



Sign Language-Aided Carpentry and Joinery Training For Enhanced Employability of Deaf and Hard Of Hearing (DHH) Learners

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Abstract

The study investigated the effectiveness of sign language-aided instruction in enhancing the skill development and employability of deaf and hard-of-hearing (DHH) learners in carpentry and joinery trade within Technical and Vocational Education and Training (TVET) centers. A descriptive survey design was adopted, and responses were obtained from 73 carpentry and joinery instructors using structured questionnaires. The internal consistency of the instrument items was determined by the use of Cronbach alpha reliability method and 0.86 reliability coefficient was obtained. Data were analyzed using mean, standard deviation, and t-test statistics. Findings revealed that sign language-aided instruction significantly promotes cognitive, psychomotor, and affective skill development, while also enhancing learners' employability and potential for sustainable self-employment. Results further indicated no significant gender differences in instructors' perceptions, suggesting shared views on the strategies and potentials of integrating sign language into vocational training. Based on these findings, the study recommended that TVET institutions formally integrate sign language-aided instruction into carpentry and joinery curricula to promote inclusivity and improve the employability index of DHH learners.

Keywords: Deaf and hard of hearing, Sign language, Carpentry & Joinery training, Learners, Employability.

Original Research Article

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INTRODUCTION

Technical and Vocational Education & Training (TVET) plays a vital role in equipping individuals with job-specific skills required in today's labor market (UNESCO, 2015). Among the various occupational areas under TVET, carpentry and joinery trade stand out as skill-based trades that demand precision, creativity, and hands-on problem-solving abilities (Oduwaiye & Okoro, 2019). These trades involve constructing, assembling, and repairing wooden structures and furniture, requiring mastery of tools, materials, and safety standards (Bureau of Labor Statistics, 2022). Globally, vocational training is recognized not only as a means of skill acquisition but also as a pathway to economic empowerment and social inclusion, particularly for marginalized groups such as persons with disabilities (ILO, 2020). For deaf and hard of

hearing learners, access to quality vocational training can be transformative, offering opportunities for self-reliance, entrepreneurship, and enhanced employability (Kumar & Singh, 2017). However, despite global advocacy for inclusive education, significant gaps remain in the delivery of vocational training to learners with the deaf and hard of hearing challenges. One of the most critical challenges is communication. In traditional carpentry and joinery workshops, trainers rely heavily on verbal instructions, demonstrations accompanied by spoken explanations, and interactive discussions (Foster, 2018). Without appropriate communication adaptations, deaf and hard of hearing learners may struggle to fully grasp technical concepts, safety protocols, and operational procedures.

Sign language, a visual-manual form of communication, has been recognized as a critical enabler of learning for the deaf and



hard-of-hearing population (National Association of the Deaf, 2021). In vocational training contexts, integrating sign language into teaching methodologies can significantly enhance comprehension, participation, and skill mastery (Ademokoya & Oyewumi, 2019). In carpentry and joinery training, sign language can be applied in explaining workshop safety procedures, giving step-by-step instructions during construction tasks, communicating design measurements and material specifications, and Provision of constructive feedback during practical assessments. When adapted effectively, sign language instruction not only improves understanding but also fosters a more inclusive and supportive learning environment, which is essential for building learner's confidence and work readiness (Okeke & Uzoagulu, 2020).

Carpentry and joinery, as subfields of technical education, require learners to develop a blend of cognitive, psychomotor, and affective skills (Bureau of Labor Statistics, 2022). Competence in this trade involves accurate measurements, cutting, assembling, and finishing of wooden products; the ability to read and interpret technical drawings; and adherence to safety protocols. Carpentry and joinery is structured around a competency-based curriculum, which emphasizes progression through demonstrated mastery of specific tasks rather than the completion of a predetermined duration of study (Foster, 2018).

In this regard, while the model affords flexibility to learners, it also underscores the necessity of targeted communication strategies to ensure that deaf and hard of hearing learners achieve performance standards without being disadvantaged by their hearing limitations. **Consequently**, employability, defined as the capacity to obtain and retain meaningful employment, adapt to workplace dynamics, and pursue continuous career development (Yorke, 2006) emerges as a central objective of such training. Within the carpentry and joinery sector, employability is contingent upon a combination of technical proficiency, adherence to workplace safety protocols, problem-solving competence, and the exhibition of professional behavior (ILO, 2020). **However**, for deaf and hard of hearing learners, the enhancement of employability depends on three interrelated factors: the acquisition of market-relevant technical skills, the cultivation of confidence to participate effectively in mixed-ability work settings, and the development of strategies to navigate workplace communication demands. **In this context**, the integration of sign language-aided instruction serves as a critical mechanism for achieving these outcomes, as it enables learners to access and internalize training content without communication barriers. **Therefore**, such an approach not only ensures equity in skill acquisition but also aligns educational outcomes with labor market expectations, ultimately strengthening the employment prospects of deaf and hard of hearing individuals (Kumar et al., 2017).

The study was guided by two complementary yet distinct theoretical frameworks. Vygotsky's Sociocultural Theory (1978) posits that learning occurs through social interaction mediated by language and cultural tools; however, its reliance on spoken language as the primary mediating tool can marginalize learners with hearing impairments if not adapted appropriately. In this context, sign language assumes a critical role, functioning as an alternative but equally legitimate mediating tool within the Zone of Proximal Development (ZPD) and thereby enabling deaf and hard of hearing learners

to access and master complex practical skills in trades such as carpentry and joinery. Savickas' Career Construction Theory (2005), by contrast, foregrounds career development as a meaning-making process shaped by both individual agency and social context, but it has been critiqued for underemphasizing the structural and communicative barriers faced by marginalized groups. When applied to DHH learners, however, the integration of inclusive pedagogies such as sign language instruction addresses these gaps by fostering technical identity formation, strengthening self-efficacy, and enhancing employability outcomes. Taken together, these two frameworks not only provide a foundation for understanding the learning and career trajectories of deaf and hard of hearing learners but also expose the necessity of adapting theoretical models to reflect the realities of inclusive technical education.

Similarly, despite the recognized potential of inclusive vocational training, there remains a scarcity of empirical studies focusing on sign language integration in carpentry and joinery training within the Nigerian context. Many TVET centers lack the capacity, resources, or trained instructors to effectively accommodate learners with deaf and hard of hearing (Ademokoya et al, 2019). Moreso, empirical research specifically examining sign language-aided instruction in trades such as carpentry and joinery remains sparse. The few studies that exist tend to focus on broader Science, technology, Engineering & mathematics (STEM) education or digital skills accommodations according to American Sign Language (ASL). No known studies systematically assess how sign-supported technical trade instruction influences comprehension, practical performance, vocational confidence, and hence employability in trade-specific contexts.

Thus, the study addresses the identified gap by investigating how sign language-aided carpentry and joinery training influences three critical areas: comprehension of technical concepts and safety procedures, accuracy and efficiency in executing trade tasks, and self-efficacy leading to enhanced employability and entrepreneurial readiness of deaf and hard of hearing learners. The research contributes to theory by integrating sociocultural and career construction perspectives, **while also** advancing practice through actionable guidance for inclusive training programs and policy frameworks that promote sustainable livelihoods for deaf and hard of hearing learners. **Additionally**, the study responds to the urgent need for evidence-based instructional models that bridge communication barriers and strengthen employability indexes for deaf and hard of hearing learners.

Statement of the Problem

Employment remains a critical pathway to social inclusion and economic independence for individuals with disabilities, yet deaf and hard of hearing learners continue to experience disproportionately high unemployment rates globally and in Nigeria (World Health Organization [WHO], 2021). Despite national and international commitments to inclusive education and the rights of persons with disabilities, access to vocational training for DHH learners remains inadequate, fragmented, and often poorly adapted to their communication needs (United Nations, 2015). Carpentry and joinery are key trade within the building construction sector and

hold significant potential for self-reliance, entrepreneurship, and employability. However, most existing carpentry and joinery training programs rely heavily on verbal instruction and auditory cues, making them inaccessible to many DHH learners. Where inclusion efforts exist, they often involve partial accommodations, such as lip-reading or written notes, which do not adequately address the linguistic and cognitive realities of sign language users (Marschark & Hauser, 2012).

The absence of sign language-aided instruction in TVET centers has resulted in three major gaps; skill acquisition gap (DHH learners often acquire incomplete or inaccurate knowledge of trade processes due to communication barriers), employability gap (limited mastery of carpentry and joinery skills reduces their competitiveness in the labour market and hinders entrepreneurship opportunities), and equity gap (lack of adapted training perpetuates systemic exclusion, contradicting the goals of Sustainable Development Goal (SDG-4) on inclusive and equitable quality education). In Nigeria, these challenges are compounded by the scarcity of specialized TVET centers for persons with disabilities and a shortage of trainers proficient in both sign language and carpentry/joinery (Omede & Bakare, 2014). Consequently, many deaf and hard of hearing learners remain underemployed or confined to low-income, low-skill jobs, despite having the potential to excel in skilled trades when provided with accessible training environments. Without a deliberate shift towards sign language-aided carpentry and joinery training, the cycle of unemployment, economic dependency, and social marginalization among deaf and hard of hearing learners will persist. Therefore, how to integrate sign language into carpentry and joinery training to enhance the employability and economic empowerment of this underserved population was the problem the study sought to address.

Purpose of the Study

The main purpose of the study was to investigate sign language-aided carpentry & joinery training, as a strategy for enhancing the employability of deaf and hard of hearing learners. Specifically, the study aims to:

1. Evaluate the effect of sign language-aided instruction on the cognitive, psychomotor, and affective skill development of deaf and hard of hearing learners in carpentry and joinery trade.
2. Determine how sign language-aided carpentry and joinery training influences the employability of deaf and hard of hearing learners.
3. Investigate strategies for implementing sign language-aided instruction in TVET centers for deaf and hard of hearing learners in carpentry and joinery trade.

Research Questions

Three research questions were posed to guide the conduct of the study. They were as follows:

1. **How does sign language-aided instruction affect the cognitive, psychomotor, and affective skill development of deaf and hard of hearing learners in carpentry and joinery trade?**

2. **In what ways does sign language-aided carpentry and joinery training influence the employability of deaf and hard of hearing learners?**
3. **What strategies can be used to implement sign language-aided instruction in TVET centers for deaf and hard of hearing learners in carpentry and joinery?**

Hypotheses

The following hypotheses, tested at 0.05 level of significance, served as the compass for data collection and analysis.

H₀₁: Carpentry and joinery instructors perceived that sign language-aided instruction has **no significant effect** on the cognitive, psychomotor, and affective skill development of deaf and hard of hearing learners in carpentry and joinery.

H₀₂: Carpentry and joinery instructors perceived that sign language-aided carpentry and joinery training **does not significantly influence** the employability index of deaf and hard of hearing learners.

H₀₃: Carpentry and joinery instructors **do not identify** effective strategies for implementing sign language-aided instruction in TVET centers for carpentry and joinery trade training.

METHODOLOGY

Research Design

The study employed the survey research design. Survey design was suitable for obtaining quantifiable data from a defined population to describe their perceptions, experiences, and opinions.

Area of Study

The study was confined to Enugu State, focusing on integrating sign language into carpentry and joinery training to enhance skills acquisition, employability, and economic empowerment of deaf and hard of hearing learners.

Population of the Study

The study population consisted of 81 professional woodwork instructors from the departments of Industrial Technical education at the University of Nigeria, Nsukka (UNN), Technology and Vocational education department, Enugu State University of Science and Technology (ESUT), and the Bina Foundation TVET Centre, Enugu. These instructors were selected due to their authority in carpentry and joinery trade. A purposive sampling technique was adopted to select respondents who met the inclusion criteria of having relevant professional experience in carpentry/joinery instruction. A total of 81 respondents participated in the study.

Instrument for Data Collection

The instrument used for data collection was a structured questionnaire. The questionnaire consisted of sections addressing demographic data, perceptions of sign language-aided instruction, its effects on skill acquisition, its influence on employability, and strategies for implementation in TVET centers. Items were designed using a 5-point Likert scale to enable statistical analysis.

Validity and Reliability of the Instrument

The validity of the instrument was established through expert review, involving two professionals each in woodwork technology and special needs education. The questionnaire items were refined to enhance clarity and relevance **based on their feedback**. Furthermore, reliability was assessed through a pilot test conducted with 15 respondents who shared similar characteristics with the study population. The internal consistency of the instrument was then determined using Cronbach’s Alpha, which yielded a coefficient of 0.86.

Method of Data Collection

Data were collected through direct administration of

the questionnaire to the respondents, both in person and electronically, depending on accessibility and convenience. Respondents were given clear instructions and adequate time to complete the instrument.

Method of Data Analysis

Data were analyzed using descriptive and inferential statistics at the 0.05 significance level. A cut-off mean of 3.50 determined item acceptance. Hypotheses were accepted when the calculated t-value was $\geq$ critical value and rejected when lower. Of 81 questionnaires distributed, 73 were returned indicating a return rate 90.12%.

RESULTS

Table 1: Mean and SD ratings of Carpentry & Joinery instructors on the overall skill development of DHH learners in carpentry and joinery trade. (N=73)

S/N	Item statements	Mean	SD
Sign language-aided instruction improves DHH learners:			
1.	Understanding of carpentry and joinery concepts.	3.90	1.23
2.	Ability to solve woodworking-related problems	4.10	0.91
3.	Interpretation of technical drawings and measurements	3.74	1.03
4.	Ability to correctly use carpentry tools and equipment	4.12	0.74
5.	Ability to effectively assemble joinery projects according to specifications	3.79	1.39
6.	Ability to measure and cut materials more accurately	3.90	1.05
7.	Ability to complete practical carpentry tasks faster and more efficiently	3.80	1.11
8.	Interest in carpentry and joinery activities.	3.78	1.02
9.	Confident in carrying out carpentry projects	4.29	0.66
10.	Teamwork and collaboration among colleagues	3.93	0.81
11.	persistency in overcoming challenges during carpentry tasks	4.16	0.91
12.	Acquisition of relevant marketable carpentry and joinery skills required in the trade	3.85	0.59
13.	Chances of deaf and hard of hearing learners securing long-term employment in carpentry.	4.25	0.57

Table 1 presents the responses of carpentry and joinery instructors on the effect of sign language-aided instruction on the cognitive, psychomotor, and affective skill development of deaf and hard of hearing learners. The respondents agreed with all the items shown in the table. Based on the 3.50 baseline for agreement, the findings indicate that the instructors shared a common opinion on the effects of integrating sign language-aided instruction in the training of deaf and hard of hearing

learners in general woodworking. The expected results of such integrated instruction include improved chances for deaf and hard-of-hearing learners to secure long-term employment in carpentry, acquisition of marketable carpentry skills, and encouragement of teamwork and collaboration, among others. The overall benefit is directed toward inclusive self-employment.

Table 2: t-test on the mean ratings of male and female carpentry & Joinery Instructors on the overall skill development of DHH learners in carpentry and joinery trade through the use of sign language aided instruction.

Instructors	N	Mean	Std. Deviation	t-test	df	Sig.	Dec.
Male	62	3.40	0.24	1.92	71	0.170	Do not reject H ₀₁
Female	12	3.84	0.32				



Table 2 containing an independent-samples t-test showed no significant difference between male and female carpentry and joinery instructors in their ratings of sign language-aided instruction on learners' skill development, $t(71) = 1.92, p = .17$.

Since $p > .05$, the null hypothesis was not rejected, indicating that both groups shared similar perceptions of its effectiveness in enhancing the cognitive, psychomotor, and affective skills of deaf and hard of hearing learners.

Table 3: Mean and standard deviation ratings of carpentry and joinery instructors on the potential of sign language-aided training for enhancing DHH learners' employability. (N=73)

S/N	Item statements	Mean	SD
14.	Learners taught with sign language support show greater confidence during job interviews and work trials.	3.86	1.16
15.	Learners who receive sign language-aided carpentry training have higher customer satisfaction when offering services.	3.64	0.87
16.	Learners trained with sign language support are more likely to own carpentry and joinery businesses.	3.79	0.99
17.	Sign language-aided training increases learners' chances of securing long-term employment in carpentry.	4.05	0.79
18.	Sign language-aided instruction improves DHH learners' ability to meet industry standards in carpentry work.	4.29	0.75
19.	Sign language-aided training enhances learners' ability to work effectively in team-based carpentry projects.	3.90	0.73

Table 3 presents the respondents' mean ratings on the potential of sign language-aided training to enhance the employability of deaf and hard-of-hearing learners, using the 3.50 cut-off point

as the basis for agreement. The mean responses show that the respondents agreed on all the items.

Table 4:t-test on the mean ratings of male and female carpentry and joinery instructors on the potential of sign language-aided training for enhancing DHH learners' employability

Instructors	N	Mean	Std. Deviation	t-test	df	Sig.	Dec.
Male	61	3.91	0.36	0.31	71	0.58	Do not reject H_{02}
Female	12	3.99	0.34				

An independent-samples t-test showed no significant difference between male and female carpentry and joinery instructors in their ratings of the potential of sign language-aided training for enhancing the employability of deaf and hard-of-hearing learners, $t(71) = 0.31, p = .58$. Since $p > .05$, the null hypothesis

was not rejected, indicating that instructors shared similar views on the potential of integrating sign language-aided instruction to foster sustainable employability among deaf and hard-of-hearing learners.

Table 5: Mean and SD ratings of carpentry and joinery instructors on the strategies for implementing sign language-aided instruction in TVET centers for DHH learners in carpentry and joinery trade. (N=73)

S/N	Item statements	Mean	SD
	DHH learners' carpentry skills acquisition could be improved through:		
20.	Developing specialized carpentry and joinery curriculum Materials in sign language.	4.00	1.01

21. Provision of professional development for TVET instructors on sign language communication.	4.16	0.80
22. Collaboration between sign language experts and carpentry instructors.	4.00	0.82
23. Reducing class sizes in TVET centers.	3.90	0.94
24. Integrating technology, such as instructional videos with sign language, supports skill acquisition in carpentry.	4.19	0.86
25. Provision of adequate funding and resources.	4.07	0.93

Table 5 presents the respondents' mean ratings on strategies for implementing sign language-aided instruction in TVET centers for deaf and hard-of-hearing learners in carpentry. Using the

3.50 cut-off point as the benchmark for agreement, the results indicates unanimous support for all the listed strategies.

Table 6: t-test on the mean ratings of male and female carpentry and joinery instructors on the strategies for implementing sign language-aided instruction in TVET centers for DHH learners in carpentry and joinery trade.

Instructors	N	Mean	Std. Deviation	t-test	df	Sig.	Dec.
Male	61	4.06	0.37	0.16	71	0.69	Do not reject H_{02}
Female	12	4.00	0.40				

An independent-samples *t*-test revealed no significant gender difference in instructors' ratings of strategies for implementing sign language-aided instruction in TVET centers, $t(71) = 0.16$, $p = .69$, indicating shared views on its role in promoting inclusive skill acquisition and development among deaf and hard-of-hearing learners.

DISCUSSION

The study investigated the role of sign language-aided instruction in enhancing carpentry and joinery training for deaf and hard-of-hearing learners in TVET centers. Findings showed that such instruction supports the acquisition of cognitive, psychomotor, and affective skills essential for vocational competence and confidence. This aligns with earlier research highlighting the value of inclusive pedagogies in fostering skill mastery and participation among learners with hearing impairments (Okeke & Uzoagulu, 2020). Results further revealed that sign language-aided instruction improves employability by equipping learners with marketable skills, exposing them to team-based carpentry project delivery, and promoting sustainable self-employment. These findings resonate with Ademokoya & Oyewumi (2019), who noted that inclusive learning experiences strengthen DHH learners' employability and career readiness. No significant gender differences were observed in instructors' perceptions of instructional strategies or outcomes, suggesting consensus across groups. This supports Foster's (2018) conclusion that integrated training instructions are equally valued regardless of gender.

In general, the study underscores the need to integrate sign language-aided instruction into TVET programs to strengthen

inclusivity, enhance employability, and foster sustainable self-employment among DHH learners in carpentry and joinery trade.

CONCLUSION

The study examined the effectiveness of sign language-aided instruction in enhancing the training of deaf and hard-of-hearing learners in carpentry and joinery trade within TVET centers. The findings established that such instruction significantly supports the acquisition of cognitive, psychomotor, and affective skills, while also improving learners' employability and prospects for sustainable self-employment. Both male and female instructors shared similar perceptions, confirming broad consensus on the value of integrating sign language into vocational training.

The study concludes that sign language-aided instruction is not only a tool for communication but also a critical pedagogical strategy for advancing inclusive education, promoting equity, and bridging skill gaps among DHH learners. Its systematic adoption in TVET programs can enhance accessibility, strengthen career pathways, and contribute to the overall employability index of DHH learners in carpentry and joinery trades.

RECOMMENDATIONS

The following recommendations are presented based on the findings of the study:

1. TVET institutions should formally integrate sign language-aided instruction into carpentry and joinery curricula to ensure that DHH learners can fully

participate in both theoretical and practical aspects of training.

2. Regular training and professional development programs should be organized for carpentry and joinery instructors to enhance their proficiency in sign language and inclusive teaching strategies, thereby improving instructional delivery.

Educational policymakers should prioritize inclusive education by establishing specialized TVET centers in each local government area and providing adequate resources, such as sign language interpreters and adapted training materials. This approach would strengthen skill acquisition of the underserved learners, employability pathways and promote sustainable self-employment among deaf and hard-of-hearing learners.

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