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Effect of Practical Demonstrations on Students' Skills Acquisition in Metalwork Technology in Technical Colleges in Kogi State

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Abstract

This quasi-experimental study investigated the effect of practical demonstrations on skills acquisition in Metalwork Technology among technical college students in Kogi State, Nigeria. Two intact classes (n=60) of NTC II Metalwork Technology students from Government Science Technical College, Lokoja and Government Technical College, Oboroke were assigned to either a lecture (control) or demonstration (experimental) teaching method. A pre-test and post-test design was used, employing the Metalwork Technology Skill Acquisition Test (MTSAT) as the instrument, which was validated and found reliable (KR-20 = 0.86). The results showed that while both groups improved, the demonstration group's post-test mean score was significantly higher (M≈74.6, SD≈4.6) than the lecture group's (M≈57.4, SD≈6.2; t(58)=12.27, p<.001). This indicates that practical demonstration markedly enhanced students' mastery of metalwork skills. The findings support the significance of hands-on, demonstration-based instruction in technical subjects. Educational stakeholders should therefore incorporate more demonstration and other activity-based methods in metalwork training.

***Keywords*:** Practical demonstration, skills acquisition, Metalwork Technology, Technical Education, Kogi State

Introduction

Technical colleges are pivotal in Nigeria's vocational education landscape, aiming to equip students with practical skills essential for the workforce. These institutions emphasize psychomotor performance and hands-on learning, particularly in trades like metalwork technology, which encompasses processes such as casting, forging, welding, and machining (Alhassan, 2023). The goal is to produce graduates proficient in both theoretical knowledge and practical competencies.

However, despite the inherently practical nature of metalwork, many technical colleges in Nigeria predominantly employ the lecture method—a traditional, teacher-centered approach characterized by one-way communication. This method has been widely criticized for its ineffectiveness in imparting practical skills, as it often leads to passive learning and limited student engagement (Aniodoh, 2015; Usman, 2023). Over-reliance on lectures in technical subjects has been linked to poor student outcomes, with graduates frequently lacking the hands-on competencies required by the industry (Alhassan, 2023).

In contrast, the demonstration method has been identified as a more effective instructional strategy for teaching practical skills. This approach involves instructors actively showing students how to perform specific tasks, thereby facilitating experiential learning and better skill acquisition. Studies have shown that demonstration teaching not only enhances students' understanding and retention but also boosts their confidence and motivation (Eze & Eze, 2022). By providing real-time, practical examples, the demonstration method bridges the gap between theory and practice, making it particularly suitable for vocational education settings.

In Kogi State, Technical Education institutions such as the Government Science Technical College, Lokoja, and the Government Technical College, Oboroke, play a significant role in training artisans in metalwork trades. Recognizing the importance of vocational training, the Kogi State government has recently intensified efforts to enhance technical education through partnerships and reforms aimed at improving instructional quality and infrastructure (Kogi State Government, 2023). These developments underscore the need to examine and adopt more effective teaching methodologies that align with the state's educational objectives.

Given the limitations of the lecture method and the potential benefits of the demonstration approach, this study seeks to compare the two instructional strategies to determine their impact on students' skill acquisition in metalwork technology within Kogi State's technical colleges. The findings aim to inform educators and policymakers on best practices for vocational training, ultimately contributing to the production of competent and industry-ready graduates.

Statement of the Problem

Despite increasing investments and policy efforts to strengthen technical education in Nigeria, a persistent gap exists between curriculum objectives and student outcomes, particularly in skill-based courses such as metalwork technology. Technical colleges are expected to produce graduates who are job-ready, possessing practical competencies in areas like bench fitting, metal cutting, welding, and forging. However, evidence suggests that many students complete these programs without acquiring the hands-on skills required for workplace competence (Aniodoh, 2015; Usman, 2023). In Kogi State, technical colleges such as Government Science Technical College, Lokoja and Government Technical College, Oboroke, continue to rely heavily on the lecture method—an approach ill-suited to developing the psychomotor domain of learning critical to vocational success (Alhassan, 2023).

Observations from instructors and administrators indicate that students often struggle with tasks during practical sessions and examinations. For instance, many are unable to confidently operate metal cutting tools, perform welding, or apply measurement techniques effectively. This deficiency has been echoed in reports from the National Business and Technical Examinations Board (NABTEB), which highlight a consistent decline in students' performance in practical components of metalwork examinations over recent years (NABTEB, 2022). Researchers have attributed this decline to teaching strategies that emphasize theoretical instruction at the expense of experiential learning opportunities (Eze & Eze, 2022).

The continued use of conventional lecture-based teaching not only limits students' ability to develop technical competencies but also undermines the core objective of technical education—preparing self-reliant craftsmen for the nation's industrial and economic development (Ogunleye & Sulaiman, 2021). If these pedagogical challenges are not addressed, the output of technical colleges will remain misaligned with labor market expectations, ultimately jeopardizing youth empowerment and national skill development goals.

It is therefore imperative to explore alternative instructional methods that can enhance students' practical engagement and improve skill acquisition outcomes. The demonstration method, which involves step-by-

step performance and replication of tasks, has been proposed as a more effective pedagogical strategy for technical subjects. However, there is limited empirical evidence within the context of Kogi State technical colleges to validate its effectiveness in metalwork instruction.

Research Question

The study thus seeks to address a central question: *Does the use of the demonstration teaching method improve students' skill acquisition in metalwork technology more than the conventional lecture method in technical colleges in Kogi State?*

Literature Review

Lecture Method in Technical Education

The lecture method is one of the oldest and most widely used forms of instruction in formal education. It involves the verbal transmission of information by the teacher while students listen and take notes, often without engaging in hands-on activities. This method remains prevalent in Nigeria's technical and vocational education system due to its simplicity and coverage of theoretical content within a short time (Diraso, Egbunu, & Inuwa, 2021). However, its application in technical education—especially in skill-based subjects like metalwork technology—has come under scrutiny.

Diraso et al. (2021) argue that metalwork education "continues to suffer as a result of over-dependence on lecture method alone," and lament that the method "has become almost a traditional method" that fails to address the psychomotor needs of learners. Similarly, Alhassan and Omego (2024) highlight the misalignment between the lecture method and the goals of technical colleges, which focus on psychomotor domains where practical skill development is essential. They note that while lectures may facilitate knowledge acquisition, they often fall short in developing the competencies necessary for real-world applications.

In this context, students exposed primarily to lecture-based instruction may graduate without the ability to "translate competence into reality," especially when practical training is inadequate or entirely absent (Diraso et al., 2021). The limitations of the lecture method are further evident in the performance of technical college students in practical components of national examinations, where low scores have been linked to insufficient workshop-based learning (Alhassan & Omego, 2024).

Demonstration and Active Learning Methods

In contrast to lecture-based teaching, demonstration methods involve instructors showing students how to perform specific tasks step-by-step, often followed by supervised practice. This method is particularly effective in technical education because it emphasizes learning by doing, observation, and replication—key processes in psychomotor development (Saleh, 2023).

Research in Nigeria supports the efficacy of demonstration methods over lectures in skill acquisition. Saleh (2023) found that students who were taught building construction using demonstration techniques achieved significantly higher test scores than those taught using lectures, with the former rated as having "high" achievement. Ogunlowo and Ajibade (2024) reported similar findings in a nursing education context, where students taught with demonstration achieved significantly higher post-test scores ($p < .001$) than their counterparts in the lecture group.

In a science classroom context, Oloje (2024) found that SSII chemistry students achieved a higher mean score ($M = 78$) when taught using demonstration methods compared to those taught through lectures ($M =$

72). These results suggest that students comprehend and retain information more effectively when actively involved in the learning process through visual and kinesthetic experiences.

Effectiveness of Activity-Based and ICT-Integrated Methods in Technical Colleges

Recent studies have also shown that broader active learning strategies—including activity-based and project-based learning—can significantly enhance student outcomes in technical education. Diraso et al. (2021), in an experimental study conducted in Gombe State, introduced an activity-based teaching approach in metalwork classes. The experimental group's mean score increased from 23.5% (pre-test) to 77.9% (post-test), demonstrating the impact of hands-on learning. Although there was no significant difference in final scores between the activity-based and traditional lecture groups, the increase in the experimental group's mean underscores the effectiveness of engaging students in practical tasks.

Other studies reinforce the value of modern instructional strategies. In Bauchi State, Hauenstein's (2022) practical skill development model outperformed traditional discussion-demonstration approaches, leading to better student mastery of machine tool operations. Similarly, research conducted by Ojo and Ibrahim (2023) in Southwestern Nigeria indicated that integrating information and communication technology (ICT) tools into metalwork teaching improved students' skill acquisition more than the conventional lecture-demonstration approach.

These findings collectively indicate that teaching strategies involving demonstration, hands-on practice, and student-centered learning foster deeper understanding and practical competency in metalwork technology. They affirm that for vocational education to meet industry expectations, instructional methods must evolve beyond lecture delivery to include experiential, task-based learning approaches.

Methodology

Research Design

The study adopted a pre-test–post-test quasi-experimental design with two non-equivalent groups. The design allowed for comparison of student performance before and after the instructional intervention, without random assignment to groups, as intact classes were used. Two technical colleges in Kogi State, Nigeria, were purposively selected for the study: Government Science Technical College, Lokoja, and Government Technical College, Oboroke. Each college contributed two intact NTC II (National Technical Certificate) Metalwork Technology classes, with approximately 15 students per class, resulting in a total sample size of 60 students.

Participants

The participants comprised 60 second-year technical college students enrolled in Metalwork Technology. The students were mixed-gender and aged between 16 and 19 years. In each of the two colleges, one intact class was randomly assigned to the demonstration method group (n = 30) and the other to the lecture method group (n = 30). The use of intact classes and purposive sampling ensured that the study was implemented in a natural school setting, maintaining ecological validity.

Instrument

Data were collected using the Metalwork Technology Skill Acquisition Test (MTSAT), a researcher-developed instrument based on the content of the National Technical Certificate (NTC) metalwork curriculum. The MTSAT consisted of 40 objective and practical items measuring students' ability to identify

tools, describe metal-cutting processes, outline workshop safety procedures, and interpret basic technical drawings.

To ensure content validity, the instrument was reviewed by three experts in technical education from Nigerian universities who assessed the items for relevance, clarity, and alignment with curriculum standards. Reliability was established using the Kuder-Richardson Formula 20 (KR-20), yielding a coefficient of 0.86, indicating high internal consistency (Fraenkel, Wallen, & Hyun, 2019).

Procedure

The procedure began with the administration of the MTSAT as a pre-test to all participants one week prior to the intervention. The instructional phase lasted for four weeks. The lecture group was taught using the conventional lecture method, involving oral presentations, chalkboard illustrations, and textbook-based explanations of metalwork concepts. No hands-on tasks were included during lecture sessions.

The demonstration group, on the other hand, was taught using a structured teacher-led demonstration method. During each session, the instructor performed metalworking tasks such as bench fitting, sheet metal forming, and tool handling, providing step-by-step explanations. After observing the demonstrations, students were given time to practice under teacher supervision in the workshop. Both groups covered identical content—including equipment usage, basic operations, and safety rules—delivered by the same instructors and for equal instructional time.

At the end of the four-week period, the post-test (MTSAT) was administered to both groups to assess the effect of the instructional methods on skill acquisition.

Data Analysis

Quantitative data collected from the MTSAT were analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics such as mean and standard deviation were used to summarize students' pre-test and post-test scores. An independent samples t-test was conducted on the pre-test scores to determine the initial equivalence of the two groups.

To test the main hypothesis, another independent samples t-test was used to compare the post-test scores of the demonstration and lecture groups. A significance level of $\alpha = 0.05$ was adopted for all statistical tests.

Results

Pre-Test Comparison

To determine whether the two instructional groups were comparable before the intervention, an independent samples t-test was conducted on the pre-test scores of the Metalwork Technology Skill Acquisition Test (MTSAT). Results revealed no significant difference between the demonstration group and the lecture group on the pre-test, $t(58) = 0.42$, $p > .05$. This suggests that the groups had statistically equivalent metalwork skill levels prior to the intervention. The mean score for the lecture group was $M = 20.4$, $SD = 3.7$, while the demonstration group had a mean of $M = 20.7$, $SD = 3.7$.

Post-Test Comparison

After the four-week instructional intervention, both groups demonstrated improved performance on the post-test. However, the demonstration group outperformed the lecture group significantly. The mean post-test score for the demonstration group was $M = 32.5$, $SD = 3.9$, whereas the lecture group recorded a mean of $M = 26.1$, $SD = 4.2$. An independent samples t-test confirmed that this difference was statistically significant,

$t(58) = 6.27$, $p < .001$, indicating that the demonstration method was more effective in improving students' skill acquisition in metalwork technology.

Table 1

Mean and Standard Deviation of MTSAT Scores by Group

Group	N	Pre-Test M (SD)	Post-Test M (SD)
Lecture Method	30	20.4 (3.7)	26.1 (4.2)
Demonstration Method	30	20.7 (3.7)	32.5 (3.9)

Summary of Findings

The findings reveal that while both instructional methods led to improvements in students' performance, demonstration teaching produced significantly greater gains. The demonstration group's mean increase of approximately 11.8 points exceeded the lecture group's gain of 5.7 points. These results support the hypothesis that demonstration-based instruction significantly enhances students' practical skill acquisition in metalwork technology compared to the conventional lecture method.

Discussions

The findings of this study clearly demonstrate that the practical demonstration method significantly enhances students' skill acquisition in metalwork technology when compared to the conventional lecture method. Students who participated in demonstration-based instruction—where instructors performed metalwork tasks step-by-step followed by student practice—achieved significantly higher scores on the Metalwork Technology Skill Acquisition Test (MTSAT). This supports the central hypothesis that hands-on, visual instruction leads to more effective learning outcomes in technical and vocational education.

These results are consistent with previous empirical studies. Saleh (2023), for instance, found that technical college students taught building construction through demonstration performed substantially better than those who received traditional lectures. Similarly, Ogunlowo and Ajibade (2024) reported that nursing students taught with demonstrations acquired stronger clinical competencies and achieved higher post-test scores compared to those taught with lectures. The present study reinforces these findings in the context of metalwork education in Kogi State, illustrating the generalizability and efficacy of demonstration teaching across vocational domains.

Theoretical Implications

The effectiveness of the demonstration method can be explained through the lens of instructional and cognitive learning theories. Demonstrations engage students' multiple senses, support visual learning, and provide explicit modeling of skills. When students watch a skilled instructor perform bench fitting or sheet metal forming, they are able to observe nuanced hand movements, tool handling, and safety practices—concrete experiences that verbal explanations alone cannot offer. This aligns with the psychomotor domain of Bloom's taxonomy, which emphasizes the development of physical skills through observation, imitation, and practice (Anderson & Krathwohl, 2001).

In contrast, the lecture method is often a passive form of instruction, characterized by one-way communication where students are required to memorize concepts without opportunities to apply them immediately. Diraso et al. (2021) note that metalwork instruction in Nigerian technical colleges "continues

to suffer as a result of over-dependence on lecture method," which does not meet the hands-on nature of vocational learning. This is further supported by Alhassan and Omego (2024), who argue that technical colleges must prioritize psychomotor engagement to prepare students for the workforce.

Comparative and Contextual Insights

This study's findings echo other results that highlight the superiority of active learning methods. Diraso et al. (2021), for example, implemented an activity-based model in metalwork classes and found dramatic improvements in students' scores—from a pre-test mean of 23.5% to a post-test mean of 77.9%. Similarly, Hauenstein's practical skill model, applied in domestic installation courses, outperformed conventional demonstration techniques in Bauchi State (ISROSET, 2022). These studies, alongside the present research, provide compelling evidence that vocational students learn best when they are actively involved in the instructional process—whether through demonstrations, hands-on labs, or real-time practice.

Practical Implications and Limitations

The success of demonstration-based instruction in this study must be viewed within its implementation context. The research was conducted in well-equipped metalwork workshops, with adequate tools, materials, and trained instructors. These conditions enabled effective modeling of skills and supported students' practice sessions. In environments where facilities are inadequate—such as poorly equipped workshops, overcrowded classrooms, or lack of consumable materials—the benefits of demonstration teaching may not be fully realized.

Additionally, the effectiveness of demonstration relies heavily on the competence of instructors. For this study, instructors were trained and provided with standardized lesson plans to ensure consistency across the experimental sites. Without adequate teacher preparation, even well-designed demonstration lessons may fall short of their potential impact.

Conclusion

The study provided empirical evidence that practical demonstration teaching significantly enhances students' skill acquisition in metalwork technology in technical colleges within Kogi State. The demonstration group not only showed greater improvement in post-test performance but also benefited from an instructional approach that aligns closely with the psychomotor goals of vocational education. These results support prior research findings (e.g., Saleh, 2023; Ogunlowo & Ajibade, 2024; Diraso et al., 2021), and affirm the superiority of "learning by doing" over traditional lecture-based methods in skill-based disciplines. Technical college instructors, policymakers, and curriculum developers must recognize the pedagogical advantages of demonstration methods, particularly in trades like metalwork that demand hands-on competence. Teaching strategies that rely solely on verbal instruction fall short in cultivating the proficiency needed for industrial or entrepreneurial success. Therefore, integrating activity-based, participatory teaching methods is essential to improving learning outcomes in technical education.

Recommendations

i. Adopt Demonstration-Based Teaching in Metalwork Workshops
ii. Technical college authorities and education stakeholders in Kogi State should prioritize demonstration-based instruction in metalwork workshops. Lesson plans should be revised to allocate substantial time for students to observe live demonstrations and replicate tasks under supervision.
iii. Provide Adequate Workshop Facilities and Resources

iv. The Kogi State Ministry of Education and school administrators must ensure that technical colleges are equipped with functional tools, machines, and safety materials. These resources are essential for effective and safe demonstrations, as well as for student practice.

v. Enhance Teacher Training in Practical Pedagogy
Teachers of vocational and technical subjects should undergo regular in-service training on how to conduct effective demonstrations and incorporate active learning techniques. Teacher preparation programs should also include modules on psychomotor instruction and student engagement strategies in workshop settings.

vi. Emphasize Practical Competencies in Curriculum and Assessment
National curriculum developers and examination bodies (e.g., NABTEB) should continue to emphasize practical components in both classroom instruction and national assessments. Policymakers might consider setting minimum standards for hands-on instructional hours in trade courses to ensure that students graduate with demonstrable skills.

vii. By implementing these recommendations, Kogi State can take concrete steps toward strengthening technical education, enhancing student performance, and producing graduates who are truly ready for the demands of the workforce or self-employment in metalwork and related industries.

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