



Industry Evolving Needs and TVET Institutional Offerings: A Qualitative Response to the On-Demand Skill Gap in Nigerian Woodwork Technology Institution

Daniel Uchenna Chukwu^{*}, Hyginus Osita Omeje, Samson Abayomi Ojo, Anayo Alagba Okekpa, Mark Nande Vershima, Isaac Chinedu Kechere

Department of Industrial Technical Education, University of Nigeria, Nsukka, Nigeria

Email address:

chukwu.daniel@unn.edu.ng (Daniel Uchenna Chukwu)

^{*}Corresponding author

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Abstract: This study investigates the disparity or mismatch between the skills demanded by the evolving woodwork industry and the skills currently provided or available within Nigerian Woodwork Technology Institutions under Technical and Vocational Education and Training (TVET). This disparity signifies the discrepancy between the skills needed by the industry, including modern technological proficiencies, specialized techniques, and adaptability, and the skills being taught or available within the educational framework of these institutions. The qualitative response in this context was used to address and analyze this discrepancy through an in-depth examination of the industry's evolving needs and the offerings provided by TVET institutions, highlighting the areas where the skills provided fall short of meeting the demands of the industry. Findings show that woodwork industries' on-demand skills include: machinery proficiency, customization and design adaptability, digital design and prototyping, and specialized joinery and finishing techniques among others. Among the challenges of meeting this need include resource limitation/lack of funds, faculty training and manpower development, as well as rapid technological changes, seen in the industry. With poor funding of the Woodwork Technology Education (WTE) and TVET as the major challenge of the training institutions, we concluded with a call for government funding in Nigeria. By allocating funds to upgrade the woodworking machinery in our TVET institutions, we can ensure that Nigeria's woodworking education aligns with global advancements, creating a skilled workforce capable of meeting the demands of the modern woodworking industry.

Keywords: TVET, Woodwork Technology Education, Qualitative Research Method, Industry Needs

1. Introduction

In an era marked by rapid technological advancements, globalization, and dynamic shifts in market demands, industries across sectors are undergoing continuous evolution [1]. This transformation brings forth an escalating demand for a highly skilled and adaptable workforce, compelling Technical and Vocational Education and Training (TVET) institutions to reassess their offerings. The landscape of industry needs is constantly evolving, propelled by emerging technologies, changing consumer preferences, and the imperative for sustainable practices [2]. Consequently, this evolution poses a critical challenge to TVET institutions

worldwide, requiring them to align their educational frameworks with the ever-shifting requirements of the industries they serve.

TVET refers to technical education or training designed to impart specific skills relevant to a profession, enabling individuals to secure employment and sustain their livelihoods [3]. The imperative to bridge the gap between industry needs and TVET offerings is more pressing than ever before. Industry demands are no longer static but rather dynamic, requiring a workforce equipped not only with technical competencies but also with a spectrum of adaptable skills [4]. This necessitates a paradigm shift in the way TVET institutions conceptualize and deliver their

programmes. While the core technical skills remain essential, the integration of soft skills, digital literacy, innovation, entrepreneurship, and sustainability into the curriculum has become paramount [5]. Consequently, an in-depth understanding of the evolving needs of industries and a proactive approach to revamping educational offerings has become imperative for the sustained relevance and effectiveness of TVET institutions.

The complexities underlying the alignment of TVET offerings with industry needs are multifaceted. It involves a comprehensive understanding of industry trends, technological advancements, market demands, and socio-economic factors. TVET institutions must continuously engage with industry stakeholders, fostering robust partnerships that facilitate a more agile response to changing needs [6, 7]. Moreover, addressing this alignment challenge necessitates an overhaul of institutional structures, pedagogical approaches, and resource allocation strategies within TVET systems to ensure a dynamic and adaptable educational environment. This pursuit of alignment presents an opportunity for innovation, collaboration, and strategic planning to cultivate a workforce that can effectively contribute to the evolving landscape of industries worldwide.

In the realm of woodwork technology education, the symbiotic relationship between the industry's evolving needs and Technical and Vocational Education and Training (TVET) institutional offerings stands as a pivotal axis shaping the future of this specialized sector. Woodwork technology education (WTE) is a specialized form of vocational training focused on imparting knowledge, skills, and techniques related to woodworking and carpentry. It involves practical instruction in working with wood, including various aspects such as design, crafting, joinery, finishing, and the use of woodworking tools and machinery. WTE equips individuals with the proficiency needed to create, construct, and manipulate wood-based materials into diverse products, ranging from furniture and cabinetry to intricate woodwork pieces, while also integrating modern technological advancements within the field. The woodwork industry, steeped in tradition yet continuously propelled by technological innovations and changing market demands, presents a compelling case for the realignment and evolution of TVET programmes. As the industry witnesses a metamorphosis influenced by sustainability imperatives, digitalization, and customized craftsmanship, the imperative for WTE training institutions to adapt and cater to these evolving needs becomes increasingly crucial.

Within the WTE landscape, the paradigm of craftsmanship is undergoing a fundamental transformation. Traditional woodworking skills now coalesce with cutting-edge technologies, demanding a comprehensive overhaul of TVET institutional offerings. Today's woodwork industry seeks professionals versed not only in traditional joinery and craftsmanship but also proficient in utilizing advanced machinery like CNC routers, and laser cutters, and embracing digital design tools for precision and efficiency [8]. Simultaneously, the call for sustainable practices, eco-

friendly materials, and the ability to cater to diverse and personalized client preferences reshape the skill sets and proficiencies expected from graduates of woodwork technology programmes [14].

The intricate interplay between the industry's evolving needs and TVET institutional offerings in woodwork technology education embodies a multifaceted challenge. It necessitates a profound understanding of the industry's trajectory, embracing innovation while preserving the essence of craftsmanship, and fostering a curriculum that harmonizes tradition with technological advancements. Collaboration and dialogue between industry experts and educators become indispensable [6, 7], fostering partnerships that facilitate the integration of emerging trends, sustainable practices, and digital proficiencies within woodwork technology education. The evolving nature of the woodwork industry presents a clarion call for TVET institutions to navigate this transformative landscape adeptly, ensuring graduates possess the holistic skill sets demanded by an industry in flux. We therefore sought answers to the current needs of the woodwork industry, and why it is difficult for the training institution to match up.

2. Methodology

This study adopted a qualitative research method. This method allows for interviews, observations, and focus group discussions on issues circumventing the experiences, circumstances, and perspectives of experts in the two sectors of interest – industry and education. According to Moriarty [15], the choice of qualitative research method is based on sample size, especially when selected based on peculiarity, and close contact data collection method involving interactions amongst the researcher and the participants. Also, the qualitative method is employed when analysis involves emergent concepts, requiring the need for pattern identifications and distinctions, as well as using inquiry to project more meaningful explanations. It is equally noteworthy to mention that the qualitative method allows people to speak in their own words, and not based on the researcher's idea [9].

Firstly, we used open-ended interview questions directed to ascertain the on-demand skill needs in some selected wood/furniture article-producing industries across different cities. A total of 7 management staff were interviewed, by different persons in 5 different locations. We asked: Given the trend in technological development, are there machines and special equipment that you have that are different from what you know in the last three decades, please mention a few. Do you think that the same machines and equipment are in schools where woodwork technology is studied? Are there experiences you have had in the last five years with graduates of woodwork technology at any level that suggest poor preparation for employment in industries? So far, what skill sets would you suggest to be included in the TVET training institutions for woodwork technology students' immediate employability? What do you think would be the major

challenges in meeting this on-demand skill integration in training institutions?

Secondly, the responses to the questions from the industry practitioners formed the bulk of the focus group discussion among the TVET lecturers in the Department of Industrial Technical Education, University of Nigeria, Nsukka. Specifically, the researchers did a guided tour of the woodwork section of the Department, observing the machines and equipment used in teaching and learning of woodwork technology. Documentations were made, and further questions on the “on-demand skills” were asked based on the responses of the industry experts. Thus, each on-demand skill was questioned for answers, plans, and explanations, and finally, challenges were discussed. The discussion was done between three researchers and 7 (4 non-academic and 3 academic) staff members of the Department. The next section covers the results, discussion, and conclusion on the study’s explorations, with a call for government intervention in funding.

3. Results

The results here are presented as responses to the questions, and some responses are also joined, to make a better meaning.

Question: Given the trend in technological development, are there machines and special equipment that you have and are different from what you know in the last three decades, please mention a few?

Responses:

- 1) *Yes! A lot of them are useful in intricate curves and accurate dimensioning. The CNC router, Panel saws, etc. are lacking in most schools.*
- 2) *Yes! So many have changed over time. I think the institutions are still where they were in equipment and infrastructure, hence the incessant strikes by the ASUU group. We have good and well-planned dust collectors - to ensure that our environment is safe for workers of all statuses, modern router machines – to account for major customized designs and curves in our products.*
- 3) *Yes, I have some machines and special equipment that are different from what I used to know in the last three decades. Some of them are computer numerical control routers and detail sanders.*

Question: Do you think that the same machines and equipment are in schools where woodwork technology is studied?

Responses:

Everyone but one of the respondents said “No” or “No, I do not think so.” The only person who said, “Yes” added that “the machines may be obsolete, moribund or financially demanding to revive and sustain, given the current nature of educational funding in Nigeria.”

Question: Are there experiences you have had in the last five years with graduates of woodwork technology at any level that suggest poor preparation for employment in industries?

Responses:

- 1) *Yes, and yes!!! I have had the privilege of interviewing workers for the company. I must say that oftentimes, the higher education counterparts are better in theory than in practice. On the other hand, those who learned woodwork from artisans find it extremely difficult to use any big machine at all. In all, we simply employ as interns and retrain them in specific skills as required.*
- 2) *There are so many. I recall a graduate of woodwork from a higher institution who could not cut mortise using machines. You know we work more with machines to meet up with demands and maintain precision. So, the inability to work with machines is a total no for us in the industry.*
- 3) *So far, I must say that some persons who have approached us for employment are prepared for the industry in soft skills more than in the technical and core machine woodworking skills. I have met prospective employees who are passionate about the industry, with dreams and product ideas, entrepreneurial mindsets, and so on. But the issue is that I think higher institutions have left the core skills of the woodwork to focus on the soft skills – the issue is also not far-fetched as equipment and manpower could be their problem.*
- 4) *I would say yes. This is because some graduates still find it difficult to effectively operate some basic woodwork machines. In fact, I have had to put most of the graduates on a short-term training programme before they fit into my organizational set-up.*

Question: So far, what skill sets would you suggest to be included in the TVET training institutions for woodwork technology students’ immediate employability?

Responses:

Soft skills need to be integrated. A whole lot of the graduates do not have the ability to manage themselves, relate well with others, or work in a team to achieve organization-set goals and objectives.

Other responses from the participants are summarized in Table 1.

Table 1. On-Demand Skills for Woodwork Technology Students.

S/N	On-demand woodwork skills
1	Machinery proficiency
2	Customization and design adaptability
3	Digital design and prototyping
4	Specialized joinery and finishing techniques
5	Safety protocols and risk management
6	Material knowledge and sustainable practices
7	Business and entrepreneurial skills
8	Environmental compliance and regulations
9	Adaptation to industry trends and technology integration
10	Collaboration with other trades

Question: What do you think would be the major challenges in meeting the on-demand skill set integration in TVET training institutions?

Responses:

There are two ways to look at the challenge. The challenge may come from knowing the appropriate instructional

techniques to use in helping students develop this vital skill set. Another challenge may come from the instructor who may also require training so that they can effectively teach soft skills.

Other responses from the participants are summarized in Table 2.

Table 2. Challenges of Meeting On-Demand Skill Set in Woodwork Technology Education.

S/N	Challenges to Meeting On-demand Woodwork Skill Set
1	Resource limitation/lack of funds
2	Faculty training and manpower development
3	Obsolete curriculum
4	Obsolete equipment and machines
5	Teacher-centered teaching techniques
6	Poor industry/institution collaborations
7	Rapid technological changes

Guided Tour Experience: Observation

The guided tour was necessary as it confirmed to the researchers (especially those from other institutions) the experience shared by the industry experts. For emphasis, the woodwork section of the Industrial Technical Education, at University of Nigeria, is the foremost workshop that was set up in the 1960s to deliver training in woodwork-related trades such as carpentry and joinery, furniture making, cabinetry, upholstery, etc. Being the torchbearer in vocational teacher education, it has been a home to so many “teachers of teachers” across the nation, wherever the woodwork technology education is mentioned. However, on arrival, those who graduated from the Department decades ago could only point few changes that have taken place (the list of available equipment and their status is presented in Table 3).

From inception till now, the section has witnessed only two (2) interventions in terms of equipment upgrades. The few pieces of equipment brought in through the interventions are indeed fairly vital but are only serving as much as the technical staff know about it. Meanwhile, the WTE section of the Department has a total of 16 staff members, comprising 1 Professor, 7 other Academics, and 8 Technical Staff members. But none of them reported to have been trained neither on the full utility of any machine found in their workshop nor on the servicing beyond replacement of cutters and blades. Thus, there is an obvious need for the available manpower to be supported through training and exposure to the industry requirements of the present.

Table 3. Woodwork Equipment/Machines and their Observed Status.

S/N	Woodwork Equipment/Machines	Status
1	Radial arm saw	Needs servicing
2	Spindle moulder	Moribund
3	Mortiser	Moribund
4	Circular saw bench	Working
5	Lathe machine	Needs servicing
6	Surfacer	Working
7	Band saw	Needs servicing
8	Thicknesser	Working
9	Spray booth cylinder	Working
10	Disc sander	Working
11	Grinding stone	Working

S/N	Woodwork Equipment/Machines	Status
12	Press drill	Working
13	Handtools	Scarcely available, and in bad condition where available

4. Discussion

In this section, the discussion centered on the industry’s on-demand skill set, the importance, and the efforts made by the staff members to align the institution with the demands of the industry. Lastly, the challenges were discussed.

From the findings, the woodwork industry needs the following specific on-demand skill sets and proficiencies to be adequately addressed by current Woodwork TVET programmes: machinery proficiency, customization and design adaptability, digital design and prototyping, specialized joinery and finishing techniques, safety protocols, and risk management, material knowledge and sustainable practices, business and entrepreneurial skills, environmental compliance and regulations, adaptation to industry trends and technology integration, and collaboration with other trades.

Machinery Proficiency: It is noteworthy that modern woodworking involves a wide array of advanced machinery, from CNC routers to laser cutters. TVET institutions need to emphasize hands-on training with these machines, ensuring students are adept at operating, troubleshooting, and maximizing their potential. Practical exposure to these tools can enhance graduates’ readiness for industry roles demanding technological proficiency.

Having laid the explanation and findings from the industry experts, we asked the teachers: Given the importance of this skill, does the TVET training sufficiently cover the operation, maintenance, and troubleshooting of advanced woodworking machinery like CNC routers, laser cutters, or automated shaping tools, considering their prevalence in modern workshops?

Their answer was a unanimous “No” adding that the institution would first of all be equipped with the modern equipment, and then the available manpower trained on the usage, diagnosis, and maintenance, before the students who are at the receiving end would be empowered with the skills.

Customization and Design Adaptability: This skill captures the ability to cater to diverse client preferences and create bespoke designs and is crucial in today’s woodworking industry. TVET programmes should encourage creative thinking, design exploration, and adaptability to fulfill custom orders, preparing students to navigate the dynamic landscape of client demands.

The question is: Are woodwork technology graduates trained to handle custom orders, and bespoke designs, and adapt to diverse client preferences while maintaining quality and precision in woodworking projects?

There are provisions in woodwork courses where designs are treated as part of the contents. But it is obvious that more needs to be done in this regard – this is because most students concentrate on scaling through the examinations after the classes than on getting the skills required to make them stand

out after graduation. The staff members must find means of engaging the students in more meaningful activities using inquiry and problem-based approaches rather than any form of teacher-centered learning technique [10].

Digital Design and Prototyping: Integrating Computer-Aided Design or Modeling (CAD/CAM) software and prototyping tools into the curriculum empowers woodwork students to visualize, design, and simulate projects digitally before execution. This proficiency streamlines the design process, ensuring precision and feasibility, ultimately minimizing material waste and maximizing efficiency.

We discussed this question: Are Woodwork courses integrating digital design software (CAD/CAM) and prototyping tools that enable woodworkers to create detailed plans, visualize designs, and simulate projects before actual production?

The finding was far from expectations, as there were no computer laboratories where such software exists for teaching and learning. The students were rather been encouraged to own personal computers and make attempts to learn on their own. It suggests that the government through curriculum design and implementation has not paid attention to building the digital skills of the students in woodwork technology. It is also sad to note that the available manpower lacked the skills themselves, and no one gives what he/she does not possess.

Specialized Joinery and Finishing Techniques: Woodwork technology training institutions must focus on teaching a spectrum of specialized joinery techniques and finishing methods. Mastery of techniques like dovetailing or hand-cut joinery, coupled with various finishing methods, ensures graduates possess the craftsmanship sought after in high-quality woodworking projects.

Do woodwork training cover a wide array of specialized joinery techniques (e.g., dovetail, mortise, and tenon) and finishing methods (e.g., staining, distressing, or specialized coatings) necessary for diverse woodworking projects?

Inquiry via the discussion showed that the skills for joinery are mainly taught manually, as that is the level of the available manpower and machines. Upgrade is required to ensure that industry-standard of jointing is adequately achieved in the woodwork training institutions. On the other hand, specialized finishing differentiates imported goods from Nigerian-made wooden articles, thus efforts must be made by the teachers to learn and adopt modern finishing techniques to produce competitive graduates. There is also a decay of the skill-development impact of working with manufactured boards as seen in this era – the medium density fibreboards (MDF), and high-density fibreboards (HDF) with different top finishings – limit the development of jointing and finishing skills.

Safety Protocols and Risk Management: Woodworking environments carry inherent risks; thus, woodwork programmes should prioritize safety protocols, hazard identification, and risk management strategies to instill a culture of safety among students. Practical training in using safety equipment and handling hazardous materials is crucial

for a secure work environment.

To what extent are woodwork technology students trained in safety protocols specific to woodworking machinery, hazardous materials, and risk management strategies to ensure workplace safety?

The subject of core safety is left to chance in the training institutions. Little wonder the industry finds this skill lacking in the graduates of woodwork institutions. The discussions pointed to the fact that although the machines are few, in most of the practical sessions, the power supply disrupts the usage of the machines, making every aspect of safety on the machine end with theory. The poor attitude and experience of the students concerning safety have many reasons, stating the obvious.

Material Knowledge and Sustainable Practice: Understanding wood properties, sourcing sustainable materials, and employing eco-friendly practices are pivotal. woodwork education should incorporate lessons on responsible wood sourcing, ecological impact awareness, and the adoption of sustainable practices to align with global trends toward environmental conservation.

To what extent do woodwork programmes emphasize sustainable wood sourcing, ecological impact awareness, and knowledge of alternative materials, considering the growing demand for eco-friendly practices in woodworking?

This seems to be beyond the students' scope, as they are taught to buy from the timber markets, and are not necessarily part of the tree felling and conversion processes. However, the sustainability issue is general knowledge that does not depend on the area of study [11]. The students should therefore be armed with the knowledge, attitude, and behaviours, towards a sustainable environment, economy, and society.

Business and Entrepreneurial Skills: Equipping students with business acumen, pricing strategies, client communication, and project estimation fosters entrepreneurship within the woodworking sector. TVET programs should incorporate modules that prepare graduates not just as skilled artisans but also as savvy entrepreneurs capable of running successful woodworking ventures.

Are woodwork technology graduates equipped with business management skills, such as pricing strategies, client communication, project estimation, and entrepreneurship, necessary for operating their woodworking enterprises?

Findings and discussions show that entrepreneurship education which has become part of every student's core curriculum is yielding expected results. Lecturers of woodwork technology however lament bitterly that most persons who graduate to venture into business usually diverge from the woodwork line of businesses. The lamentation of lecturers elaborates that starting up a business in the woodwork industry requires funds, and most young graduates are not fortunate with the funds, and there is no support from the established industries or government to help intending business-minded graduates from the institutions. Another reason for the divergent venturing is poor skills in practical woodwork, making it challenging to compete

favourably in the labour market.

Collaboration with Other Trades: Encouraging collaboration with professionals from related trades like architecture, interior design, or construction fosters integrated project execution. Woodwork education should facilitate interdisciplinary collaboration, preparing graduates for diverse collaborative endeavors in the industry.

How well do woodwork technology programmes prepare students to collaborate with professionals from related trades, such as architects, interior designers, or construction teams, to deliver integrated projects?

Aside from the interdepartmental courses during semesters, there are no opportunities for collaboration in real project execution among the students, and among other disciplines. *“It is agreeable that woodwork technology can be a complimentary skill in areas of construction, interior designing, and architecture, but I must say that we have failed to look out for opportunities within the campus where students would join forces in delivering projects.”* Besides, integrated project delivery is a sustainable approach to construction in this era [12], it is therefore important to nurture and encourage the idea of collaboration among the students, as it builds skills, enhances communication, and teamwork abilities, as well as other 21st century skills [13].

Lastly, it is imperative to say that by focusing on these on-demand skills, TVET woodwork education can ensure graduates possess a holistic skill set, aligning with industry needs and fostering a workforce capable of meeting the demands of a dynamic woodworking sector.

Challenges

On integrating on-demand skill sets into woodwork training institutions, discussants agree with and comment on the challenges, including:

- 1) **Resource Limitations/Lack of Funds:** Acquiring modern equipment, technology, and materials required to teach these new skills can be costly. Many institutions, especially in less developed regions, face budgetary constraints that hinder their ability to invest in the necessary resources. This is making the challenge of obsolete equipment and machines a persistent one.
- 2) **Faculty Training and Development:** Educators lack of expertise or training in the latest technologies or skills. Providing ongoing professional development for instructors to stay current with industry trends and practices is essential but can be challenging due to time and financial constraints.
- 3) **Obsolete Curriculum:** Revising and adapting existing curricula to incorporate rapidly evolving industry demands is a significant challenge. Updating syllabi, modules, and coursework to encompass new skills while maintaining the foundational knowledge base can be complex and time-consuming.
- 4) **Teacher-Centered Teaching Techniques:** Integrating on-demand skills often requires a shift from traditional teaching methods to more flexible, hands-on, and practical approaches. Adapting teaching methodologies and assessment criteria to align with these demands

might face resistance or institutional inertia. It also requires the staff’s professional development through training and workshops.

- 5) **Poor Industry/Institution Collaboration:** Establishing effective partnerships with industry stakeholders for insights into current demands, hands-on training opportunities, and guidance on skill requirements can be difficult. Bridging the gap between academia and industry expectations requires ongoing communication and collaboration.
- 6) **Rapid Technological Changes:** In rapidly evolving fields, such as technology or digital industries, skills become outdated quickly. Constantly updating the curriculum to keep pace with these changes while ensuring a foundational understanding can be demanding. Effective collaboration between the industry and the learning institution can provide leverage for the latter.

Addressing these challenges requires a concerted effort involving collaboration among educational institutions, industry partners, policymakers, and regulators. It demands flexible and adaptable strategies that prioritize ongoing curriculum review, investment in faculty development, resource allocation, and fostering strong industry-academia partnerships to ensure TVET and woodwork institutions can effectively meet the on-demand skill sets required by evolving industries [6, 7].

5. Conclusion: A Call for Government Funding Intervention in Nigeria

The woodworking industry in Nigeria stands as a testament to our rich cultural heritage and artisanal craftsmanship. However, in the face of a rapidly evolving global market and technological advancements, there exists a profound disparity between the tools and equipment available in our Technical and Vocational Education and Training (TVET) institutions and the modern machinery prevalent in the industry.

It is imperative to acknowledge that our TVET institutions are struggling to keep pace with the transformative innovations reshaping the woodwork industry. The absence of modern machines and equipment in these educational settings hampers the holistic development of our future workforce. Without access to cutting-edge tools like CNC routers, laser cutters, and other advanced woodworking machinery, our students are being left behind, unprepared to meet the demands of a modern, technology-driven woodworking sector.

Therefore, we urgently call upon the Nigerian government to intervene and bridge this technological gap by allocating dedicated funding to equip our TVET institutions with state-of-the-art woodworking machinery. This funding would not only modernize our educational infrastructure but also empower our students with practical, hands-on experience on par with global industry standards. By investing in these

institutions, the government would not only be nurturing the skills of our youth but also fostering innovation, entrepreneurship, and competitiveness within the woodworking sector. Empowered with modern tools and equipment, our students will be better equipped to contribute meaningfully to the industry, drive economic growth, and preserve our cultural legacy.

In conclusion, we appeal to the Nigerian government's commitment to our country's educational development and the prosperity of our industries. By allocating funds to upgrade the woodworking machinery in our TVET institutions, we can ensure that Nigeria's woodworking education aligns with global advancements, creating a skilled workforce capable of meeting the demands of the modern woodworking industry.

Conflicts of Interest

The authors declare no conflicts of interest.

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