Apply heat transfer process, temperature gradient and heat diffusibility, its application to solidification and furnaces	3.03	1.05	HR	3.67	.62	HR
34	furnace linings, fire different types of furnaces and charge different types of furnaces available	3.32	.74	HR	3.78	.50	HR
35	Operate furnaces to ensure fuel Efficiency	2.95	.77	HR	3.45	.67	HR
36	Make up charges including fluxes and Covers	3.03	.90	HR	3.49	.70	HR
37	Carry out tapping operations	3.48	.78	HR	3.39	.75	HR
38	Carry out molten metal treatment	2.94	.72	HR	3.25	.77	HR
39	Operate and maintain Thermocouples, Optical and Total Radiation Pyrometers	3.31	.73	HR	3.41	.63	HR

Keys: No of metal work technicians = 150; No of lecturers / instructors = 116; $\bar{X}$ = Mean; SD = Standard deviation; HR = Highly Required

Data in table 4 showed that metalwork technicians had a 2.50-3.48 and standard deviation range of .72-.88 while the lecturers / instructors had a mean range of 3.25-3.78 and standard deviation range of .50-.77. The standard deviations showed homogeneity in the respondents' opinion. This indicated that both respondents agreed that innovative skills in melting, molten metal handling and treatment are highly required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state.

Hypotheses

HO: There is no significant difference in the mean ratings of metal work industry technicians and lecturers/instructors on the innovative skills in foundry technology that are required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state.

Table 5: t-test analysis skill in foundry technology

Respondents	$\bar{X}$	SD	N	P-value	df	t-Cal	t-Crit	RMK
Lecturers /Instructors	3.32	.73	116					
				0.05	217	1.32	1.69	No Sig
Technicians	3.37	.75	150					

Data in Table 5 showed that t-cal (1.32) is less than t-crit (1.69), hence the hypothesis stated was accepted. This means that there was no significant difference in the mean ratings of metal work industry technicians and lecturers/instructors on the innovative skills in foundry technology that are required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state.

IV. DISCUSSION

The results revealed that pattern making skills, core making skills, moulding process skills; melting, molten metal handling and treatment skills were highly required innovative skills in foundry technology for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state. The results further revealed no statistical significant difference in the mean rating of respondents on the innovative skills in foundry technology that are required for mechanical engineering graduates entrepreneurship development in tertiary institutions amidst covid-19 pandemic in Rivers state. one of the main industries prompting the development of world economy, is a process of melting metals and moulding them into different shapes (Park 2012). The findings is also in agreement with Medina (2010) when they observed that metal casting is a means of pouring melted metal into mould to form it into a shape on cooling.

CONCLUSION

Based on the findings of the study, it was concluded that foundry technology offers relevant innovative skills that are required for graduates to excel in entrepreneurship even in the face of covid-19 pandemic in Rivers state. The manpower needs of the 21st century labour market demands that young school leavers should be equipped with rather innovative skills and technical competencies that will ginger them to start their venture than to wait for scarce employment opportunities in Rivers State.

RECOMMENDATIONS

Base on the findings of study, the following recommendations were made:

1. Government should encourage non-government organizations (NGO) to sponsor and organized seminars, conferences, workshops and symposia for technical teachers and instructors in technical colleges in Rivers State to sensitize them on communicating the different relevant and innovative skills to students, as well as how these skills will lead them to be employers of labour, than being job seekers.
2. Administrators of technical colleges should always organize programmes to improve the quality of training given to students as these will help in addressing the issue of negative attitudes and perceptions of students towards technical education.

REFERENCES

[1] Abioye, A. A. *(*2018). A review on automotive industries and foundries in Nigeria.

[2] Akpan, C. and Etor, C. (2013). University lecturers' perception of entrepreneurship education as an empowerment strategy for graduate self-employment in South- South Nigeria.

[3] Amaechi, J. O. and Thomas, C. G. (2021). Innovative machine practice skills for mechanical engineering trades students' self-reliance in a post covid-19 economy in Rivers state. *International Journal of Advances in Engineering and Management (IJAEM), 3(12),* 14-21.

[4] Amaechi, J. O. and Thomas, C. G. (2020). Perceived relevance of practical skills in content development of motor vehicle mechanic works trade in technical colleges in Nigeria for global competitiveness. *Global Scientific Journal, 8(12),* 2165-2180.

[5] American Welding Society (2013). Advancing the science, technology, and application of *welding* and allied joining and cutting processes worldwide.

[6] Cranmer, J. K. (2014). Career centre, building the western Australian workforce by increasing government of Western Australia, department of training and workforce development.

[7] Ehimen, T. E and Ezeora, B. U. (2018).Metalwork practice skills needed by technical college graduates for sustainable employment in Edo and Enugu States of Nigeria. *International Journal of Education and Evaluation, 4, (6),* 37- 48.

[8] Emmanuel, O. E. and Ariyo, S. O. (2014). Assessment of the skills possessed by the teachers of metalwork in the use of computer numerically controlled machine tools in technical colleges in Oyo State. *Journal of Education and Practice, 5 (3),* 45-52.

[9] Federal Government of Nigeria (2013). *National policy on education (6th ed.).* NERDC Press.

[10] Folayan, S. A. (2010). Re-training needs of mechanical engineering technologist in manufacturing industries. *Journal of Technology Education, 7 (2),* 72 -76.

[11] Jimoh, I. and Abhulimen, A. (2013). Casting Technology and Developments. Nigeria as a Case Study. *International Journal of Scientific & Technology Research, 2 (11),* 231-239.

[12] Mahesh, N.S. (2013). Forging and Extrusion Process. http//www. ramaiahschoolofadvancedstudies.com

[13] Medina, G.R. (2011). Medina Construction Students put Skills to Work on Bind house. www.iiardpub.org

[14] National Board for Technical Education (NBTE) (2011). The development of national vocational

qualifications framework for Nigeria: A report of the national steering committee, NBTE Press. https://www.nbte.gov.ng/

[15] National Board for Technical Education (NBTE) (2016) Directory of accredited programmes offered in polytechnics, technical and vocational institutions in Nigeria, (18th ed.). https://net.nbte.gov.ng/sites/default/files/2021-05/2021%20DIRECTORY.pdf

[16] Nwokolo J.O., (2010). Training skills relevant for employment in metal work industries in Nigeria. The way forward. *Journal of Nigerian Vocational Association, 15 (1),* 28-39.

[17] Ojio, K.G. (2010). Re-evaluation of instructional resources for teaching metal works in secondary schools in Ekiti State. Thesis submitted to department of teacher education, university of Nigeria, Nsukka.

[18] Okwelle, P. C. and Owo, O. F. (2017). Skills Acquisition in Technical Vocational Education and Training: Tool for Sustainable Entrepreneurship Development of Electrical/Electronic Students in Polytechnics, Rivers State. *Book of proceeding for 2nd Annual Conference of the Faculty of Technical Education, Ignatius Ajuru University of education, Rumuolumeni, Port Harcourt.*

[19] Okwelle, P. C. (2011). Effective students' involvement in public relations: a strategy for improving enrolment into technical teacher education programme in Nigeria *American Journal of Social and Management Sciences*. http://www.scihub.org

[20] Park, R. M. (2012). Forging and stamping, encyclopaedia of occupational health and safety. A revision of the 3rd edition IOP Conference Series: Materials Science and Engineering Paper. Open Access. http://www.ohio.com/w/medina-constructionstudent-put-skills-to-work

[21] Yakubu, B. (2014). The Need for Competency in Metal Work Technology in Nigerian Technical Colleges. *Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS), 5(8),* 153-154.