

# ENHANCING MECHANICAL TECHNOLOGY STUDENTS' SKILLS FOR SELF-RELIANCE AND ECONOMIC GROWTH IN RIVERS STATE TERTIARY INSTITUTIONS

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## Abstract

The development of any nation is closely linked to the social and economic contributions of its citizens, with education and vocational training playing pivotal roles in fostering community and national growth. In Nigeria, the economy has faced significant challenges due to heavy reliance on oil and importation of essential goods, resulting in declining non-oil sector productivity and overall GDP stagnation. Mechanical technology education, offered in higher institutions, is designed to equip students with practical skills, technical knowledge, and creative competencies necessary for industrial production, self-reliance, and national economic development. This discipline emphasizes hands-on experience with materials, tools, and machinery, preparing students to contribute meaningfully to industrial advancement and entrepreneurship. Despite its strategic importance, mechanical technology education in Nigeria has not received adequate attention, limiting its potential impact on sustainable economic development. This study highlights the capacity-building needs of mechanical technology students, advocating for enhanced training programs, modern infrastructure, and policy support to strengthen their competencies. By addressing these needs, tertiary institutions in Rivers State can empower students to drive self-reliance, stimulate industrial growth, and contribute to the broader socioeconomic development of the nation.

**Keywords:** Mechanical technology, capacity building, self-reliance, vocational education, economic development

## Introduction

The development of any nation hinges on the social and economic contributions of her citizens. Education, vocational and technical training play a major role at promoting community and national development (Oguntuyi (2016)). In the recent past, the Nigerian economy has witnessed a myriad of challenges occasioned by huge reliance on oil and imports of essential goods for both domestic and industrial consumptions. Oil and gas sector remains a potent driver of the Nigerian economy, which accounted for about 95% of the export earnings of the economy and 85% of government revenue (Ndudechinyere, Eze & Nweke, 2018). According to Focus Economics (2019), GDP has consistently fallen since 2015 as a result of a consistent fall in manufacturing productivity. Growth in the non-oil sector has been falling for quite many years and remains weak till date.

Mechanical technology is one of the vocational programmes offered in higher institutions. It is designed to produce mechanical technicians for production industry and for self-reliance. In mechanical technology according to Okparaeké in Abel (2021), students are expected to work with materials, tools, equipment and machines for production activities for economic development of the nation, Ogundele (2014) defines mechanical technology Education as “the aspect of knowledge, which involves special manipulative skills, creative minds, and attitudes required to practice a profession (occupation) for the benefit of that individual and the society at large. It promotes

and facilitates the acquisition of applied skills and basic scientific knowledge. It is planned programme of course and learning experiences that begin with the supports of basic academic and life skills and enables the achievement of high academic standards for industry and continuing education Ozoemena (2018). It cannot be over emphasized that mechanical technology education is part and parcel of the engine of economic growth. No nation can fight a war without the army. In the same vein, Nigeria cannot develop economically without well-equipped technical education institutions. Unfortunately, Nigeria does not seem to give mechanical education the attention it deserves. (Dike in Odo, Okafor, Odo, Ejikeugwu & Ugwuoke, 2017).

Mechanical technology education are used to define trades that are related to the cutting, forming or joining of metals (Sharma cited in, 2014). Skills in metal manufacturing have broad applications in virtually every aspect of modern society. Hence, it is the backbone of many occupations. Some occupations that depend on mechanical trades include agriculture, transport, commerce, building, equipment and appliances in business communication, electrical/electronics. It aims to ensure that students gain the appropriate skills in shaping metals for use in appliances, tools and machinery. Virtually any functional industry depends on the quality of mechanical trade personnel. Hence, there is a need for experts such as machinists, die makers, fitters and other allied skills.

An important element at the centre of any production activity and meaningful development is human capacity. People not only initiate and drive all economic and production activities, but also determine and control other resources that are involved in production. Developing countries all over the world have been making use of their comparative advantage in productivity and economic growth as a result of the strength of their education and human capital development programmes as these are considered fundamental key to any meaningful national development. According to the United Nations Development Project (UNDP) bulletin in Bassey and Saue (2021), Capacity building is the ability of individuals, organizations and societies to perform functions, solve problems, and achieve goals. Capacity development entails the sustainable creation, utilisation and retention of that capacity, in order to reduce poverty, enhance self-reliance, and improve people's lives. Human capacity building is a long-term continuing process of development involving all stakeholders including ministries, local authorities, non-governmental organizations, professionals, academics and many more stakeholders which entails the utilization of a country's human, scientific, technological, organizational, institutional resources and capabilities to achieve increased productivity. In the same vein, the World Health Organization (WHO) cited in Bassey and Saue (2021) posited that human capital development is the building and strengthening of human and institutional resources for effectiveness and increased productivity.

Ajayi; Oyebola; Olodude, & Adegbami (2016) opined that Capacity building is thus based on learning and acquisition of skills and resources among individuals and organizations. It is committed to sustainable development, to a long rather than short term perspective, and attempts to overcome the shortcomings of traditional way of doing things toward achieving individual and organizational development. While sustainable development is that "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Although, skills and knowledge can be acquired in various settings, but formal education systems play a paramount role in this connection. In other words, economic and sustainable developments are increasingly driven by the advancement and application of knowledge. Education in general

and higher education in particular, are fundamental to the construction of a knowledge economy and society in all nations

Students' capacity building for self-reliance and labour productivity and modern economic growth that is production-oriented, according to Ndudechinyere et al (2018), is largely based on improvement in the production processes, methods and strategies that are capable to transform the economy into a system of modern mass production necessary for sustained economic development and growth. According to the International Labour Organization in Banjo and Oludele (2020), the higher production capacity of the future generation can only be achieved through quality basic and higher education that is complemented with skill acquisition through training programmes such as technical and vocational education training (TVET), which mechanical technology education is part and parcel of.

### **Problem of the Study**

Mechanical technology education as a branch of technical education programme in higher Institutions is geared towards preparing her students for work. It is a suitable means of tackling the socio-economic challenges currently faced by the nation with respect to dwindling revenue, social unrest and increase in unemployment rate. Rivers State like any other state in Nigeria faces some challenges in its development plans and efforts to improve the quality of life of its citizens. In the view of Olufunmilayo (2017), There is no doubt in the fact that presently, majority of Nigerian youth especially able-bodied men and women are unemployed and even those who are employed, mostly do not have the necessary skills and capacity to sustain themselves should they be out of work. Invariably, poverty which is borne out of deficit in the technical capacity for sustainable development is rampant in the society. The critical economic issues concern the need to foster sustainable rapid economic growth that will cater for the needs of its large population and the imperative for proper integration of its domestic economy into the world economy in the face of increasing globalization (Tani and Kalus, 2019). The government recognizes that advancing good democratic governance is key to the political stability of the country. Overcoming the challenges of poverty, fighting corruption, meeting the basic needs of the people, inadequate and inefficient infrastructure and development of human resources and capital for sustainable growth and equity are critical social challenges that government is determined to address. It is on this note that the research looked into capacity building needs for mechanical technology education students' self-reliance and sustainable economic development in tertiary institutions in Rivers State

### **Purpose of the Study**

The study is aimed at capacity building needs for mechanical technology education students' self-reliance and sustainable economic development in tertiary institutions in Rivers State. Specifically, the study examined

1. Machine tool operational skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State.
2. Welding and fabrication skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State

### **Research Question**

The following research questions were used for the study.

1. What are the machine tool operational skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State?
2. What are the welding and fabrication skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State?

### Hypothesis

The following null hypotheses were tested at .05 level of significance:

1. There is no significant difference between the mean responses of lecturers and lab/workshop technologists on the machine tool operational skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State
2. There is no significant difference between the mean response of lecturers and lab/workshop technologists on the welding and fabrication skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State

### Methodology

The study was carried out in Rivers State, in the three tertiary institutions that offer mechanical technology education programmes. These tertiary institutions are Rivers State University Port Harcourt, Ignatius Ajuru University of Education, Rumuolomini, Port Harcourt, and Federal College of Education (Technical) Omoku River State in affiliation with University of Nigeria Nsukka. The design of the study was a descriptive survey. The population of the study comprised of 36 mechanical education lecturers and 16 workshop technologist in these tertiary institutions. From this population, all the Lecturers and workshop technologists were sampled for the study using purposive random sampling technique. The study adopted a two sectioned survey questionnaire tagged "Capacity building needs for mechanical technology education students' selfreliance and sustainable economic development in tertiary institutions in Rivers state" for the study. The instrument for data collection was face and content validated by three expert in the department of Industrial Technology Education in Ignatius Ajuru University of education Rumuolumini, Port-Harcourt. Rivers State, the instrument was structured in a four point rating scale of strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD). The reliability of the instrument was determined using Cronbach Alpha Reliability method, test after administering it to 8 lecturers as respondents in Niger Delta University Bayelsa state, who were not part of the study, the reliability coefficient achieved was 0.89. The researchers administered the questionnaires to the respondents directly and all the instrument were retrieved. Mean and Standard Deviation were used to answer the research questions while z-test statistical tool was used to test the hypotheses of the instrument. Mean value 2.50 was set as cut off point for mean less than 2.50 was rejected while mean value equal or greater than 2.50 was accepted.

### Results and Discussion

**Research Question 1:** What are the machine tool operational skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State?

**Table 1, means responses on machine tool operational skills required for mechanical technology students' capacity building,**

	Lecturers =36	w/s technologists= 16

s/n	Items	$\bar{x}_1$	SD <sub>1</sub>	Decision	$\bar{x}_2$	SD <sub>2</sub>	Decision			
1	Skills to calculate speeds, feeds, and depth of cut for various machine applications	3.44	.98	Agree	3.21	.56	Agree			
2	Skills to use carbides and other tool materials to increase productivity	3.97	.76	Agree	3.43	.73	Agree			
3	Skills to use arbor and shop-presses	3.87	.87	Agree	3.90	.89	Agree			
4	Knurling skills	4.33	.74	Agree	3.90	.72	Agree			
5	Skills to identify and use hand reamers accurately	3.99	.78	Agree	3.42	.89	Agree			
6	Skills to use reciprocating and horizontal band cutoff machines	4.55	.82	Agree	3.88	1.00	Agree			
7	Skills to prepare and use the vertical band saw	4.21	.91	Agree	3.90	.90	Agree			
8	skills to demonstrate the use of all controls on the vertical milling machine	3.90	.69	Agree	3.77	.83	Agree			
9	Skills to align the milling machine head and select, align and use work holding devices	3.41	.76	Agree	4.10	.91	Agree			
10	Skills to select, mount, and operate the milling cutters	4.11	.97	Agree	4.19	.78	Agree			
11	Skills to perform face and center drill parts correctly	3.22	.67	Agree	3.39	.91	Agree			
12	Skills to drill, ream, and bore on the lathe	2.90	1.00	Agree	3.44	.87	Agree			
13	Skills to make all calculations, adjustments and settings to machine sixty degree external threads	3.11	.78	Agree	3.99	1.11	Agree			
14	Skills to use HSS and carbide cutting tools correctly	3.64	.83	Agree	3.77	1.01	Agree			
15	Skills to setup the drill presses for drilling countersinking, counter-boring, and reaming operations	3.72	.91	Agree	4.10	.90	Agree			

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16 Skills to identify points using the incremental dimensioning system	3.91	.89	Agree	3.22	.81	Agree
17 Skills to determine unknown small, or large diameter for taper turning	4.00	.64	Agree	4,11	.73	Agree
<b>Total</b>	<b>3.78</b>	<b>.82</b>	<b>Agree</b>	<b>3.74</b>	<b>.85</b>	<b>Agree</b>

Source. Field survey, 2024

Table 1, on the machine tool operational skills needed for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State, shows that lecturers and workshop technologists agreed that all the items posted above, are machine tool operational skills needed for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State. This is based on the grand mean score of 3.78 and 3.74 respectively which is above 2.50 that was earlier stated as the acceptable means. Furthermore, the closeness in the standard deviation for the two groups which is .82 and .85 shows homogeneity in their responses.

**Research Question 2:** What are the welding and fabrication skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State?

**Table 2, means responses on welding and fabrication skills required for mechanical technology students' capacity building,**

s/n	Items	Lecturers =36			w/s technologists= 16		
		X <sub>1</sub>	SD <sub>1</sub>	Decision-x <sub>2</sub>	SD <sub>2</sub>	Decision	-
1	Skills to weld beads on plates, flat position without and with filler	3.22	.67	Agree	3.55	.76	Agree
2	Skills to perform oxy-acetylene cutting correctly	3.45	.89	Agree	3.98	.78	Agree
3	Skills to check accurately for part squareness before welding	3.89	.94	Agree	3.78	.89	Agree
4	Skills to weld a band saw blade	3.48	.69	Agree	3.55	.90	Agree
5	Skills to weld beads on plate E6010, E6011, and E7018 depending on availability	4.21	.71	Agree	3.67	.93	Agree
6	Skills to identify the use of a particular measuring tool based on tool characteristics	3.76	.94	Agree	4.11	.91	Agree
7	Skills to identify basic semi-precision measuring tools	3.45	.81	Agree	3.89	.96	Agree
8	Skills to weld all kind of joints	4.11	.90	Agree	3.89	.97	Agree

9	Skills to weld with Gas Tungsten Arc welding	3.87	.69	Agree	3.87	.69	Agree
10	Skills to weld with Gas metal arc welding	3.22	.58	Agree	3.56	.80	Agree
11	Skills to weld with shielded metal arc welding process	3.78	.77	Agree	4.11	.91	Agree
<b>Total</b>		<b>3.67</b>	<b>.78</b>	<b>Agree</b>	<b>3.46</b>	<b>.86</b>	<b>Agree</b>

Source. Field survey, 2024

Table 2, on the welding and fabrication skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State, shows that lecturers and workshop technologists agreed that all the items posted above, are welding and fabrication skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State. This is based on the grand mean score of 3.67 and 3.46 respectively which is above 2.50 that was earlier stated as the acceptable means. Furthermore, the closeness in the standard deviation for the two groups which is .78 and .86 shows homogeneity in their responses.

**Hypothesis 1;** There is no significant difference between the mean responses of lecturers and lab/workshop technologists on the machine tool operational skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State

**Table 3, z-text analysis on machine tool operational skills required for mechanical technology education students' capacity building**

Category	N	X	SD	DF	z-cal.	z-crit	Remark
Lecturers	39	3.78	.82	50	.84	2.01	Accepted
workshop technologists	16	3.74	.85				

Source, field survey 2024.

Data in table 3 above reveal that z-calculated (.84) is not greater than z-critical (2.01) at 0.05 level of significance. Therefore, the null hypothesis was accepted. Hence, there is no significant difference between the mean responses of technical education lecturers and technical education workshop technologists on the machine tool operational skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State

**Hypothesis 2,** Welding and fabrication skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State

**Table 4, z-text analysis on welding and fabrication skills required for mechanical technology education students' capacity building**

Category	N	X	SD	DF	z-cal.	z-crit	Remark
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Lecturers	36	3.67	.78				
Workshop technologists.	16	3.46	.86	50	.16	2.01	Accepted

Source, field survey 2024.

Data in table 3 above reveal that z-calculated (.16) is not greater than z-critical (2.01) at 0.05 level of significance. Therefore, the null hypothesis was accepted. Hence, there is no significant difference between the mean responses of technical education lecturers and technical education workshop technologists on the welding and fabrication skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State

### Conclusion

From the findings, it is concluded that Skills to calculate speeds, feeds, and depth of cut for various machine applications, Skills to use carbides and other tool materials to increase productivity, Skills to use arbor and shop-presses, Knurling skills, Skills to identify and use hand reamers accurately, Skills to prepare and use the vertical band saw, skills to demonstrate the use of all controls on the vertical milling machine, Skills to align the milling machine head and select, align and use work holding devices, Skills to select, mount, and operate the milling cutters, Skills to perform face and center drill parts correctly, Skills to weld with shielded metal arc welding process, Skills to weld with Gas metal arc welding, Skills to weld with Gas Tungsten Arc welding, Skills to weld all kind of joints, Skills to identify basic semi-precision measuring tools, Skills to identify the use of a particular measuring tool based on tool characteristics, Skills to weld beads on plate E6010, E6011, and E7018 depending on availability, Skills to perform oxy-acetylene cutting correctly, among others are the machine tool operational, and welding and fabrication skills required for mechanical technology education students' capacity building for self-reliance and sustainable economic development in tertiary institutions in Rivers State

### Recommendation

The following recommendations were made as it concern the study

1. Tertiary institutions and the Government should encourage staff (lecturers and workshop instructors) to upgrade their practical knowledge by periodically sending them into the industry to get acquainted with the current requirements of the work environment and the machine tool operational, as well as, welding and fabrication skills required for practical skill capacity building of mechanical technology education students' in tertiary institutions in Rivers State
2. Lecturers should concentrate more on building the practical skills than theoretical knowledge on the students
3. The relationship between the industries and the tertiary institutions should be strengthened to enable both the lecturers, workshop technologists and the students to acquainted with the recent machines and skills needed for capacity building

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