Annals of Technology Education Practitioners Association of Nigeria
ATEPAN (September, 2026) 11(1), 83-89
ISSN: 2645-2839 (Print)
eISSN: 2645-2847 (Online)

MISCONCEPTIONS AMONG METALWORK TRADE STUDENTS IN GOVERNMENT TECHNICAL COLLEGES IN KANO STATE: TRACKING MISCONCEPTIONS USING ChatGPT

Abubakar Adamu Njibulwa
Correspondence email address: *anadamu.ste@buk.edu.ng*
Correspondence Phone Number: *08038610426*
Bayero University Kano. Facaulty of Education, Science and Technology Education Department, Kano State, Nigeria

Abstract: *Technical Vocational Education and Training (TVET) is a comprehensive term that refers to those aspects of the education process involving in addition to general education, involving the study of technology which dealt with the acquisition of practical skills, attitudes, and knowledge in relating to occupations such metalwork trade. Misconceptions tend to be stable, resistant to change, and very problematic to the students. Due to their strength and flawed content, misconceptions also interfere with students' learning of the correct understanding of technical concepts. Example, 'Boss' which means rounded projection on the outside of the cast metal, confused with 'Boss' that is principal officer in the organization. The objective of the study was: 1) To find out the mean score of rural and urban students in misconceptions in metalwork trade. 2) To find out the mean scores NTC I, NTC II and NTC III students in misconceptions in metalwork trade among metalwork trade students in technical colleges of Kano State Nigeria. Two research questions were raised: 1) Is there any difference in mean score of rural and urban students in misconceptions in metalwork trade? 2) Is there any difference in mean score of NTC I, NTC II and NTC III students in misconceptions in metalwork trade? The survey research design was use for the study. Two Hypothesis were formulated as, Ho_1: There is no significant difference between the urban and rural students' performance students in misconceptions in metalwork trade. 2) Ho_2: There is no significant difference between NTC I, NTC II and NTC III students' performance in misconceptions in metalwork trade. The area of the study comprises of 5 Senior Technical colleges of Kano State. Purposive sampling was used to select four Technical colleges. The target population of the study was 210 NTC I, NTC II, and NTC III Metalwork trade students. Purposive sampling was use to select 129 NTC I, NTC II and NTC III Metalwork trade students. NABTEB pass question papers was adopt as the instrument for data collection. The data was analyses using SPSS. The findings of the study indicated that the mean score of rural students was 6.304 and the mean score of 7.759 of urban students in misconceptions in metalwork trade. Some of the recommendation includes; Teachers should devote more time in explanations and definitions of some misconceptions so that students will be familiar with them. Students should be taught to use appropriate concept in describe and explain metalwork trade concept. Teachers should use visual representations of the words in order to assist students' understanding metalwork trade. Tracking Misconceptions using ChatGPT as a tool to address misconceptions among metalwork trade students presents an innovative way forward. ChatGPT could serve as a powerful resource to correct misunderstandings, enhance learning, and provide continuous support to metalwork students.*

Keywords: *misconceptions, Metalwork, Trade and Technical Education*

Introduction

Technical Vocational Education and Training (TVET) is a comprehensive term that refers to those aspects of the education process in addition to general education, involving the study of technology which dealt with the acquisition of practical skills, attitudes, and knowledge in relating to occupations such metalwork trade. Metalwork trade according to Arikpo, et al, (2022), is the application of knowledge in the activity of making objects out of metal artistically and skillfully. In other words, it is the totality of all the processes involved in the production of metal articles. Metalwork trade consists of; foundry, forging, welding and fabrication, sheet metal work, machine shop practice (metal machining), and metallurgy. The metalwork trade aims at providing the labor market with qualified workers who could work successfully with modern production technologies in metalwork industries.

However, these aims could be related to the pedagogical skill of the teacher's ability to implement pedagogical interaction that will help the students understand concepts in metal work trade, which are related to the industrial usage. The pedagogical approach should be among the prescribed learning theories, such as constructivist learning theory, which states that students come to the learning environment with preconceptions, which occur during their interactions within the physical and social environment, and those preconceptions affect students' learning. These preconceptions lead to students' misconceptions in learning. Studies revealed that misconceptions emanate from students' different cultures, religions, and languages, which are frequently similar or different from the English language. Misconceptions may deeply penetrate students' minds and resist change (Olaitan and Asogwa, 2023). Thus, learning could only take place if there is a behavior change. Misconceptions could be, in some cases, parallel to the explanations made by the teacher. Moreover, Daniel et al (2020), viewed that inadequate resources are not the only factor hindering the effective teaching and learning of metalwork trade; factors such as misconceptions, or incorrect and incomplete understandings of metalwork concepts, represent another significant challenge. Misconceptions occur when students hold beliefs or explanations that contradict technical meaning, often due to inadequate prior knowledge, poor teaching methods, or cultural influences.

Furthermore, Mumuni et al (2022) conducted a study on misconceptions among 550 Level 100 students of First-Year students at Bagabaga College of Education on the Visual Arts and Technical Education aspects of the Foundations of Social Studies and Technical Vocational Education and Training (FFSSTVET) subject. It was found that students had different ideas about the nature of Visual Arts and Technical Education at the Colleges. Adamu et al (2024) examined the determinants of misconceptions of vocational and technical education programmes among 342 candidates of the Unified Tertiary Matriculation Examination (UTME) in Yobe state, Nigeria. The study, concluded that the general misconception on vocational and technical education programmes has a negative effect on the attitude and interest of UTME candidates towards the programme in Nigeria. The study recommended, among others, that students should be educated on the importance of vocational and technical education programmes, and the Yobe state government should initiate orientation programmes that would educate potential UTME candidates on the importance of vocational and technical education in Nigeria. Daniel et al (2020) conducted a study comparing the knowledge, presence of misconceptions, and critical thinking ability of vocational education and training (VET) fitness students at the beginning and end of their training, and qualified personal trainers (PTs). It also examines differences in the sources of information used by students and professionals. VET students' knowledge improved, and misconceptions decreased from pre- to post-training. Thus, the information varies and, with the application of skills, may result in misconceptions forming.

Moreover, it is of paramount importance for teachers in TVET, most especially in the metalwork trade. For example, concepts like; a)'Boss', which means 'rounded projection on the outside of the cast metal', is often confused with 'principal officer in the organization'. b)' Operations' in metal machining are often confused with medical surgery. c) 'Lead' is a metal, which is often confused with leading people. d) 'Die' in metal forming (in Hausa language refers to 'Mutuwa'), somebody's end of 'life'. e) 'File' is used for smoothed/thickness reduction of metal surface, confused with the office 'file.' f) 'Plates' used in holding pieces of metal are confused with kitchen utensils, g) 'Draft' 'turning', 'feed' 'Tolerance', 'mandrel', 'drawing down', 'lathe dog', 'Normalizing,' among others, students may confuse with the common meaning, which is more familiar with and misunderstanding or failing to grasp the concept as it is used in the metalwork trade. These misconceptions are particularly problematic in the metalwork trade as they can interfere with the learning of more advanced topics in the metalwork course, making it difficult for students to progress in their studies. If these misconceptions are not addressed early, they can persist, affecting students' academic performance and their interest in pursuing further studies or careers in the metalwork trade.

Despite these problems there is no much research conducted that directly examines the misconceptions in the metalwork trade at technical colleges. Most of the studies conducted in the metalwork trade were focused on assessing the performance of job-specific tasks rather than students' deep knowledge or understanding of metalwork concepts (Jolley, 2019). The conditions for misconceptions to exist in the metalwork trade are certain, due to the nature of the course, which are practical-oriented course with different concept application/usage from the craftsmen's view, which in most cases differ in theory and training based on school application /usage. Moreover, according to the chief examiner's report (2012), National Business and Technical Examinations Board (NABTEB), indicated misconceptions among students in the metalwork trade, including the wrong usage of metalwork concepts. This leads to weak or poor performance in the metalwork trade. Hence, based on these backgrounds, there is a need to investigate misconceptions among students in the metalwork trade.

Objectives of the Study

1) To find out the mean score of rural and urban students in misconceptions in the metalwork trade.
2) To find out the mean scores NTC I, NTC II and NTC III students in misconceptions in the metalwork trade.

Research Questions

1) Is there any difference in mean score of rural and urban students in misconceptions in metalwork trade?
2) Is there any difference in mean score of NTC I, NTC II and NTC III students in misconceptions in metalwork trade?

Hypothesis

HO_1: There is no significant difference between the urban and rural students' performance students in misconceptions in metalwork trade.

HO_2: There is no significant difference between NTC I, NTC II and NTC III students' performance in misconceptions in metalwork trade.

Methodology

The survey research design was used for the study. The survey design is concerned with people, their beliefs, opinions, motivation, and behavior by collecting and analyzing data from the sample (Sambo, 2005). The area of the study comprises of 5 Senior Technical colleges of Kano State (Nasarawa, Ungogo, Danbatta, Tiga, and Bagauda). A stratified sample was used to select 5 out of 32 Technical colleges. The target population of the study was 210 NTC I, NTC II, and NTC III Metalwork trade students. Purposive sampling was use to select 129 NTC I, NTC II and NTC III Metalwork trade students. NABTEB pass question papers were adopted as the instrument for data collection. Purposive sampling is a sampling technique in which the researcher relies on his or her own judgment when choosing members of the population to participate in the study (Sambo, Ibid). Thus, the researcher only considers the schools that offer General Metalwork Trade. The instrument used for data collection is the objective Type NABTEB fast question papers. Twenty (20) questions were selected that are related to the misconceptions in the metalwork trade. The objective questions were subjected to validation by an expert. Copies of the questionnaire were distributed to respondents with the help of a research assistant. The mid- point scored was 8 marks out of score of 20 marks. That is score of 8marks and above is pass marks while score below 8marks is fail. The data was analysed using SPSS soft ware which includes T- Test, ANOVA and Tukey HSD Post hoc Test's.

Results and Analysis

Research Question 1: Is there any difference in the mean score of rural and urban students in misconceptions in the metalwork trade?

Table 1: Mean score of rural and urban students in misconceptions in metalwork trade.

	Location	N	Mean	Std. Dev.	Mean Difference
Performance	Rural	46	6.304	2.7315	1.455
	Urban	83	7.759	2.0754	
Total		129			

Table 1: above shows the mean score of rural students in misconceptions in metalwork trade is 6.304 with standard deviation of 2.7315. The mean score of urban students in misconceptions is 7.759 with standard deviation of 2.0754. There mean difference of 1.455.

Research Question 2: Is there any difference in mean score of NTC I, NTC II and NTC III students in misconceptions in metalwork trade?

Table 2: Mean score of NTC I, NTC II and NTC III students in misconceptions in metalwork trade

	School		Mean	Std. Dev.	Mean Difference
Performance	NTC I	NTC II	6.467& 7.652	2.2115&2.4875	1.1855
		NTC III	7.658	2.4193	1.1912
	NTC II	NTC III	7.652& 7.658	2.4875&2.4193	.0057

Table 2 above shows the mean score of NTC I, NTC II and NTC III is 6.467, 7.652 and 7.658 with their standard deviation 2.2115, 2.4875 and 2.4193 respectively. The mean difference between NTC I, NTC II and NTC III is 1.1855, 1.1912 and .0057

Hypothesis One: There is no significant difference between the urban and rural students' performance students in misconceptions in metalwork trade.

Table 3: Summary of t-test Results on Significant Difference in Performance between Rural and Urban Students

	Location	N	Mean	Std. Dev.	t-test	Df	P< Value	Decision
Performance	Rural	46	6.304	2.7315	-3.398	127	0.001	Ho Rejected
	Urban	83	7.759	2.0754				

Level of significance 0.05

Table 3 shows that the P< Value is 0.001 which is less than 0.05. Therefore, the null hypothesis is rejected. Thus, there significant Difference in Performance between Rural and Urban Students

Hypothesis Two: There is no significant difference between NTC I, NTC II and NTC III students' performance in misconceptions in metalwork trade.

Table 4a: Summary of ANOVA Results Significant Difference in Performance between NTC I, NTC II and NTC III Students

	Location	N	Mean	Std. Dev.	F	Df	P< Value	Decision
Performance	NTC I	45	6.467	2.2115	3.669	2	0.028	Ho Rejected
	NTC II	46	7.652	2.4875				
	NTC III	38	7.658	2.4193				
Total		129						

Level of significance 0.05

Table 4a shows that the P<Value is 0.028 which less than 0.05. Therefore, the null hypothesis is rejected. Thus, there significant Difference in Performance between NTC I, NTC II and NTC III Students. There is significant difference and the difference is indicated between NTC I and NTC II in the post hoc test in Table 5.

Table 4b: Summary of Tukey HSD Post hoc Test's Results

School	School	Mean Difference	P< Value	Decision
NTC I	NTC II	-1.1855	.049	Significant at the 0.05 level of Sig.
	NTC III	-1.1912	.063	Not Significant
NTC II	NTC III	-.0057	1.000	Not Significant

Result from Table 4b indicates that a significant mean difference exists between NTC I and NTC II. P<Value of 0.049, which has the same level of significance value 0.05.

Discussion of Findings

The result of Table 1 shows that the mean score of rural students in misconceptions in metalwork trade is 6.304, which is less than the midpoint of 8 marks that indicating a failure. This may be because the students are more conversant with their mother tongue as suggested by. UNESCO (2003), cited in Makikoki et al (2008) stated that there is a strong necessity for developing countries to establish an appropriate set of concepts to enable local people to learn metalwork trade efficiently throughout their educational programs. Instruction in the mother tongue is beneficial for students to acquire a basic concept in the metalwork trade. Even though urban students pass with a mean score of 7.759, which is 8 marks. The performance score was weak. Thus, the misconceptions are certain because of the similar meaning from the common meaning, which is more familiar to them. These misconceptions make understanding more difficult for students. These findings are in line with Kempa (1991), who states that some of the causes of students' learning difficulties include communication problems arising from misconceptions about technical education with context-specific specialized meanings.

Table two indicated that the differences in mean score of NTC I with a mean score of 6.467. This shows that NTC I had failed with a mean score less than the mid-point pass of 8marks. But NTC II with a mean score of 7.652 and NTC III with a mean score of 7.658, which is equal to 8marks, are the passing marks. The difference in mean score could be a result of the syllabus coverage of the metalwork trade by the metalwork trade teachers. Thus, NTC I had less coverage of the course content than NTC II and NTC III.

Recommendation: Tracking Misconceptions metalwork trade Using ChatGPT

Tracking Misconceptions in metalwork trade**:** ChatGPT could track recurring questions or misconceptions and offer tailored resources or explanations to help metalwork students better grasp the correct information. Using ChatGPT as a tool to address misconceptions among metalwork trade students presents an innovative way forward. ChatGPT could serve as a powerful resource to correct misunderstandings, enhance learning, and provide continuous support to metalwork students and educators. Below are some alternative solutions or ways forward for using ChatGPT to tracking misconceptions:

A) Instant Query Resolution: Metalwork trade students could use ChatGPT to ask questions at any time and get immediate answers. This could help them correct misconceptions they might have during their studies. By offering explanations, step-by-step guides, or addressing common errors, metalwork students could clear doubts about the metalworking techniques, tools, and processes.

B) Text-Based Simulations: ChatGPT could be used to create interactive problem-solving scenarios for metalwork students. For example, ChatGPT can simulate real-world metalworking tasks or

troubleshooting exercises, allowing metalwork students to engage in scenario-based learning to better understand how to handle different metalworking challenges.

C) Virtual Skill Development: Although ChatGPT cannot physically demonstrate all the metalwork processes but it can explain concepts in detail and guide metalwork students through complex procedures (e.g., welding, machining, forging, etc.) via step-by-step breakdowns, assisting them in visualizing and understanding these processes.

D) Personalized Guidance: ChatGPT could serve as a personalized tutor by adjusting the explanations based on each metalwork student's level of understanding. For example, if a metalwork student is struggling with the basics of welding, ChatGPT could provide foundational explanations before moving on to more advanced topics.

E) Facilitate Peer Discussions: ChatGPT could facilitate discussions between metalwork students by helping them articulate their thoughts more clearly. For instance, metalwork students can input their understanding of a metalworking technique, and ChatGPT can provide feedback or further elaboration to ensure accuracy.

F) Correcting Cultural and Societal Misconceptions: Dispel Gender and Cultural Stereotypes: ChatGPT could offer guidance on addressing stereotypes among metalwork students in the metalworking industry. It could provide stories of successful female metalworkers, discuss the benefits of diversity in metalwork trade skills, and challenge cultural perceptions that may discourage certain individuals from entering the metalwork field.

G) Incorporating Industry Trends and Updates: ChatGPT could keep students updated on the latest trends, technologies, and standards in the metalworking industry. Discussing modern tools, machinery, and automation in metalworking it could help bridge the gap between what students may believe the industry to be and the reality of its evolving nature.

H) Access to Industry Experts: ChatGPT could provide insights into the latest industry metalwork practices through virtual interviews, research summaries, and case studies from the metalworking field. This could help metalwork students understand fully how the metalwork trade works in contemporary settings and as such combat the misconceptions among metalwork students.

Conclusion

In conclusion, the misconceptions among metalwork trade students will invariably affect their academic performance in the general metalwork trade. It is therefore imperative for technical teachers in metalwork to establish a new approach in teaching metalwork concepts by a structured, integrated knowledge base on the job-oriented usage of basic concepts in the metalwork trade through the use of an Artificial Intelligence AI tool such as ChatGPT. Teachers teaching metalwork subjects should also evaluate misconceptions among students by the end of the given lesson. Teachers should use visual representations of the concepts to assist in understanding the basic concepts in the metalwork trade. Teachers should also devote more time in explanations and definitions of some basic concepts so that the students will be familiar with them in order to avoid misconceptions in the metalwork trade among metalwork trade students. Students should be taught to use appropriate concepts in describe and explain technical concept metalwork trade.

References

Adamu, A., et al. (2024). Determinants of Misconception of Vocational and Technical Education Programmes Among Candidates of Unified Tertiary Matriculation Examination (UTME) in Yobe State, Nigeria. *Multidisciplinary Journal of Vocational Education & Research, 6*(1), 73-82. ISSN (Print): 2630 – 7081.

Arikpo, et al. (2022). Instructional Model for Teaching Metalwork Trades in Technology-based Education: An Empirical Evidence from Nigeria. *Journal of Positive School Psychology, 6*(3), 1950–1963.

Daniel, et al. (2020). Misconceptions in the knowledge of vocational fitness students and graduates. *Australian Journal of Adult Learning, 60*(1).

Olaitan, S. E., & Asogwa, C. I. (2023). Teacher training and its impact on students' misconceptions in science subjects. *Nigerian Journal of Science Education, 14*(2), 101-114.

Jolley, D. (2019). *Misconceptions and Critical Thinking Ability In Undergraduate Exercise Science Students, Vocational Fitness Students, and Exercise Professionals*. [Unpublished doctoral dissertation]. Curtin University.

Kempa, R. F. (1991). Students' learning difficulty in science. Causes and possible remedies. *Online Journal Ensenanza de Las ciencias, 9* (2), 119-128.

Mumuni, et al. (2020). Students' Misconceptions about Visual Arts and Technical in the Study of SSTVET in Bagabaga College of Education, Tamale. *Social Education Research, 1*.

Makiko, et al.(2008). Technical Terminology in Asian Languages: Different Approaches to Adopting Engineering Terms. *The 6th Workshop on Asian Language Resource*.

National Business & Technical Examination Board. (2015). *Chief examiners report November/December NBC/NTC/ANBC/ANTC Examination*. National Business and Technical Examination Board.

Sambo, A. A. (2005). *Research method in education*. Stirling Horden Publishers (Nig) Ltd.