



Evaluation of Availability, Adequacy, Accessibility, Utilization and Maintenance of ... Aminu, B. (2026)

Evaluation of Availability, Adequacy, Accessibility, Utilization and Maintenance of Pedagogical Apparatus on Metalwork Technology Teaching among Schools in Katsina State, Nigeria

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Abstract

This study examined the condition and use of pedagogical apparatus for teaching and learning Metalwork Technology in selected government technical and secondary schools in Katsina State, Nigeria. The study focused on four related dimensions: the availability and adequacy of workshop apparatus; accessibility and utilization of available equipment; maintenance practices; and challenges affecting the provision and effective use of workshop resources. A descriptive survey design was adopted and complemented with direct workshop observation to strengthen the evidence obtained from respondents. The population comprised 310 respondents, consisting of 30 Metalwork Technology teachers and 280 students from six selected institutions. A sample of 195 respondents was used, comprising all 30 teachers and 165 students selected through proportionate random sampling. Data were collected using the Pedagogical Apparatus Questionnaire (PAQ) and a Pedagogical Apparatus Observation Checklist (PAOC). The instruments were subjected to expert validation, while internal consistency was established using Cronbach's alpha. Descriptive statistics, including mean, standard deviation, frequency and percentage, were used to analyze the data. The findings indicated low availability of most essential workshop equipment, inadequate quantities and outdated machines, restricted student access, low utilization, and weak maintenance practices. Inadequate funding was the most frequently reported challenge, followed by lack of modern equipment, poor maintenance culture and shortage of technical personnel. The study concludes that the quality of practical Metalwork Technology instruction in the selected schools is constrained by deficiencies in workshop resources and their management. The study recommends increased and sustained funding, provision of modern equipment, preventive maintenance systems, improved access arrangements, and continuing professional development for teachers and technical support staff.

Keywords: pedagogical apparatus; Metalwork Technology; workshop facilities; equipment utilization; maintenance; technical education; Katsina State.

Introduction

Background to the Study

Technical and vocational education and training (TVET) is expected to connect education with the practical demands of work, entrepreneurship and economic development. Contemporary TVET policy places increasing emphasis on relevant skills, quality learning environments and stronger links between training institutions and changing labour-market needs (UNESCO, 2022). This expectation is particularly important in Metalwork Technology because the subject is practical by nature and requires learners to work directly with tools, machines, materials and workshop procedures.

Metalwork Technology encompasses activities such as fitting, machining, welding, fabrication, drilling, cutting and other metal-processing operations. Learners cannot develop these competencies effectively through theoretical instruction alone. They need repeated opportunities to observe demonstrations, handle tools, operate machines, practice procedures and receive feedback. This practical orientation makes the availability, adequacy, accessibility, utilization and maintenance of workshop apparatus central to the quality of instruction. Recent Nigerian studies similarly report



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continuing concerns about workshop resources and equipment utilization in technical education (Lappi & Onuh, 2021; Adamu, 2024; Ya'u et al., 2025). The problem is not simply whether a machine or tool exists in a workshop. A facility may be physically present but unavailable to students, insufficient for the class size, obsolete, unsafe, poorly maintained or rarely used. Consequently, assessment of workshop provision should consider the entire chain from availability and adequacy through accessibility, actual instructional utilization and maintenance. This broader perspective is consistent with recent evidence from Kano State showing that workshop facilities and equipment were not being utilized effectively and that funding and teacher preparation for improvisation remained important concerns (Ya'u et al., 2025). Experiential learning provides a useful educational perspective for understanding why these resources matter. In practical learning, knowledge develops through meaningful experience, reflection, conceptual understanding and further experimentation. Morris (2020), in a systematic review of experiential learning, emphasizes the importance of contextually rich concrete experience, critical reflection and active experimentation. In Metalwork Technology, functional workshop apparatus therefore provides the setting in which practical experience can occur.

Statement of the Problem

The effectiveness of Metalwork Technology instruction depends heavily on the opportunity learners have to engage with appropriate workshop tools, machines and instructional materials. However, the manuscript evidence from the selected schools indicates that many essential apparatus are either unavailable, inadequate in quantity, difficult for students to access, underutilized or poorly maintained. The low ratings recorded for modern machines are particularly concerning because technical education is expected to prepare learners for contemporary work environments. The practical consequence is that students may spend considerable time learning procedures theoretically without obtaining sufficient opportunities to practice them. Where equipment is limited, students may have to share machines in ways that reduce individual practice time. Where machines are obsolete or faulty, teachers may avoid practical activities or rely heavily on demonstrations. Where maintenance is weak, the condition of equipment can deteriorate further. Similar concerns have been documented in Nigerian technical education settings, including Gombe, Kano and North-Eastern Nigeria (Lappi & Onuh, 2021; Adamu, 2024; Ya'u et al., 2025). The central problem addressed by this study is therefore the gap between the practical requirements of Metalwork Technology and the actual condition and use of pedagogical apparatus in selected schools in Katsina State. Empirical evidence is needed to show not only what equipment is available, but also whether it is adequate, accessible, utilized and maintained, and what institutional challenges limit its provision.

Purpose of the Study

The purpose of the study was to examine the condition and use of pedagogical apparatus for teaching and learning Metalwork Technology in selected government technical and secondary schools in Katsina State, Nigeria.

Objectives of the Study

1. determine the availability and adequacy of pedagogical apparatus used for teaching and learning Metalwork Technology;
2. examine the accessibility and utilization of available pedagogical apparatus by teachers and students;
3. assess the maintenance practices applied to Metalwork Technology workshop equipment; and



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4. identify the major challenges affecting the provision, management and effective use of pedagogical apparatus.

Research Questions

1. What is the level of availability and adequacy of pedagogical apparatus used for teaching and learning Metalwork Technology?
2. To what extent are available pedagogical apparatus accessible to and utilized by teachers and students?
3. What maintenance practices are applied to Metalwork Technology workshop equipment?
4. What major challenges affect the provision, management and effective use of pedagogical apparatus?

Significance of the Study

The study provides evidence that can assist education authorities, school administrators, Metalwork Technology teachers, curriculum planners and other stakeholders in making decisions about workshop provision. For government and funding agencies, the findings identify areas requiring investment. For school administrators, they highlight the importance of equipment-access arrangements and preventive maintenance. For teachers, the findings draw attention to the relationship between available resources and opportunities for practical learning. For students, better provision and management of workshop apparatus can increase opportunities for hands-on practice and competency development.

Scope of the Study

The study was limited to selected government technical and secondary schools offering Metalwork Technology in Katsina State. The institutions were Government Technical College Mashi, Government Technical College Ingawa, Government Technical College Funtua, Government College Funtua, Government College Katsina, and Government Secondary School Daura. The study focused on workshop tools, machines and other pedagogical apparatus, with particular attention to availability, adequacy, accessibility, utilization and maintenance.

Review of Related Literature

Technical and Vocational Education and Training

TVET is concerned with developing knowledge, skills and attitudes that enable individuals to participate effectively in work and economic life. UNESCO (2022) emphasizes that contemporary TVET should support employability, entrepreneurship, lifelong learning and transitions toward digital and sustainable economies. This broad mandate requires learning environments that are sufficiently resourced and responsive to occupational practice. For technical subjects, the workshop is not merely a physical room; it is an instructional environment in which learners translate concepts into practical performance. Consequently, the quality of workshop facilities can influence the opportunities available for practice and the extent to which teachers can implement practical components of the curriculum.

Metalwork Technology and Practical Skill Development

Metalwork Technology is inherently practice-oriented. Students are expected to develop competence in the safe and accurate use of hand tools, measuring instruments, machines and fabrication equipment. Such competence is developed progressively through demonstration, guided practice, repeated performance and feedback. Evidence from Nigerian studies continues to show that workshop facilities and equipment are important issues in the preparation of technical learners (Lappi & Onuh, 2021; Okwelle et al., 2022).



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Pedagogical Apparatus in Metalwork Technology

Pedagogical apparatus refers in this study to the tools, machines, equipment, instructional materials and related workshop resources used to support teaching and learning. Examples include lathes, welding machines, drilling machines, measuring instruments, cutting tools, workbenches and related safety resources. The usefulness of such apparatus depends on more than physical presence. It must be sufficient for the number of learners, functional, accessible, safe and aligned with curriculum requirements. Recent evidence from Kano State is especially relevant because it examined workshop facilities and equipment utilization specifically in Metalwork Technology and reported low utilization of facilities and instructional materials, alongside concerns about funding, maintenance and teacher improvisation (Ya'u et al., 2025).

Availability and Adequacy of Workshop Facilities

Availability refers to whether required equipment exists in the workshop, whereas adequacy concerns whether the available resources are sufficient in quantity, quality, functionality and suitability for the learners and curriculum. A workshop can therefore have some equipment and still be inadequate if a large class must share a small number of machines or if the machines no longer reflect current practice. Lappi and Onuh (2021) examined metalwork instructional facilities in Science and Technical Colleges in Gombe State and highlighted concerns relating to availability and utilization. Adamu (2024) similarly reported the importance of adequate workshop and training facilities in NCE (Technical) institutions in North-Eastern Nigeria. These studies support the need to examine workshop resources beyond a simple inventory of equipment.

Accessibility and Utilization of Equipment

Accessibility concerns the extent to which teachers and students can actually obtain and use available equipment during instruction. Utilization concerns the frequency and quality with which the equipment is employed for teaching and learning. These two dimensions are closely related but not identical. Equipment may be available but inaccessible because of restricted access, insufficient quantities, safety concerns, breakdowns or poor scheduling. Ya'u et al. (2025) found that workshop facilities and equipment in the Kano State study were not utilized effectively. Okwelle et al. (2022) also emphasized the importance of machine-operation skills for producing graduates who are ready for work. Together, these findings suggest that the presence of equipment must translate into actual learning opportunities if workshop resources are to contribute to competence development.

Maintenance of Workshop Equipment

Maintenance includes preventive servicing, inspection, cleaning, adjustment, repair and replacement of worn components. In Metalwork Technology, maintenance has an instructional as well as an operational function. Functional equipment supports regular practical activities, while neglected equipment can interrupt lessons and increase safety risks. The present study therefore treats maintenance as a core dimension of pedagogical apparatus rather than an administrative issue that is separate from teaching and learning.

Theoretical Framework: Experiential Learning Theory

The study is anchored in Experiential Learning Theory. The theory explains learning as a process in which learners develop knowledge through experience, reflection, conceptualization and active experimentation. Morris (2020) reviewed and refined Kolb's model, emphasizing contextually rich concrete experience, critical reflective observation, context-specific abstract conceptualization and pragmatic active experimentation. This perspective is directly relevant to Metalwork Technology because learners need opportunities to encounter real tools and machines, reflect on their performance, understand the principles involved and apply what they have learned in subsequent tasks. The theory also provides a rationale for examining availability, accessibility and utilization



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together. If essential apparatus are unavailable, learners have fewer concrete experiences. If equipment is available but inaccessible or underutilized, opportunities for active experimentation are reduced. Poor maintenance further interrupts the learning cycle because faulty equipment limits meaningful practical engagement. Thus, the condition and use of pedagogical apparatus can be understood as an important environmental support for experiential learning.

Empirical Review and Research Gap

Recent Nigerian evidence demonstrates that workshop-resource problems remain relevant across different technical education contexts. Lappi and Onuh (2021) investigated availability and utilization of metalwork instructional facilities in Gombe State. Okwelle et al. (2022) focused on operational skills required in metalwork and highlighted the need for continuing training to support work-ready graduates. Adamu (2024) assessed workshop adequacy and training facilities in NCE (Technical) institutions in North-Eastern Nigeria. Ya'u et al. (2025) examined workshop facilities and equipment utilization for Metalwork Technology in Kano State and reported low utilization. The present study extends this body of evidence by examining five closely connected conditions—availability, adequacy, accessibility, utilization and maintenance—within selected government technical and secondary schools in Katsina State. It also identifies the institutional challenges associated with these conditions. The combination of questionnaire evidence and direct observation provides a more rounded description of the workshop environment than an inventory alone.

Research Methodology

Research Design

A descriptive survey research design was adopted. The design was appropriate because the study sought to describe existing conditions in selected schools without manipulating the learning environment. Direct observation was also used to complement questionnaire responses and provide an additional source of evidence. The use of more than one source of evidence is consistent with established approaches to educational research and can strengthen interpretation of field conditions (Creswell & Creswell, 2021).

Area of the Study

The study was conducted in selected government technical and secondary schools in Katsina State, Nigeria. The institutions were Government Technical College Mashi, Government Technical College Ingawa, Government Technical College Funtua, Government College Funtua, Government College Katsina, and Government Secondary School Daura.

Population of the Study

The population consisted of 310 respondents: 30 Metalwork Technology teachers and 280 students involved in Metalwork Technology in the selected institutions.

Sample and Sampling Technique

A sample of 195 respondents was used. All 30 teachers were included through census sampling, while 165 students were selected through proportionate random sampling. This approach ensured that all available teachers in the selected schools were represented while the student sample was distributed proportionately.

Instruments for Data Collection

Two instruments were used: the Pedagogical Apparatus Questionnaire (PAQ) and the Pedagogical Apparatus Observation Checklist (PAOC). The questionnaire captured respondents' perceptions of availability, adequacy, accessibility, utilization, maintenance and challenges. The observation checklist was used to examine the physical condition and presence of workshop resources.



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Validity and Reliability

The instruments were subjected to expert review by specialists in Technology Education and Measurement and Evaluation. Internal consistency was established using Cronbach's alpha, with 0.70 treated as an acceptable minimum threshold for the instrument. Care was taken to ensure that questionnaire items were aligned with the research questions and the constructs being examined. Contemporary methodological literature emphasizes the importance of clear evidence for validity and reliability when reporting questionnaire-based research (Taber, 2020; Taherdoost, 2021).

Data Collection Procedure

Questionnaires were administered personally by the researcher, while workshop observations were conducted in the selected institutions. The use of direct observation was intended to complement respondents' perceptions and reduce reliance on a single data source.

Method of Data Analysis

Data were analyzed using frequency, percentage, mean and standard deviation. The analysis was organized around the four consolidated research questions. The original manuscript proposed independent-samples t-tests; however, the available compiled dataset does not contain respondent-level scores or sufficient group-level variance information to calculate valid t-values and p-values. Accordingly, no inferential statistics have been invented or reported in this publication-ready version. This is an important methodological safeguard because statistical significance cannot be established from mean differences alone.

Presentation of Results

Research Question 1: Availability and Adequacy of Pedagogical Apparatus

S/N	Pedagogical apparatus / adequacy indicator	Teachers' Mean	Students' Mean	SD	Remark
1	Lathes are available	2.10	1.95	0.78	Low
2	Welding machines are available	2.30	2.05	0.81	Low
3	Drilling machines are available	2.25	2.00	0.76	Low
4	Measuring instruments are available	2.40	2.20	0.70	Moderate
5	Cutting tools are available	2.15	1.90	0.82	Low
6	Equipment is sufficient in number	1.85	1.70	0.88	Very Low
7	Tools meet class-size needs	1.90	1.75	0.80	Low
8	Machines are modern	1.60	1.55	0.90	Very Low
9	Workshop space is adequate	2.20	2.10	0.75	Low

The results indicate that the availability and adequacy of workshop apparatus were generally low. Measuring instruments recorded the comparatively highest availability rating, while modernity of machines recorded the lowest ratings. The very low rating for equipment sufficiency also suggests that the number of available resources does not adequately match instructional needs. The pattern is consistent with recent Nigerian evidence reporting continuing concerns about workshop adequacy in technical education (Lappi & Onuh, 2021; Adamu, 2024).

Research Question 2: Accessibility and Utilization of Pedagogical Apparatus

S/N	Indicator	Teachers' Mean	Students' Mean	SD	Remark
1	Students have access to machines	2.00	1.85	0.79	Low
2	Teachers can freely use equipment	2.30	2.10	0.74	Moderate
3	Equipment is shared effectively	1.95	1.80	0.83	Low
4	Equipment is frequently used	2.10	1.90	0.80	Low
5	Practical lessons are regular	2.20	2.00	0.77	Moderate
6	Students actively use machines	1.95	1.80	0.85	Low

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Accessibility was generally limited, particularly from the students' perspective. Although teachers reported somewhat better access, students' access to machines and their active use of equipment remained low. The low rating for effective sharing also suggests that class size and equipment availability may restrict individual practice. The utilization pattern is comparable with recent findings from Kano State, where workshop facilities and equipment were reported to be underutilized for effective teaching and learning (Ya'u et al., 2025).

Research Question 3: Maintenance Practices

S/N	Maintenance indicator	Teachers' Mean	Students' Mean	SD	Remark
1	Equipment is regularly serviced	1.70	1.60	0.90	Very Low
2	Faulty machines are repaired quickly	1.80	1.65	0.88	Low
3	A maintenance culture exists	1.75	1.60	0.92	Very Low

Maintenance practices were rated very low overall. Regular servicing received the lowest ratings, while prompt repair of faulty machines was also weak. This pattern suggests that even where equipment is available, its instructional value may be reduced when preventive and corrective maintenance systems are inadequate. The finding reinforces the need to view maintenance as part of educational quality assurance rather than as an occasional response to equipment failure.

Research Question 4: Challenges Affecting Provision and Use of Pedagogical Apparatus

S/N	Challenge	Frequency	Percentage (%)
1	Inadequate funding	160	82
2	Lack of modern equipment	150	77
3	Poor maintenance culture	140	72
4	Shortage of technical staff	120	62

Inadequate funding was the most frequently identified challenge, followed by lack of modern equipment, poor maintenance culture and shortage of technical staff. The result indicates that the workshop problem is not caused by a single factor. Financial provision, equipment modernization, maintenance management and technical staffing appear to interact in shaping the quality of practical instruction. This interpretation is also consistent with recent evidence from Nigerian technical education settings (Adamu, 2024; Ya'u et al., 2025).

Discussion of Findings

Availability and Adequacy

The finding that most workshop apparatus were rated low in availability and adequacy indicates a substantial mismatch between the practical requirements of Metalwork Technology and the resources available to support those requirements. The particularly low rating for modern machines is important because technical education must remain responsive to changing occupational practices. UNESCO (2022) emphasizes that TVET systems should respond to evolving skills demands and support transitions in the world of work. The finding also agrees with Lappi and Onuh (2021), who reported concerns about the availability and utilization of metalwork instructional facilities in Gombe State. It is further supported by Adamu's (2024) assessment of workshop adequacy in NCE (Technical) institutions in North-Eastern Nigeria. Taken together, these studies suggest that workshop-resource constraints remain a recurring issue in Nigerian technical education.

Accessibility and Utilization

The low level of student access and utilization suggests that simply providing equipment is insufficient. Learners need regular, supervised opportunities to use the equipment themselves. From an experiential learning perspective, restricted access reduces the concrete experiences and active experimentation through which practical understanding develops (Morris, 2020). The result also



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supports the recent Kano State study by Ya'u et al. (2025), which reported inadequate utilization of workshop facilities and equipment. The implication is that schools should pay attention not only to procurement but also to equipment scheduling, class organization, teacher supervision and opportunities for individual practice.

Maintenance Practices

The very low maintenance ratings reveal a weakness that can progressively worsen other workshop problems. When machines are not serviced or repaired promptly, equipment becomes unavailable, and the effective stock of usable apparatus declines. Maintenance therefore affects availability, accessibility and utilization simultaneously. A preventive maintenance system would be more sustainable than relying mainly on repair after breakdown.

Challenges

The prominence of inadequate funding confirms that resource provision is closely linked to institutional capacity. However, funding alone may not solve the problem if procurement is not aligned with curriculum requirements or if equipment is not maintained after purchase. A more sustainable approach should combine adequate funding with needs assessment, equipment modernization, preventive maintenance, technical staffing and accountability mechanisms. This broader systems perspective is consistent with UNESCO's emphasis on transforming TVET to meet changing economic and skills demands (UNESCO, 2022).

Conclusion

The study concludes that pedagogical apparatus for teaching and learning Metalwork Technology in the selected schools in Katsina State are generally inadequate. Availability and adequacy were low, student access and utilization were limited, maintenance practices were weak, and inadequate funding was the most prominent challenge. These conditions may restrict the amount and quality of practical experience available to learners. Because Metalwork Technology is fundamentally practical, improving the workshop environment is essential to creating meaningful opportunities for skill development.

Recommendations

1. Government and relevant education authorities should increase and sustain funding for Metalwork Technology workshops, with priority given to equipment identified as essential by curriculum and class-size requirements.
2. Schools should introduce preventive maintenance schedules covering inspection, cleaning, servicing and timely repair of workshop equipment.
3. Modern and industry-relevant machines, tools, measuring instruments and safety equipment should gradually replace obsolete or non-functional resources.
4. School administrators should establish transparent equipment-access and workshop-use schedules that give students sufficient opportunities for supervised hands-on practice.
5. Metalwork Technology teachers and technical support personnel should receive continuing professional development on modern equipment, safe workshop practices, maintenance and appropriate improvisation.
6. Education authorities should periodically inspect and evaluate technical workshops using clear standards for availability, adequacy, functionality, accessibility, utilization and maintenance.

Contribution to Knowledge

The study contributes localized empirical evidence on the condition of pedagogical apparatus in selected government technical and secondary schools in Katsina State. Its main contribution is the consolidation of availability, adequacy, accessibility, utilization and maintenance into a single



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assessment framework, while also identifying the institutional challenges associated with workshop provision. The findings can serve as baseline evidence for future intervention studies, comparative studies across Nigerian states and research examining the relationship between workshop conditions and students' practical competencies.

Limitations of the Study

The study was limited to six selected government technical and secondary schools in Katsina State and therefore should not be generalized automatically to all technical and secondary schools in Nigeria. In addition, the compiled dataset available for this manuscript contains summary statistics rather than respondent-level scores. Consequently, inferential tests that require raw or complete group-level variance data have not been reported. Future studies should preserve respondent-level datasets so that inferential analysis and effect-size estimation can be conducted transparently.

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