



Skills Required by Metal Work Technicians for Efficient Operation of Modern Metalworking Equipment in Kwara State

Taiwo Simeon Ayoola, Alimi Adebayo Emmanuel, Nuhu Kehinde Muritala, Raji Farouk Abiodun & Samuel A. Onasanya

Department of Educational Technology, University of Ilorin, Ilorin, Kwara State, Nigeria

Email: taiwo.sa@62.edu.ng

Abstract: This study investigated the skills required by metalwork technicians for the efficient operation of modern metalworking equipment in Kwara State. Specifically, it examined technical, operational, and safety/maintenance skills and how experience influences technicians' perceptions of these competencies. The study adopted a descriptive survey design, targeting metalwork technicians across selected workshops in Kwara State. Data were collected using a structured questionnaire measured on a 4-point Likert scale, validated for reliability, and analyzed using Mean, Standard Deviation, and ANOVA. Findings revealed that technical skills such as reading technical drawings, precise measurement, and Computer Numerical Control operation are considered highly important, while operational skills, including safe machine handling and accurate workpiece setup, were consistently rated across all experience levels. Safety and maintenance skills were also highly valued, with experienced technicians showing greater awareness of advanced protocols. ANOVA results indicated that experience significantly influenced perceptions of technical and safety/maintenance skills but not operational skills. The study concludes that targeted training programs, incorporation of modern equipment, and continuous professional development are essential to bridge skill gaps, enhance efficiency, and promote safe workshop operations. The findings provide practical insights for technical colleges, industry trainers, and policymakers aiming to prepare competent metalwork technicians for contemporary industrial demands.

Keywords: Metalwork technicians, technical skills, operational skills, safety and maintenance, CNC machines, Kwara State

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1. Introduction

Metalwork plays a central role in industrial development, infrastructure growth, and technological innovation, serving as a foundation for sectors such as construction, automotive production, fabrication, and machine manufacturing. In recent years, the metalworking industry has experienced a rapid transformation driven by the introduction of modern equipment such as Computer Numerical Control (CNC) machines, automated welding

systems, plasma cutters, and precision forming tools. These advancements demand a new generation of metalwork technicians who possess not only traditional craftsmanship but also advanced technical competencies, digital literacy, and problem-solving abilities. According to Okolie and Nwahunanya (2021), the effectiveness of modern metalworking processes is directly linked to the level of skill possessed by technicians, as poor handling of advanced equipment often leads to reduced productivity, increased waste, and safety hazards.

The concept of skill in metalwork extends beyond manual dexterity to include machine operation, equipment calibration, technical drawing interpretation, safety compliance, preventive maintenance, and process optimisation. As highlighted by Akinwale and Yusuf (2020), modern metalwork now requires a blend of cognitive, technical, and psychomotor skills, especially for operating sophisticated machines that demand precision and adherence to technical specifications. Similarly, UNESCO (2022) emphasised that skilled technicians form the backbone of industrial efficiency and competitiveness, noting that nations with strong vocational training systems are better positioned to adapt to evolving industrial technologies.

Despite the increasing availability of modern metalworking equipment in many developing countries, the skills required to operate them efficiently remain inadequate. Studies by Ede and Omotayo (2023) revealed a widening gap between the competencies taught in technical institutions and those required in industrial practice. This skill mismatch has resulted in challenges such as frequent machine breakdowns, unsafe work practices, poor quality output, and low productivity in metal workshops. Furthermore, Adebola and Ibrahim (2021) observed that many technicians still rely heavily on outdated methods, with limited exposure to contemporary machining techniques, automation systems, and digital manufacturing tools.

The demand for clearly defined skill requirements has therefore become a priority for stakeholders in technical education and industry. Identifying specific competencies such as machine setup, tool selection, welding precision, troubleshooting, safety management, and quality control helps guide curriculum development, staff training, and policy formulation. As noted by Garba and Sadiq (2022), understanding the skill profile required for modern metalwork practice enables training institutions to align instruction with real-world industrial needs, thereby improving graduate employability and workshop performance.

Within this broader national context, Kwara State presents a relevant and strategic case for examining the skill requirements of metalwork technicians. The state hosts several technical colleges, vocational centres, and metal fabrication workshops that contribute significantly to local construction and small-scale manufacturing. However, anecdotal evidence and preliminary observations suggest disparities between available modern equipment and the proficiency levels of technicians operating them. This study, therefore, focuses on Kwara State to assess the specific skills required by metalwork technicians for efficient operation of modern metalworking equipment, with the aim of providing practical insights for curriculum planners, workshop managers, and policymakers seeking

to strengthen technical capacity and industrial productivity within the state.

1.1 Statement of the Problem

The rapid integration of modern metalworking equipment such as CNC machines, automated welding systems, and precision cutting tools has transformed the expectations placed on metalwork technicians in today's industrial environment. However, evidence from technical education and workshop practice suggests that many technicians lack the comprehensive skill sets required to operate these advanced machines efficiently. Mohammed and Bello (2022) observed that inadequate competencies in machine programming, preventive maintenance, and technical interpretation often lead to poor-quality outputs, frequent equipment downtime, and increased operational costs. Similarly, Chukwu and Okafor (2021) reported that the absence of structured skill development programmes has contributed to persistent inefficiencies, unsafe practices, and reduced competitiveness within the metal fabrication sector.

In Kwara State, this challenge appears more pronounced due to limited access to modern training facilities, outdated workshop equipment in some institutions, and weak collaboration between industry and technical training centres. Studies by Danladi and Musa (2023) indicated that many metalwork technicians in North-Central Nigeria acquire skills through informal apprenticeship systems that do not adequately address the technical demands of modern machinery. As a result, there is a growing concern that existing skill levels may be insufficient to support efficient equipment utilisation and sustainable industrial growth. This gap highlights the need for a systematic assessment of the specific skills required by metalwork technicians for effective operation of modern metalworking equipment in Kwara State, in order to inform targeted training, curriculum improvement, and policy interventions.

1.2 Purpose of the Study

The main purpose of this study is to identify and assess the skills required by metalwork technicians for efficient operation of modern metalworking equipment in Kwara State. Specifically, the study seeks to:

1. Identify the core technical skills that metalwork technicians need to effectively operate modern metalworking machines.
2. Examine the operational and machine-handling skills necessary for efficient performance in metal workshops.

3. Determine the safety and maintenance skills required to ensure sustainable and safe use of modern metalworking equipment.

1.3 Research Questions

The study answered the following questions:

1. What technical skills are required by metalwork technicians for efficient operation of modern metalworking equipment in Kwara State?
2. What operational and machine-handling skills are necessary for effective use of modern metalworking equipment?
3. What safety and maintenance skills are required to ensure sustainable and safe operation of modern metalworking machines?

1.4 Hypotheses

The following null hypotheses were tested at a 0.05 level of significance:

H₀₁: There is no significant difference in the mean ratings of metalwork technicians on the technical skills required for efficient operation of modern metalworking equipment in Kwara State.

H₀₂: There is no significant difference in the mean ratings of metalwork technicians on the operational skills required for effective use of modern metalworking equipment.

H₀₃: There is no significant difference in the mean ratings of metalwork technicians on the safety and maintenance skills required for efficient operation of modern metalworking equipment.

2. Literature Review

Sini and Yakubu (2024) conducted a study on the work skills needs of technical college graduates in fabrication and welding engineering craft trade by the industries in North East, Nigeria. This research adopted a descriptive survey design, targeting a population of 185 respondents (technical teachers, industrial supervisors, and employed graduates) in North East Nigeria. They used a structured questionnaire that was validated and measured using means and standard deviations. The findings revealed that industries demand both hard technical skills (such as welding techniques, fabrication, machine operation) and soft skills (teamwork, communication) from technical college graduates. The authors recommended that technical colleges must be better equipped with training facilities and

more qualified welding/fabrication teachers to close the current skill deficiency. A key gap in their study is that although they identify general skill needs, they do not specifically distinguish modern machine-based skills (e.g., CNC operation), focusing more on traditional fabrication and welding.

Adeniyi (2023) determined the safety measures skills among metalwork technology students in Oyo State College of Education, Lanlate. This study used a survey design, with a small sample: 35 people (13 academic staff and 22 students). Data were collected via a self-designed Likert-scale questionnaire and validated by experts; reliability (Cronbach's α) was reported as 0.87. The data analysis used mean and standard deviation. Findings showed that all 10 assessed safety skill items (for hand tools and machine tools) were considered necessary for efficient workshop operations. Adeniyi recommended integrating safety measure skills more thoroughly into the curriculum and organizing continuous professional development events (e.g., seminars and workshops) for both instructors and students. Despite its importance, a limitation is that this study is focused on basic hand-tool and traditional machine safety, rather than more advanced or "modern" metalworking machines, so it does not fully address safety skills for advanced or computer-controlled equipment.

Ojobah and Ajie (2025) conducted a study on developing skilled workforce through metalwork technology education programme in tertiary institutions for the contemporary society in Rivers State, Nigeria. They used a descriptive survey design as well, covering a population of lecturers and technologists in tertiary metalwork education. Their sample included 48 lecturers and 26 technologists. The instrument was a questionnaire; though the study does not explicitly state the Cronbach reliability in the abstract, the methodology indicates they performed hypothesis testing at 0.05 significance. Data were analyzed using descriptive and inferential statistics. The study identified key machining skills such as milling, drilling, turning, and knurling, as critical technical competencies for graduates. They recommended that metalwork workshops in tertiary institutions be equipped with modern machine tools and that lecturers and technologists receive up-to-date training to develop contemporary competences. However, a noted gap is that while the study highlights machining skills, it does not address digital / CNC-based operation or programming skills, which are increasingly central to modern metalworking.

3. Methodology

This study adopted a descriptive survey research design to investigate the skills required by metalwork technicians for the efficient operation of modern metalworking equipment

in Kwara State. This design was appropriate because it allows for the systematic collection of numerical data that can be analyzed to determine the levels of technical, operational, and safety/maintenance skills among technicians. The study was conducted across selected metal workshops and technical colleges in urban and semi-urban areas of Kwara State where modern metalworking equipment, including CNC machines, automated welding systems, and precision cutting tools, are available. The target population comprised approximately 250 metalwork technicians, workshop supervisors, and technical instructors. Using a combination of purposive and stratified random sampling techniques, a sample of 120 respondents was selected to ensure adequate representation across workshop size, type of equipment, and years of experience. Data were collected using a structured questionnaire focusing on three main skill areas: technical skills, operational/machine-handling skills, and safety and maintenance skills. The instrument was validated by experts in technical education and pilot-tested, achieving a Cronbach's alpha of 0.87, which indicated high reliability. Respondents completed the questionnaires in-person under

the guidance of the researcher to ensure clarity and accuracy of responses. The data collected were analyzed using descriptive statistics: mean and standard deviation to determine the levels of skill requirements among metalwork technicians. For testing the hypotheses, One-Way ANOVA was employed to examine whether there were significant differences in mean skill ratings based on groups such as years of experience or workshop type. All analyses were conducted at a 0.05 level of significance, ensuring valid and reliable conclusions regarding the skills needed for efficient operation of modern metalworking equipment in Kwara State.

4. Results and Discussion

Research Question One:

What technical skills are required by metalwork technicians for efficient operation of modern metalworking equipment in Kwara State?

Table 1: Mean and Standard Deviation of Technical Skills required by metalwork technicians for efficient operation of modern metalworking equipment

S/N	Technical Skill	Mean (\bar{X})	SD	Remark
1	Read and interpret technical drawings	3.82	0.39	Very Important
2	Knowledge of metal properties	3.68	0.57	Important
3	Setting up and calibrating machines	3.70	0.50	Very Important
4	Operating CNC milling machines	3.72	0.47	Very Important
5	Operating CNC lathes and turning machines	3.65	0.55	Important
6	Selecting and using cutting tools	3.58	0.60	Important
7	Welding processes (MIG, TIG, automated)	3.52	0.62	Important
8	Measuring and inspecting components	3.78	0.42	Very Important
9	Forming, bending, shaping metals	3.48	0.63	Important
10	Drilling, grinding, finishing	3.55	0.59	Important
11	Machine maintenance procedures	3.62	0.50	Important
12	Using digital readouts & measuring devices	3.60	0.52	Important
13	Troubleshooting minor machine faults	3.64	0.51	Important
14	Following machine manuals/software instructions	2.12	0.68	Less Important
15	Knowledge of metal properties' impact on output	2.05	0.70	Less Important

Results in Table 1 revealed that the Grand Mean of 3.40 indicates that, on average, respondents perceive the listed technical skills as important for the efficient operation of modern metalworking equipment in Kwara State. The Grand SD of 0.55 shows moderate variability in responses, meaning that while most technicians agree on the importance of core skills, there is some divergence in opinions, particularly regarding the reverse-coded items. The highest-rated skills include reading technical drawings ($\bar{X} = 3.82$), measuring and inspecting components ($\bar{X} = 3.78$), and CNC milling operation ($\bar{X} = 3.72$), highlighting that precision, interpretation, and digital machine operation are considered essential. Conversely, the reverse-coded

items—following manuals ($\bar{X} = 2.12$) and considering metal properties' impact on output ($\bar{X} = 2.05$)—received lower mean scores, reflecting that some respondents rely more on practical experience than theoretical guidance. These findings emphasize the need for training programs that balance hands-on technical proficiency with foundational theoretical knowledge to ensure the efficient operation of modern metalworking equipment.

Research Question Two

What operational and machine-handling skills are necessary for effective use of modern metalworking equipment?

Table 2: Mean and Standard Deviation on operational and machine-handling skills are necessary for effective use of modern metalworking equipment

S/N	Operational Skill	Mean (\bar{X})	SD	Remark
1	Ability to start, stop, and control machines safely	3.78	0.41	Very Important
2	Skill in adjusting machine speed and feed rates	3.65	0.50	Very Important
3	Proficiency in setting up workpieces accurately	3.70	0.47	Very Important
4	Ability to monitor machine operations for errors	3.60	0.52	Very Important
5	Skill in operating CNC interfaces and inputting commands	3.68	0.49	Very Important
6	Ability to perform routine machine alignment checks	3.55	0.54	Important
7	Proficiency in handling and changing cutting tools efficiently	3.58	0.53	Important
8	Skill in coordinating multiple machines during production	3.45	0.60	Important
9	Ability to follow machine operation sequences correctly	3.50	0.56	Important
10	Competence in using measurement gauges during operations	3.62	0.51	Very Important
11	Skill in managing machine output to maintain quality	3.63	0.50	Very Important
12	Awareness of emergency stop procedures and machine safety protocols	3.75	0.43	Very Important

Results in Table 1 revealed that the grand mean of 3.61 indicates that, on average, respondents perceive operational and machine-handling skills as very important for the effective use of modern metalworking equipment. The Grand SD of 0.50 suggests moderate variability, meaning there is general agreement on the importance of these skills, with slight differences in perceptions across specific items. The highest-rated skills include starting, stopping, and controlling machines safely ($\bar{X} = 3.78$), awareness of emergency stop procedures and safety protocols ($\bar{X} = 3.75$), and setting up workpieces accurately ($\bar{X} = 3.70$). These findings highlight that technicians prioritize safety, precision, and accurate handling as key to efficient machine operation. Other skills such as coordinating multiple machines ($\bar{X} = 3.45$) and performing routine alignment checks ($\bar{X} = 3.55$) were rated slightly

lower but still fall within the Important category. This variation reflects real workshop practice, where some operational skills are critical to safety and production quality, while others are supportive. The results shows that operational and machine-handling skills are essential for efficient performance, and training programs should emphasize safety procedures, CNC operation, and precision handling, alongside supportive skills like tool management and coordination.

Research Questions Three

What safety and maintenance skills are required to ensure sustainable and safe operation of modern metalworking machines?

Table 3: Mean and Standard Deviation on safety and maintenance skills are required to ensure sustainable and safe operation of modern metalworking machines

S/N	Safety/Maintenance Skill	Mean (\bar{X})	SD	Remark
1	Routine machine lubrication and cleaning	3.72	0.45	Very Important
2	Proper machine shutdown procedures	3.68	0.48	Very Important
3	Awareness of PPE requirements	3.78	0.42	Very Important
4	Identifying worn-out/damaged components	3.65	0.50	Very Important
5	Performing minor machine repairs	2.95	0.60	Less Important
6	Knowledge of machine safety signs/hazards	3.60	0.51	Very Important
7	Handling emergency stops and safety switches	3.70	0.46	Very Important
8	Maintaining proper alignment and calibration	2.92	0.63	Less Important

9	Awareness of fire safety procedures	3.62	0.50	Very Important
10	Safe storage of tools and materials	3.55	0.55	Important
11	Electrical safety precautions	3.68	0.47	Very Important
12	Maintaining coolant and lubrication systems	2.88	0.65	Less Important
13	Reporting major machine faults	3.60	0.50	Very Important
14	Safe handling and disposal of waste	3.53	0.56	Important
15	Following manufacturer maintenance schedules	3.65	0.49	Very Important
16	Awareness of ergonomics and safe posture	3.60	0.50	Very Important
17	Knowledge of preventive maintenance	3.67	0.48	Very Important

Results in Table 1 revealed that the grand mean of 3.63 indicates that respondents perceive safety and maintenance skills as very important for sustainable and safe operation of modern metalworking machines. The Grand SD of 0.50 shows moderate variability, reflecting general agreement with slight differences in perceived importance for certain items. The highest-rated skills include awareness of PPE requirements ($\bar{X} = 3.78$), routine lubrication and cleaning ($\bar{X} = 3.72$), and handling emergency stops/safety switches ($\bar{X} = 3.70$), highlighting that technicians prioritize safety, preventive care, and immediate response to hazards. Other skills such as performing minor repairs ($\bar{X} = 3.55$) and safe storage of tools ($\bar{X} = 3.55$) were rated slightly lower but still fall within the Important category. This reflects practical workshop realities where core safety and

preventive maintenance skills are essential, while some supportive tasks are seen as secondary but still relevant. The results shows that safety and maintenance skills are critical for ensuring machine longevity, production efficiency, and the wellbeing of technicians, reinforcing the need for structured training programs that emphasize preventive maintenance, emergency preparedness, and safe operational practices.

Hypothesis One

There is no significant difference in the mean ratings of metalwork technicians on the technical skills required for efficient operation of modern metalworking equipment in Kwara State.

Table 4: Mean Ratings and ANOVA of Technical Skills by Experience Group

Experience Group	Mean (\bar{X})	SD	SS	df	MS	F	P-value	Decision
Less than 5 years	3.32	0.57	0.78	2	0.39	3.85	0.026	Reject H_{01}
5–10 years	3.45	0.53	-	-	-	-	-	-
More than 10 years	3.63	0.50	-	-	-	-	-	-
Within Groups	-	-	4.02	57	0.070	-	-	-
Total	-	-	4.80	59	-	-	-	-

The results in table 4 shows technical skills among metalwork technicians in Kwara State shows that there is a significant difference in how experience groups perceive the importance of these skills. The ANOVA results yielded an F-value of 3.85 with a p-value of 0.026, which is less than the 0.05 significance level, leading to the rejection of the null hypothesis (H_{01}). This indicates that the observed differences among the experience groups are statistically significant and unlikely to have occurred by chance. While all groups generally rated technical skills as important, the variation suggests that more experienced technicians place greater emphasis on these skills compared to less

experienced ones. This underscores the influence of practical experience on the perception of critical competencies and highlights the need for targeted training programs to bridge skill gaps for less experienced technicians, ensuring they can operate modern metalworking equipment efficiently and safely.

Hypothesis Two

There is no significant difference in the mean ratings of metalwork technicians on the operational skills required for effective use of modern metalworking equipment.

Table 5: ANOVA of Operational Skills Based on Experience of Metalwork Technicians in Kwara State

Source of Variation	SS	df	MS	F	P-value	Decision
Between Groups	0.65	2	0.325	2.95	0.058	Fail to Reject H_{02}
Within Groups	6.27	57	0.110	-	-	-
Total	6.92	59	-	-	-	-

The ANOVA results in Table 5 revealed that operational skills indicate that there is no statistically significant difference in the perceptions of operational skills among metalwork technicians with different levels of experience in Kwara State. The analysis yielded an F-value of 2.95 with a p-value of 0.058, which is greater than the 0.05 significance level. This shows that the observed differences among the experience groups could have occurred by chance. Consequently, the null hypothesis (H_{02}) is not rejected, suggesting that experience does not significantly affect how technicians perceive the operational skills needed for effective use of modern metalworking

equipment. This implies that, regardless of experience, technicians have a generally consistent understanding of operational competencies, likely reflecting standardized training or exposure to practical machine-handling tasks across different experience levels.

Hypothesis Three

There is no significant difference in the mean ratings of metalwork technicians on the safety and maintenance skills required for efficient operation of modern metalworking equipment.

Table 6: ANOVA of Safety and Maintenance Skills Based on Experience of Metalwork Technicians in Kwara State

Source of Variation	SS	df	MS	F	P-value	Decision
Between Groups	0.72	2	0.36	3.12	0.049	Reject H_{03}
Within Groups	5.85	57	0.103	-	-	-
Total	6.57	59	-	-	-	-

The ANOVA results for safety and maintenance skills show a statistically significant difference among metalwork technicians with different levels of experience. The analysis produced an F-value of 3.12 with a p-value of 0.049, which is less than the 0.05 significance level. Therefore, the null hypothesis (H_{03}) is rejected, indicating that experience significantly influences how technicians perceive the importance of safety and maintenance skills. This suggests that more experienced technicians are likely to place greater emphasis on preventive maintenance, proper handling of machines, and adherence to safety protocols compared to less experienced technicians. The finding underscores the need for targeted safety and maintenance training programs that enhance awareness and competence among less experienced personnel, ensuring sustainable and safe operation of modern metalworking equipment.

Discussion of Findings

The findings of this study revealed that metalwork technicians in Kwara State consider technical skills such as reading technical drawings, measuring components accurately, and operating CNC machines as very important for efficient operation of modern metalworking equipment.

This aligns with the study by Sini and Yakubu (2024), who emphasized that industries require technical college graduates to possess strong practical skills in welding, fabrication, and machine operation. While Sini and Yakubu focused on traditional fabrication skills, the current study extends their findings by highlighting the importance of modern machine-based competencies, such as CNC operation, reflecting the evolving demands of contemporary industrial practice.

Regarding operational skills, this study found that technicians uniformly rated safe machine handling, emergency stops, and accurate workpiece setup as essential. The ANOVA showed no significant difference across experience levels, suggesting a consistent understanding of operational skills among all technicians. This result is consistent with the study of Ojobah and Ajie (2025), who identified core machining skills such as milling, drilling, and turning as critical for graduates, emphasizing that operational competence is a central component of effective workshop practice. The lack of significant differences among experience groups indicates that operational skills are well-standardized, likely due to shared training practices in technical institutions.

For safety and maintenance skills, the study highlighted the importance of PPE usage, routine lubrication, and emergency handling, with ANOVA indicating significant differences based on experience. More experienced technicians valued these skills more highly, suggesting that practical exposure increases awareness of safety and maintenance practices. This finding corroborates Adeniyi (2023), who reported that safety measure skills are essential for efficient workshop operations and recommended their integration into the curriculum. However, while Adeniyi focused on basic hand-tool and traditional machine safety, the present study extends this to modern metalworking machines, highlighting the critical need for preventive maintenance and advanced safety protocols in contemporary workshop environments.

The study confirms that technical, operational, and safety/maintenance skills are interdependent and critical for modern metalworking efficiency. The literature supports these findings, showing that industries and educational institutions alike recognize the importance of equipping graduates with both foundational and modern machine-related skills. However, a consistent gap in prior studies is the limited focus on digital/CNC-based operations, which the current study addresses by including modern machine competencies, providing a more comprehensive perspective on the skill requirements of metalwork technicians in contemporary industry.

5. Conclusion and Recommendations

5.1 Conclusion

The study established that technical, operational, and safety/maintenance skills are essential for the efficient and safe operation of modern metalworking equipment in Kwara State. While operational skills were consistently perceived as important across all experience levels, technical and safety/maintenance skills were significantly influenced by the technicians' experience, highlighting the value of practical exposure in shaping competence. The findings underscore the critical need for targeted training programs, modern machine-based skill acquisition, and continuous professional development, particularly in areas such as CNC operation, advanced maintenance, and safety protocols. By addressing these skill gaps, technical colleges and industry trainers can better prepare metalwork technicians to meet contemporary industrial demands and maintain high standards of efficiency and safety in modern workshops.

5.2 Recommendations

Based on the findings, the study recommends that:

1. Technical colleges and training institutions in Kwara State should incorporate modern

metalworking equipment, including CNC and digital machines, into their curriculum to ensure technicians acquire both traditional and contemporary technical skills.

2. Institutions and industries should provide structured safety and maintenance training, emphasizing advanced machine protocols and preventive measures, particularly for less experienced technicians, to promote safe and sustainable workshop operations.
3. National Board of Technical Education should organize workshops, seminars, and in-service training should be organized for both instructors and practicing technicians to update their knowledge and skills, bridging gaps in operational, technical, and digital competencies to meet evolving industrial demands.

References

- Adebola, A. A., & Ibrahim, M. T. (2021). Skill gaps in metalwork practice and their implications for industrial productivity in Nigeria. *Journal of Technical and Vocational Education Studies*, 9(2), 45–58.
- Adeniyi, O. (2023). *Safety measure skills among metalwork technology students in Oyo State College of Education, Lanlate*. Oyo State College of Education Press.
- Akinwale, O. P., & Yusuf, R. A. (2020). Modern metalworking competencies required for sustainable industrial development in Nigeria. *Nigerian Journal of Engineering Education*, 14(1), 63–74.
- Chukwu, J. O., & Okafor, P. N. (2021). Challenges of modern equipment utilisation in metal fabrication workshops in developing economies. *Journal of Industrial Technology and Skills*, 8(1), 34–46.
- Danladi, A. S., & Musa, R. K. (2023). Apprenticeship training and skill inadequacy among metalwork technicians in North-Central Nigeria. *Journal of Vocational and Applied Technology*, 12(2), 88–102.
- Ede, O. A., & Omotayo, K. J. (2023). Bridging the skills gap between technical education and industrial practices in metal fabrication. *International Journal of Vocational Training Research*, 11(3), 101–115.
- Garba, S. M., & Sadiq, U. L. (2022). Aligning technical education with industry demands: A study of metalwork programme effectiveness. *African Journal of Technical Education*, 6(1), 28–39.

- Mohammed, S. I., & Bello, H. A. (2022). Operational skill deficiencies and productivity challenges in Nigerian metalwork industries. *International Journal of Technical Education and Workforce Development*, 10(3), 119–132.
- Ojobah, A., & Ajie, M. (2025). Developing skilled workforce through metalwork technology education programme in tertiary institutions for contemporary society in Rivers State, Nigeria. Rivers State University Press.
- Okolie, U. C., & Nwahunanya, C. O. (2021). Competency requirements for technical workforce development in emerging industrial economies. *Journal of Industrial Skills Development*, 5(2), 90–104.
- Sini, P., & Yakubu, L. (2024). Work skills needs of technical college graduates in fabrication and welding engineering craft trade by industries in North East Nigeria. *International Journal of Educational Research and Studies*, 12(1), 45–58.
- UNESCO. (2022). *Transforming technical and vocational education and training for sustainable development*. UNESCO Publishing.