



Relevant Foundry Craft Practice Skills for Technical College Students' Self-Employment in COVID-19 Pandemic Era in Rivers State

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJESS/2022/v27i430659

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/85804>

Original Research Article

Received 03 March 2022

Accepted 13 April 2022

Published 21 April 2022

ABSTRACT

The study examined relevant foundry craft practice skills for technical college students' self-employment in covid-19 pandemic era in rivers state. Four purposes and four research questions were raised and one null hypothesis formulated which guided the study. The study adopted the descriptive survey design. The population was 239 comprised of 180 technicians and 59 teachers/instructors in six Government Technical Colleges in Rivers State. A questionnaire structured on a 4-point rating scale was used for data collection. The instrument was validated by three specialists one from School of secondary Technical Education, Federal College of Education (Technical) Omoku, and the other two from faculty of education, Rivers State University, Port Harcourt. The reliability coefficient of .80 was obtained. The data collected from the respondents were analyzed using mean and standard deviation to answer the research questions. The findings revealed that to a high extent, practical skills in pattern making, core making, moulding process, melting, molten metal handling and treatment skills were relevant and innovative for technical college students' self-employment in covid-19 pandemic era in Rivers State. Hence, the study recommends government should promote the teaching and learning of foundry craft practice skills

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in Nigerian technical college to encourage students' self-employment on graduation, than being job seekers. School administrators, teachers and students should give foundry craft practice lessons the uppermost priority as a very relevant trade that can engender entrepreneurs in Rivers state.

Keywords: Foundry craft practice; practical skills; technical colleges; self-employment; COVID-19 pandemic.

1. INTRODUCTION

Corona virus (COVID-19) pandemic puts the world economy in a state of jeopardy in 2020, economic activities were disrupted and restrictions of movement were imposed as measures to contain the spread of the virus. Yet till date many countries, in fact, the world economy continues to battle for recovery from the dreaded effect of the pandemic. Though, before the outbreak of the 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% [1]. They further rated the country as the poverty capital of the world with an estimated 87 million people living on less than \$2 a day threshold.

This explains that the outbreak of COVID-19 pandemic widened the already existing unemployment problem in many nations, both the industrialized nations alike. In Nigeria, the scourge is assuming a colossal dimension and its 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 [2]. 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 [3].

Technical colleges are post primary institutions where students are given full vocational training that will enable them acquire relevant knowledge, skills and attitude for paid or self-employment in various occupations in the world of work [4,5]. Foundry craft practice is among courses offered in mechanical engineering trades at the Technical Colleges in Nigeria [6]. Foundry practice and 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 [4,7]. 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 (Medina, 2010).

According to American Welding Society [8] 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 craft practices provide students with practical skills that lead to production of goods and services among others (Oranu, Nwoke & Ogwo as cited in Emmanuel & 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 [9]. 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 [9].

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 [10]. 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 [10].

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 of technical and vocational education in Nigeria was that it offers its recipients functional, relevant and practical skills that enable the graduates to stand out as employer or be employed [11]. Government 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 [3]. 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 & Suwari, 2016).

Self-employment, entrepreneurship skills, technical and vocational job-specific skills can be acquired through the system of education offered by technical and vocational education in Nigeria (FGN, 2013). This implies that students of technical colleges in addition to the acquisition of technical and vocational skills also receive entrepreneurship education for self-employment [12]. They acquire relevant skills to identify symbols, to use measuring instrument, read blue prints and perform competently in a giving practical task among others (Ehimen & Ezeora, 2018). In other words, technical skills are skills expertise or technical competence related to the field of the worker, whether engineering or technical [13]. Skill is the 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) [14].

But it is a worrisome situation, that graduates of technical colleges who are supposed to be employers of labour are now job seekers (Ehimen & 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 [2]. This 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 [3]. Students of technical colleges need the know-how and relevant skills that will qualify them even as knowledgeable craftsmen, qualified technicians and professional engineers and 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 to the development of Nigerian economy [15]. Skills acquired in technical and vocational education trades; will provide and improve the standard of living with the insurance against poverty; self sustenance and will also sustain national and rural community development through youths' participation in techno-vocational skills acquisition programmes [16].

With the changing nature of Rivers state economy which is also ravaged by COVID-19 and the world of work require that the youths should be trained on current employable and

saleable skills that are relevant for self-reliance [17]. Students of technical colleges should be trained in foundry craft practice for self-reliance, self-sufficiency and self-employment in this era of COVID-19 in Rivers state. There is need to launch an investigation into the training and identification of relevant skills in this trade that corresponds to the demands of this age, which when acquired by the students will easily lead to self-employment in the foundry industry and in-turn contribute significantly to the growth of the state economy.

1.1 Purpose of the Study

The purpose of the study was to investigate relevant foundry craft practice skills for technical college students' self-employment in covid-19 pandemic era in rivers state.

Specifically the study determined:

1. Pattern making skills that are relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state.
2. Core making skills that are relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state.
3. Moulding process skills that are relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state.
4. Melting, molten metal handling and treatment skills that are relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state.

1.2 Research Questions

The following research questions guided the study.

1. What are the pattern making skills that are relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state?
2. What are the core making skills that are relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state?
3. What are the moulding process skills that are relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state?

4. What are the melting, molten metal handling and treatment skills that are relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state?

2. METHODOLOGY

The descriptive survey design was adopted for the study. The population of 239 was used as respondents, which comprised of 180 technicians from registered metalwork industries and 59 teachers/instructors in six Government Technical Colleges in Rivers State. There was no sampling because the population was of manageable size. Foundry Skills for Self-employment Survey (FSSS) was the instrument used to gather data. The instrument had 39 response items in four 4 subsections having 10 items, 6 items, 13 items and 10 items respectively designed to elicit information on relevant skills in foundry craft practice. It structured on a 4-point rating scale of 4 - Very Relevant, 3 - Relevant, 2 - Moderate Relevant, and 1 - Not Relevant. The instrument was validated by two experts in Department of Vocational and Technology Education in Rivers State University. Cronbach Alpha coefficient formula was used to determine the internal consistency of the instrument and the reliability coefficient value obtained was .80, which represents a high reliability index for the study. 239 instruments were administered, 225 instruments were retrieved and 219 found usable for analysis with mean and standard deviation to answer research questions.

3. RESULTS

3.1 Research Question 1

What are the pattern making skills that are relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state?

Data in Table 1 showed that respondents had a mean range of 2.94-3.86 and standard deviation range of .40-1.00 in pattern making. The standard deviation showed the homogeneity in the respondents' opinion. This indicated that respondents agreed that all pattern making skills that are very relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state.

Table 1. Relevant pattern making skills for technical college students' self-employment

s/n	Description of Pattern Making Skills	Respondents (N=219)		
		\bar{X}	SD	RMK
1	Correctly use of protective equipment in the foundry shop.	3.57	.70	VR
2	Ability to identify and demonstrate the principle of hazards control in the foundry shop and associated areas	3.65	.65	VR
3	Demonstrate the use of protective equipment in the foundry shop	3.43	.72	VR
4	Demonstrate the use of simple hand tools and devices to produce a simple sand mould, observing safety rules and regulations	3.86	.40	VR
5	Properly observe safety regulations when making pattern	3.43	.60	VR
6	Recognize tools, select suitable materials and produce different types of patterns for different objects.	3.45	.75	VR
7	Carry out pattern arrangement and layout on plates for moulding.	3.37	.79	VR
8	Carry out calculations relating to pattern and casting weights estimation and cost, contraction allowances using simple mathematical principles.	3.21	.63	VR
9	Draw, and design simple and complex patterns.	3.23	.71	VR
10	Select correctly materials for pattern making.	2.94	1.00	VR

Table 2. Relevant core making skills for technical college students' self-employment

s/n	Description of skills in Core Making	Respondents (N=219)		
		\bar{X}	SD	RMK
11	Take precautions against Linseed oil and the fast drying agent	3.76	.51	VR
12	Carry out simple calculations involving ingredients for mixing volumes used for moulding, test results, losses	3.63	.59	VR
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.	3.10	.87	VR
14	Carry out core-making using any of the processes	3.02	1.06	VR
15	Carry out tests on finished cores in Permeability, Green and Dry compressive strength. Green and Dry hot deformation and Shatter index	3.53	.61	VR
16	Operate core making machines proficiently while observing safety precautions.	3.21	1.02	VR

3.2 Research Question 2

What are the core making skills that are relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state?

Data in Table 2 showed that the respondents had a mean range of 3.02-3.76 and standard deviation range .51-1.06. The standard deviations showed the homogeneity in the respondents' opinion. This indicated that respondents agreed that core making skills are very relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state.

3.3 Research Question 3

What are the moulding process skills that are relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state?

Data in Table 3 showed that respondents had a mean range of 3.15-3.65 and standard deviation range of .51-1.03. The standard deviations showed the homogeneity in the respondents' opinion. This indicated that respondents agreed that moulding process skills are very relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state.

Table 3. Relevant moulding process skills for technical college students' self-employment

s/n	Description of skills in Moulding Process	Respondents (N=219)		
		\bar{X}	SD	RMK
17	Carry out simple calculations relating to liquid and metal static pressure and force	3.32	.80	VR
18	Make simple sketches of essential moulding Machines	3.65	.68	VR
19	Carry out knock-out operations by manual and mechanical means (use of intermittent and vibrating grits).	3.34	1.02	VR
20	Recognize and avoid the dangers of premature knock-out	3.26	.57	VR
21	Observe all safety measures involved in knock-out, cleaning and fettling operations	3.27	.83	VR
22	Make open and closed moulds	3.15	.80	VR
23	Make pouring cups, bushes basins, down sprue and sumps, simple slag arrester and simple runners and gates	3.24	.71	VR
24	Make simple sketches of moulding Arrangement	3.26	1.03	VR
25	Operate moulding machines of all Types	3.34	.86	VR
26	Maintain and take care of all moulding equipment in use	3.55	.67	VR
27	Apply plumbago, blacking, lampblack, talc, refractory materials Aluminium and Telurium paint, resinous coatings and inhibitors as facing materials	3.45	.93	VR
28	Use tumble barrels, shot blast cabinet and hydro blasts	3.23	.71	VR
29	Employ cranes, hoists, skips, pallets folk-lifts and conveyors for conveying finished products	3.21	.99	VR

Table 4. Relevant melting, molten metal handling and treatment skills for technical college students' self-employment

s/n	Melting, Molten Metal Handling and Treatment skills	Respondents(N=219)		
		\bar{X}	SD	RMK
30	Describe the construction and function of different furnaces mentioned	3.16	.81	VR
31	Distinguish melting losses and gains and be able to effect them by adding and removing during charge preparations	2.71	.79	VR
32	Carry out basic mathematical calculations involving	2.50	.97	VR
33	Apply heat transfer process, temperature gradient and heat diffusibility, its application to solidification and furnaces	3.03	1.05	VR
34	furnace linings, fire different types of furnaces and charge different types of furnaces available	3.32	.74	VR
35	Operate furnaces to ensure fuel Efficiency	2.95	.77	VR
36	Make up charges including fluxes and Covers	3.03	.90	VR
37	Carry out tapping operations	3.48	.78	VR
38	Carry out molten metal treatment	2.94	.72	VR
39	Operate and maintain Thermocouples, Optical and Total Radiation Pyrometers	3.31	.73	VR

3.4 Research Question 4

What are the melting, molten metal handling and treatment skills that are relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state?

Data in Table 4 showed that respondents had a mean range of 2.50-3.48 and standard deviation range of .72-.88. The standard deviations showed the homogeneity in the respondents'

opinion. This indicated that respondents agreed that melting, molten metal handling and treatment skills are very relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state.

4. DISCUSSION

The results in Table 1 revealed that pattern making skills are very relevant for technical college students' self-employment in covid-19

pandemic era in Rivers state. This finding is in line with findings of the study by Park [7] who stated that foundry is one of the main industries prompting the development of world economy, that pattern making is very relevant in the process of melting metals and moulding them into different shapes. It is also in agreement with Thomas & Amaechi [16] they found that skills acquired in technical and vocational education trades; will provide and improve the standard of living with the insurance against poverty; self sustenance and will also sustain national and rural community development through youths' participation in techno-vocational skills acquisition programmes. The finding is also in the view of Medina [13] when they observed that metal casting as a means of pouring melted metal into mould to form it into a shape on cooling requires different pattern for different shapes to be formed.

The results in Table 2 revealed that core making skills are very relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state. This finding is in agreement with Medina [13] who observed in their study that metal casting skills are means of making new products by pouring melted metal into mould to form it into a shape on cooling. It also conforms to the study by Park [7] who stated that foundry which is one of the main industries prompting the development of world economy, requires relevant skills in the process of core making, melting metals and moulding them into different shapes.

The results in Table 3 revealed that moulding process skills are very relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state. The finding of this study corroborates with the findings of Medina [13] technical skills are requisite for metal casting as a means of pouring melted metal into mould to form it into a shape on cooling.

The results in Table 4 revealed that melting, molten metal handling and treatment skills are very relevant for technical college students' self-employment in covid-19 pandemic era in Rivers state. This is in agreement with the finding by Amaechi & Thomas [17] their study found 91 practical skills relevant in content development of motor vehicle mechanic works in technical colleges in Nigeria for global competitiveness. Also agrees with Park [7] who stated that foundry which is one of the main industries prompting the development of world economy, is a process of melting metals and moulding them into different

shapes [7]. The finding is also in agreement with Medina [13] who found that when handling metal casting operations, technical skills are very relevant for pouring melted metal into mould to form a shape on cooling.

5. CONCLUSION

Foundry craft practice skills are very relevant for technical college students' self-employment in covid-19 pandemic era in Rivers. It could aid technical college students' standout and contribute meaningfully to development of the economy of the state.

The Foundry craft practice skills are very relevant in response to manpower needs of the 21st century labour market which demands young school leavers should be equipped with relevant skills and technical competencies that will ginger them to start their venture than to wait for scarce employment opportunities in Rivers State.

6. RECOMMENDATIONS

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

1. Government should promote the teaching and learning of foundry craft practice skills in Nigerian technical college to encourage students' self-employment on graduation, than being job seekers.
2. School administrators, teachers and students should give foundry craft practice lessons the uppermost priority as a very relevant trade that can engender entrepreneurs in Rivers state.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:

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