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An evaluation of how Civil Technology teachers vocationalise practical skills curriculum in metropolitan schools

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Research Article

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Abstract

The vocationalisation of school curricula is increasingly important for preparing learners with practical knowledge and skills that are relevant to further education, employment and changing workplace demands. This study evaluated how Civil Technology teachers vocationalise the practical skills curriculum in metropolitan schools. The study adopted a qualitative research approach, framed within a case study design to capture variations in practices across selected technical schools. Furthermore, Cognitive Apprenticeship Theory was employed as a theoretical framework to guide this study. Eleven Civil Technology teachers were purposively selected based on their vast experience in teaching practical skills curriculum. Data were collected through non-participant classroom observations and were analysed using inductive content analysis. The findings revealed that Civil Technology teachers vocationalised the curriculum primarily through instructional processing skills and demonstration phase. However, the extent of vocationalisation varied across classrooms. Practical teaching was frequently teacher-centred, with limited opportunities for learners to actively participate, receive sufficient explanation of procedures and develop 21st century skills that are required in the built environment industry. The findings further revealed inconsistencies in the modelling of the selection and use of appropriate tools, limited emphasis on achieving high-quality workmanship and technical practices. From the perspective of Cognitive Apprenticeship Theory, the six stages of the framework were not comprehensively enacted during the observed lessons, as teachers primarily focused on direct instruction and demonstrating practical procedures and techniques to learners. The study concludes that Civil Technology teachers are partially vocationalising the practical skills curriculum, but vocationalisation remains uneven and inconsistent aligned with real-world occupational practices.

Introduction

Technical and vocational education has become increasingly important in preparing learners with the knowledge and practical skills required in a rapidly evolving labour advancement. The changing industry demands have compelled education systems worldwide to strengthen vocational education and training (VET) by integrating practical learning with workplace expectations. In South Africa, the vocationalisation of school curricula has gained renewed attention as a strategy to reduce youth unemployment, address skills shortages and promote economic development. Consequently, technical high schools are expected to produce graduates who possess both theoretical knowledge and occupational competencies that are relevant to the construction and engineering industries (Kana & Letaba, 2024; Magagula & Awodiji, 2024).

Civil Technology is one of the vocational subjects offered in South African technical high schools to equip learners with practical skills and the ability to apply scientific principles in the built environments (Qwabe, Mtshali & Sephokgole, 2026; Department of Basic Education (DBE), 2011). According to Msimango (2024) it utilises the curriculum by integrating theoretical instruction with practical activities through the Practical Assessment Task (PAT), enabling learners to apply classroom knowledge in authentic practical contexts. Vocationalisation within Civil Technology therefore requires teachers to adopt learner-centred pedagogies, facilitate meaningful practical experiences, and align teaching with current industry standards and occupational practices. Such an approach enhances learners' technical competence, further education or employment in the construction sector (Mhlongo, Khoza, & Skosana, 2023).

Despite these curriculum intentions, several studies indicate that the implementation of vocational education in South Africa continues to experience significant challenges. These include inadequate workshop facilities, shortages of tools and materials, insufficient teacher professional development, limited industry collaboration and curriculum content that is not always responsive to contemporary workplace needs (Rivai & Rahmawati, 2025; Oviawe, Uwameiye, & Uddin, 2017). Furthermore, Rintala and Nokelainen (2020) revealed that curriculum implementation remains constrained by disparities in school resources and limited opportunities for learners to engage in real-world work experiences. These challenges reduce the effectiveness of practical teaching and create a gap between learners' skills and industry requirements (Nkwanyane, Makgato, & Ramaligela, 2022). Therefore, addressing these challenges is crucial for improving learners' practical skills and ensuring the industry readiness.

Teachers play a pivotal role in the vocationalisation of the Civil Technology curriculum because they are responsible for planning practical lessons, assessing learners' practical competencies and creating learning environments that mirror industry practice. However, little empirical research has specifically examined how teachers vocationalise the practical skills curriculum within metropolitan schools, where access to industry, infrastructure and educational resources may differ compared to rural schools. Evaluating teachers' vocationalisation practices is therefore essential for identifying effective instructional approaches and implementation challenges that can inform curriculum improvement and teacher professional development, ultimately enhancing graduates' employability. Hence, this study seeks to evaluate how Civil Technology teachers vocationalise the practical skills curriculum in metropolitan schools.

Vocationalisation of the Practical Skills Curriculum

According to Kargbo, Amakali and Machava (2026) vocationalisation of the curriculum is to the process of integrating practical, occupational knowledge and hands-on subjects into teaching and learning to prepare learners for further education, apprenticeships and employment. In Civil Technology, vocationalisation requires teachers to move beyond the transmission of theoretical knowledge by creating authentic learning experiences that reflect current construction industry practices. This includes integrating practical workshop activities, problem-solving tasks, occupational health and safety procedures, and the use of industry-standard tools and materials (Ghosh, Ray Chaudhury & Sinha, 2026; Wang, Zhu & Zakaria, 2025). Such an approach ensures that learners acquire practical skills that are directly applicable to the workplace while simultaneously developing critical thinking, communication, teamwork and professional ethics (Amish, 2024). Recent study by Storonyanska, Benovska, Patytska, Ivashko and Chulipa (2025) indicated that vocationalisation enhance the learning process, by making it more interactive and effective while increasing learner engagement and improves the technical education to labour market demands.

Teachers are central to translating vocational curriculum intentions into meaningful learning experiences that connect theoretical knowledge with practical workplace skills (Zhao & Ko, 2024). Correspondingly, Padhi, Biswal and Tripathy (2026) confirmed that effective vocationalisation requires teachers to design learner-centred practical lessons, demonstrate workplace procedures and assess learners using authentic performance-based tasks. Furthermore, teachers

should expose learners to real construction problems, encourage collaborative project work, and promote safe working practices that mirror industry expectations. According to Msimango, Mtshali and Khoza (2024), although many Civil Technology teachers receive professional development opportunities, these programmes often fail to provide sufficient discipline-specific practical training required for effective implementation of practical learning. This emphasises that teachers require continuous professional development that focuses on specialised practical skills, innovative teaching strategies and industry-aligned instructional methods.

The PAT provides an important mechanism through which teachers can vocationalise the curriculum by allowing learners to demonstrate practical competence in authentic hands-on activities (Mhlanga, Khoza & Skosana, 2023). Rather than treating the PAT as a compliance exercise, teachers should use it to simulate workplace conditions by requiring learners to apply technical knowledge, solve practical problems and produce work that meets acceptable industry standards. Mtshali and Singh-Pillay (2023) contend that enhancing the quality of practical learning and preparing learners with industry relevant skills depend on teachers' pedagogical capital, which includes curriculum knowledge, practical expertise, assessment competence and reflective practice. Their study further suggests that empowering teachers to design meaningful practical assessment activities strengthens curriculum transformation and supports vocational education objectives. This implies that Civil Technology teachers should use the PAT as a pedagogical tool to promote authentic learning experiences that mirror real workplace practices rather than merely fulfilling assessment requirements. By integrating industry standards, practical problem-solving and competency-based assessment into PAT activities, teachers can better prepare learners with the technical, employability and occupational skills required for apprenticeships, further vocational training and employment in the construction industry.

Despite the recognised importance of vocationalisation, several contextual factors continue to constrain teachers' ability to implement practical skills effectively. These include shortages of workshop equipment, insufficient construction materials, overcrowded classrooms, inadequate funding, and limited collaboration between schools and construction industry (Onikoyi, Onikoyi, Bankole & Nafiu, 2025). More recent evidence also shows that a lack of access to specialized resources and continuous professional support makes it difficult for many teachers to convert curricular objectives into real workplace-oriented learning (Assassi, Tafazoli, Rouaghe, & Bouaziz, 2025). These challenges reduce opportunities for learners to acquire industry relevant skills and contribute to the persistent mismatch between practical training received in schools and demands of labour market. Therefore, strengthening teacher capacity, improving workshop infrastructure, and establishing stronger partnerships between technical schools and industry remain essential for enhancing the vocationalisation of the Civil Technology practical skills curriculum in metropolitan schools.

Methodology

Research Approach

This study adopted a qualitative research approach to evaluate how Civil Technology teachers vocationalise the practical skills curriculum in metropolitan schools. According to Regmi (2024) qualitative research is suitable for investigating complex educational phenomena from the perspectives of the participants. A qualitative approach was considered appropriate because it enables the researcher to explore participants' experiences, perceptions and practices in their natural settings. Moreover, it provided rich and detailed insights into how teachers interpret and implement the practical skills curriculum, as well as the factors influencing its vocationalisation in the classroom.

Research Design

The study employed a qualitative case study design. A case study allows an in-depth investigation of a contemporary phenomenon within its real-life context, particularly where the boundaries between the phenomenon and the context are not clearly evident (Yin, 2018). The design enabled the researcher to examine how Civil Technology teachers vocationalise the practical skills curriculum in selected metropolitan schools while considering contextual factors such as school resources, workshop facilities, curriculum requirements and learner characteristics.

Sampling

The target population comprised 18 technical high schools with almost 20 teachers responsible for teaching Civil Technology in Further Education and Training (FET) practical curriculum from in Tshwane Metropolitan. Within this targeted population, eleven teachers were purposively selected as participants of this study. Purposive sampling is defined as the intentional selection of specific units (such as individuals, cases or events) based on their relevance to the research question, enables the researchers to gain deep insights into complex phenomena (Tajik, Golzar & Noor, 2025). The eleven teachers were selected because they operate in technical high schools that are in urban environments, where learners may have greater exposure to construction industries and vocational opportunities. Furthermore, teachers who had less than three years of teaching experience in the FET phase or were based outside the metropolitan area were excluded from the study. This ensured that teachers with vast experience of implementing the Civil Technology practical skills curriculum are considered, for enabling the study to draw on informed and meaningful accounts of curriculum vocationalisation.

Data collection

The researchers employed non-participant observations to collect data for the study. According to Barrios, Roys, Maestre and Araujo (2024) non-participant observations are relatively unobtrusive and allow researchers to collect situated data without interacting directly with participants. Non-participant observations were undertaken during practical lessons to examine how teachers enacted vocationalisation in authentic classroom and workshop settings. The use of this complementary data collection method enabled the researcher to observe teachers’ instructional practices, learner engagement, use of

equipment and the integration of practical skills in real-time, thereby providing rich contextual evidence of how Civil Technology practical skills curriculum was vocationalised.

Analysis

The study employed an inductive content analysis in order to extract themes and patterns from the data. According to Vears and Gillam (2022), the inductive content analysis is a methodical procedure for analysing qualitative data in which the analysis is likely to be guided by specific evaluation objectives. To enhance the credibility of the findings, data obtained from non-participant observations were systematically analysed and triangulated with field notes, visual materials, and teachers' explanations. Themes were developed inductively from the observed classroom practices, ensuring that the findings remained grounded in the actual teaching context. The participants were also given a chance to verify the researchers' interpretations and minimise the influence of the researchers' personal assumptions and interests.

Theoretical Framework

This study used a Cognitive Apprenticeship Theory (CAT) to explore how Civil Technology teachers enact the practical skills curriculum in the classroom. According Walters-Williams (2022), cognitive apprenticeship is a theory on how a master of a skill instructs an apprentice in that trade. It makes the assumption that people pick up knowledge from one another by modelling, imitating, and observing (El-Henawy, 2026). The framework emphasises learning through guided participation and consists of six key stages: modelling, coaching, scaffolding and articulation, reflection and exploration. Figure 1 below shows a diagrammatic representation of Cognitive Apprenticeship model as it was used as the theoretical framework to underpin the study.

These six stages assisted in understand the interaction of teaching and learning as the teacher instructed and demonstrated the practical skills curriculum in classrooms or workshops. Furthermore, the use of this model added a great value to the study by providing a theoretical lens through which the vocationalising of practical skills curriculum could be examined. Specifically, the model enabled the study to assess how teachers modelled practical procedures, coached learners during task performance, provided scaffolding and feedback, and gradually reduced their support as learners developed greater independence and competence. This framework was particularly relevant to Civil Technology, where the acquisition of practical skills requires learners to observe expert practice, engage in guided practice, receive corrective feedback, and progressively assume responsibility for performing tasks independently.

Results and Discussion

As previously stated, the study used inductive analysis to interpret the qualitative data collected through non-participant observations. This analytical approach enabled the researcher to examine how Civil Technology teachers vocationalise practical skills curriculum in metropolitan schools. The analysis revealed two overarching themes that describe the strategies and practices employed by teachers to vocationalise the practical skills curriculum. Specifically, the findings indicate that Civil Technology teachers use:

- • Instructional processing skills phase
- • Demonstration phase

Theme 1: Instructional processing skills phase

During the instructional processing phase, Teacher A used the PowerPoint slide to present the basic skills for woodworking joints as shown in Fig. 1 below, where digital tools were used to structure content delivery and guide learners through the foundational concepts.

To begin with the preparation for the woodworking PAT, Teacher A's instructional processing skills showed a harmonious balance between teacher explanation and retrieval practices. The teacher employed retrieval practices at the start of the lesson and utilised visual aids to connect previously acquired knowledge with the new content. This approach reflected the modelling stage of Cognitive Apprenticeship Theory, as the teacher guided learners by making aspects of the practical task more visible and connecting the new procedures to knowledge previously acquired. However, the deficiency of clearly articulated lesson objectives or outcomes during instructional delivery by the teacher was noted as a major setback, as it prevented learners from having an understanding of a clear direction of what to expect from the lesson. Similarly, a study by Abdulayeva (2024) highlighted that specific objectives in a lesson do not only assist with instructional planning but also increase learner motivation and engagement by demonstrating the lesson's value and relevance. Furthermore, according to Sánchez-García and Reyes-de-Cózar (2025) a well-structured design process provides clear learning objectives with a road map to offer direction and facilitate efficient assessment of learning results. Therefore, it is evident that omitting the lesson objectives during instructional delivery can lead to misconceptions among learners regarding the importance of the lesson and its intended outcomes. Therefore, this highlights the importance of the current study in advancing the vocational training for Civil Technology teachers.

At school C, the workshop was locked, and the researcher observed the learners already waiting for Teacher C outside the workshop. Teacher C then showed up 3 minutes later with the keys and the Civil Technology Grade 11 textbook to unlock the workshop. During the instructional processing phase, Teacher C told the learners that they were going to learn about drawing a superstructure, since in grade 10, they only learnt how to draw a substructure. Then the teacher started to present the lesson about the superstructure, as shown in Fig. 2 below.

Delving deeper into Teacher C's lesson, he managed to provide an interesting lesson presentation that articulated well the lesson objectives and a clear drawing of superstructure with the labelling of its components. The classroom observation of Teacher C further revealed that the lesson content was

explicitly linked to real-world applications, thereby enhancing the practical relevance of the learning activities. This practice reflects the articulation and reflection stages of Cognitive Apprenticeship Theory, as connecting theoretical concepts to authentic construction contexts can encourage learners to explain their understanding and relate newly acquired knowledge to practical situations. Moreover, the teacher consistently monitored learners' progress throughout the lesson, ensuring that the given activity is completed in the class. However, there was limited learner involvement during the lesson, as the teacher dominated classroom interactions and learners had few opportunities to actively participate, ask questions, or engage in collaborative problem-solving. Such teacher-centred instructional practices may limit learners' ability to develop critical thinking, practical competence and collaborative skills that are essential in vocational education (Pharamela and Singh-Pillay, 2025). Consequently, this reveals a gap in teachers lacking the ability to fully implement learner-centred pedagogical approaches that promote active participation and develop confidence for the application of practical knowledge in authentic workplace contexts.

Teacher G started by going to collect the learners from their technical class to come and join us for the practical class. It took almost five minutes of the learning time, as the lesson was supposed to start at 12.45. Then Teacher G waited for all the learners to finally sit down before he started the lesson presentation. Figure 3 below shows Teacher G drawing a table diagram for the calculation of shear forces on a chalkboard.

During the instructional processing skills phase, Teacher G used a traditional teaching tool, namely the chalkboard, to present the lesson. The lesson focused on bending moments, which involved structural calculations and technical drawings. The teacher initially simplified the concepts to help learners understand their relationship to real-world structural applications. He subsequently demonstrated how to calculate bending moments and shear forces to establish the equilibrium of forces acting on both sides of a beam. From the perspective of Cognitive Apprenticeship Theory, the modelling stage was inadequately enacted, as the teacher did not consistently model the correct procedures and techniques that learners were expected to reproduce. For example, the teacher used freehand drawings to illustrate the diagrams while instructing learners to use their drawing instruments. This created an inconsistency between the technique demonstrated by the teacher and the technique expected from the learners. Consequently, learners may develop misconceptions regarding the appropriate use of drawing instruments and the accuracy required in technical drawing. Thus, a study by Adhikari (2024) points out that when teachers use the right tools and correct techniques for demonstration purposes, it helps learners repeat those skills successfully and gain confidence when executing technical tasks. While, Assem, Nartey, Appiah and Aidoo (2023) argue that uncorrected misconception by a teacher can negatively influence learners' motivation and their ability to complete learning activities effectively. Therefore, the observation of Teacher G highlights a gap in the pedagogical enactment of the instructional processing phase, particularly in the modelling of appropriate technical practices. Such limitations may constrain learners' development of accurate technical skills and, consequently, weaken the vocationalisation of Civil Technology by creating a disconnect between classroom instruction and the precision and standards expected in authentic construction and engineering contexts.

Teacher H and K's lesson presentation

During the instructional processing skills phase of both teachers H and K, a vast amount of knowledge and experience was displayed, especially in the way they clarified key concepts of the lesson and demonstrated the use of tools and materials. Their ability to bridge the gap between theoretical knowledge and real-world applications was demonstrated in the step-by-step explaining process to ensure that the learners understood the order of operation of joining pipes. Both of them also integrated prior knowledge into their lesson by actively assessing learners' previous knowledge about the use of tools and materials. While Teacher H used visual aids like PowerPoint presentations to build a solid foundation of the concepts, Teacher K used the chalkboard to demonstrate his confidence and understanding of the lesson content. These practices also reflected the articulation stage of Cognitive Apprenticeship Theory, as both teachers made their knowledge and practical procedures visible by clarifying key concepts and explaining the sequence of operations to how tasks should be performed. Furthermore, their professional competence demonstrated the importance of intentionally blending of theoretical and practical knowledge to guide learners from abstract concepts towards the application of practical skills.

However, similar to the teacher-centred approach observed in Teacher C's lesson, both Teachers H and K provided limited opportunities for active learner participation. The teachers spent most of the lesson explaining, presenting and demonstrating rather than creating opportunities for learners to engage in questioning, discussion and practical reasoning. From a Cognitive Apprenticeship perspective, this limitation suggests that although the modelling stage was effectively demonstrated, the coaching stage was less evident, as learners had limited opportunities to participate actively and receive guidance while applying their developing knowledge. Consequently, learners were positioned primarily as recipients of information rather than active participants in the learning process. This may restrict the development of essential skills such as communication, critical thinking and problem-solving, which are important for effective participation in practical classes. Zitha, Mokganya and Sinthumule (2023) emphasise that learner participation promotes deeper understanding of the underlying principles and processes of subject content. Therefore, continued restriction of learner involvement may prevent learners from developing a strong conceptual foundation that can be transferred effectively to the enactment of practical skills. This finding highlights the need for professional development that equips Civil Technology teachers to move beyond explanation towards more learner-centred instructional practices that incorporate modelling, coaching, guided practice and feedback during the instructional processing phase.

Theme 2: Practical demonstration phase in Civil Technology workshops

During the demonstration phase at school A, the researcher observed Teacher A demonstrating the task to the learners, which was cutting and making a wooden table leg. Teacher A made it clear to the learners that they must cut the leg of the table according to the way they indicated in their drawings. Thus, Iyamuremye and Burns (2025) emphasised that demonstrating tasks for the learners to complete helps them to understand what proficient performance looks like and makes abstract ideas more concrete. As the teacher carried on with a cutting machine, demonstrating how to make a design on a wooden table leg, he used one of the learner's wooden table drawings from a PAT file. Figure 4 below shows the learner's wooden table drawing that was used by Teacher A to demonstrate.

Delving deeper into the demonstration phase for Teacher A, the entire practical lesson was predominantly teacher-centred, with learners remaining passive observers and having few opportunities to participate in or discuss the procedures being demonstrated. According to Cognitive Apprenticeship Theory, the coaching phases were not sufficiently implemented since the teacher gave learners few chances to engage in the practical task. As a result, learners had limited chances to practice the techniques that were demonstrated and also receiving little feedback or guidance while developing their practical skills. Furthermore, the demonstration provided limited opportunities to develop learners' critical thinking and practical reasoning, which are all essential skills required in a Civil Technology subject. A study by Stephen and Festus (2022) revealed that the involvement of learners during practical demonstration phase is essential, because it enables learners to construct knowledge through experience, and develops the competencies required by the construction industries. Similarly, Oladele (2024) attested that demonstration tasks should provide learners with opportunities to actively engage in hands-on activities that promote the application of knowledge and the development of occupational competencies. However, this act that was observed on Teacher A is the demonstration that primarily focused on the teacher performing the task, with limited opportunities for learners to gain a chance of applying theoretical knowledge to their practical lesson. Additionally, Dayi, Mtshali and Sephokgole (2026) stated that such limitation involvement prevents learners from constructing knowledge through active problem-solving. Therefore, the inadequate enactment of the coaching stage, may have constrained learners' progression from observation towards active participation and their ability to apply knowledge.

In the workshop for Teacher D, the learners who were there had already gathered all the tools and materials that they would use for the demonstration phase. Teacher D started by giving the learners PAT papers consisting of guidelines and a rubric. Then she explained to the learners what was expected from them and how they would be evaluated. After that, Teacher D was observed demonstrating to the learners how to use the tools and material, such as soldering torch, tube cutter, flux, acid core solder, as shown on Fig. 5 below.

Although the teacher demonstrated the practical task of joining copper pipe competently, there was limited emphasis on problem-solving and troubleshooting. The demonstration was rushed, with several important procedures omitted or insufficiently explained. For example, the teacher did not explain common mistakes, potential defects or corrective measures that learners might encounter during the activity. From the perspective of Cognitive Apprenticeship Theory, this reflects limited enactment of the modelling and coaching stages, as the teacher demonstrated the procedure but provided insufficient explanation of the underlying reasoning and limited guidance on how learners should respond to problems during the activity. Consequently, learners were expected to begin the practical activity despite limited evidence that they fully understood the required procedures or safety precautions. According to Chappell (2020) a teacher runs the risk of failing learners and placing them in dangerous situations when they neglect to include potential errors, safety procedures and correction measures at the beginning of the practical lesson. Therefore, the limited attention given to troubleshooting and corrective strategies reveals a gap in the teacher's enactment of the practical skills curriculum. It further highlights the importance of this study in identifying pedagogical shortcomings in the vocationalisation of practical skills curriculum in metropolitan schools.

At Teacher E's workshop, the resources were observed to not be enough to cater to all the learners. So, the teacher was using a strategy of dividing the learners into two groups, named as group A and group B. The practical timetable for these two divided groups was seen visible inside the woodworking workshop door of Teacher E's, indicating the days of attendance of each group. During the demonstration task, Teacher E demonstrated to the learners on how are they going to assemble the components of the door frame with hinges and mortise lock, using tools like clamp, hammer and screwdriver. Then he used a completed door frame with hinges and mortise lock as an example to indicate to the learners on what is the final product is expected to look like. Figure 6 below shows the door frame with hinges and mortise lock that was used by Teacher E.

The teacher completed the demonstration within a short period, resulting in a rushed presentation in which several important procedures were omitted or insufficiently explained. This reflected a short limit of scaffolding stage, as although the completed door frame provided learners with a reference point for understanding the expected outcome. The teacher did not provide sufficient step-by-step support to enable learners to confidently progress from observation to independent performance. Learners were expected to begin the practical activity despite limited evidence that they fully understood the required procedures or safety precautions. Msimango (2026) argued that this approach potentially compromised safety and the quality of the learning experience. As the learners would be forced to navigate complex concepts without adequate foundational preparation. Similarly, Billett (2020) contends that effective vocational learning requires explicit guidance, structured demonstrations, and opportunities for learners to observe, question, and practise skills before

performing tasks independently. Furthermore, Morris (2025) argues that effective teaching involves transforming subject matter into forms that are comprehensible to learners through clear explanations, demonstrations and scaffolded instruction. When demonstrations are rushed or incomplete, learners are less likely to develop the conceptual understanding and procedural competence required for safe and effective practical performance. Consequently, inadequate demonstrations may reduce learners' confidence, increase the likelihood of procedural errors, and limit the development of practical competence required in Civil Technology.

At Teacher F workshop, the teacher was observed using tools such as saw cutting and chisel to shape the joints of a wooden table. Teacher F explained to the learners that they must follow the guidelines as prescribed in the wooden PAT documents. She also mentioned that the learners they were limited to choosing from only three specific types of wooden joints namely; dovetail, rabbet and mortise and tenon joint for assembling the wooden table. However, there was less interaction between the teacher and learners, as the teacher was primarily focused on demonstrating the task, remaining mostly silent and performing the activity herself. Instead, she would only be asking learners to pass certain tools to her and indicate specifically were the learners should cut the joints. Due to time constraints, she explained that she will only demonstrate two types of joints which is dovetail and mortise and tenon joints, since these are typically the most challenging joints to make. Figure 7 below shows Teacher F demonstrating a task activity to the learners on how to make joints for a wooden table.

During this demonstration phase in overall, Teacher F failed to explain the purpose and correct selection of tools used for the practical activity. Learners observed the procedures but were not informed about why specific tools were selected or how alternative tools could be used safely and effectively. Therefore, this reflected the modelling stage, where the teacher demonstrates the practical procedure while learners observe how the task is performed.

However, the modelling was inadequately enacted because Teacher F provided limited explanation of her thought process and techniques for achieving accurate and quality workmanship. In addition, the correct use of Personal Protective Equipment (PPE) was not consistently demonstrated during the practical activity. Although observation can provide learners with an initial opportunity to become familiar with practical tasks, effective participation requires access to the knowledge, reasoning, and practices that underpin skilled performance. Therefore, Teacher F's limited explanation of tool selection and PPE use may compromise learners' understanding of safe workshop practices and restrict their ability to select and use tools appropriately in different practical contexts. Consequently, learners may acquire procedural skills without developing the underlying conceptual knowledge, decision-making abilities, and safety awareness required for independent and competent practice. Skiba (2025) argues that vocational education extends beyond the mechanical execution of tasks and requires learners to understand the rationale underpinning workplace procedures, the selection of appropriate tools, and the application of safe work practices. Similarly, Wismansyah, Kadir, Baja and Amar (2024) contend that vocational competence is achieved when learners integrate conceptual knowledge with procedural skills, enabling them to make informed decisions and adapt their practices to different workplace situations. Furthermore, the Occupational Safety and Health Administration (OSHA) emphasises that effective safety instruction requires workers and learners to receive explicit guidance on the correct use of tools, equipment and PPE to minimise workplace hazards and prevent injuries (Shekh & Sadiq, 2024). Therefore, although Teacher F's demonstration provided learners with peripheral exposure to the practical activity, the limited opportunities for active participation and insufficient explanation of tool selection and safety practices may hinder their progression from observation towards competent participation. This may ultimately weaken learners' safety consciousness, practical decision-making and readiness for authentic workplace environments.

At Teacher K's workshop, the teacher grouped the learners into a single workshop bench, so that they can all observe how soldering of copper pipes is been performed. Then he advised the learners to take out their PAT and check the rubric on how it allocates the marks so that they would not lose unnecessary marks as they join together the copper pipes. It was also observed that Teacher K is very strictly when it comes to the wearing of PPE in the workshop as seen in Fig. 8 below.

During the demonstration phase, Teacher K allowed the learners to be part of the demonstration activity. As he also provided supporting instructional guide on how to perform the task. Figure 9 below shows Teacher K instructing a learner on how to apply a soldering torch to join copper pipe together. This practice reflects the scaffolding and exploration stage of Cognitive Apprenticeship Theory, as the teacher provided learners with temporary guidance and support while they engaged in the practical task.

Following these demonstration phase, the teacher demonstrated the practical procedures in a systematic manner. However, little attention was given to modelling quality workmanship, as measurements, finishing techniques and quality control practices were not explicitly confirmed or discussed. Consequently, learners received limited guidance on the level of accuracy, precision and workmanship expected in professional woodworking environments. This may limit learners' understanding of industry expectations and reduce their ability to produce work that meets acceptable occupational standards. Lin, Hwang, Chou and Tsai (2023) argue that practical lesson should enable learners to acquire not only procedural competence but also an understanding of the quality standards and professional judgement required in the workplace. Also, Jackson, Shan and Meek (2022) attested that workplace competence develops when learners are explicitly exposed to the standards, values and practices that characterise professional occupations. Lastly, Harris, McCaffer, Baldwin and Edum-Fotwe (2020) emphasises that quality workmanship in the construction industry depends on adherence to recognised standards, accurate measurements, appropriate construction techniques and effective quality control procedures. Therefore, although Teacher K demonstrated elements of scaffolding effectively by providing guidance during the practical activity, the support did not sufficiently address the quality and industry standards required of the completed work. This suggests that demonstrations that provide procedural guidance without adequately scaffolding quality control and professional standards may reduce learners' readiness for authentic workplace environments, while also limiting the development of the professional competence expected in Civil Technology.

Conclusion

The study found that Civil Technology teachers vocationalised the practical skills curriculum through the instructional processing and demonstration phases of practical instruction. Each phase plays an important role in how practical learning takes place, although, several challenges emerged. For instant when it comes to instructional processing phase, many teachers struggled to set clear lesson objectives, apply effective teaching strategies and prepare actively the learners for hands-on activities. These problems made it difficult for learners to link theoretical knowledge with practical application, ultimately reducing the effectiveness of the learning experience. While the demonstration phase enabled learners to observe practical procedures and provided a foundation for developing technical skills. However, the findings revealed several pedagogical challenges that limited the effectiveness of this process. These included teacher-centred demonstrations, limited learner participation, insufficient explanation of procedures and their underlying rationale, inadequate modelling of tool selection, PPE, quality workmanship and industry standards. As a result, learners had limited opportunities to develop conceptual understanding, independent problem-solving abilities, critical thinking and an appreciation of safe and professional workplace practices.

The findings suggest that the modelling, articulation, coaching, scaffolding, reflection and exploration stages of Cognitive Apprenticeship Theory were not clearly enacted to the learners. Teachers frequently gave examples of how tasks should be performed, but learners were not consistently assisted to understand the reasoning behind procedures, reflect on the quality of their work and independently apply skills to unfamiliar situations. Therefore, for vocationalization to be effective, teachers must move beyond demonstration towards pedagogies that provide guided practice, feedback, problem-solving and gradual transfer of responsibility to learners. The study concludes that Civil Technology teachers are partially vocationalising the practical skills curriculum, but the process is still inconsistent and not

entirely in line with real-world vocational learning. Consequently, stronger connection between curriculum content, practical pedagogy and contemporary construction-industry practices is required. Moreover, strengthening these dimensions of vocationalisation can better prepare Civil Technology learners for further education, employment and participation in an ever-evolving construction industry.

In overall, the study is important to the field of Civil Technology and vocational education because it demonstrates that vocationalisation of practical skills development requires more than direct instruction and demonstration process. Teachers need to provide structured guidance, opportunities for learner participation, corrective feedback, reflection and independent application of skills. This is particularly relevant in the context of the Fourth Industrial Revolution (4IR), where the built environment industry increasingly requires workers who can combine technical skill with digital literacy, problem-solving, adaptability and innovation. The study therefore contributes to the field by providing empirical evidence on how practical skills curricula are vocalised in metropolitan schools and by highlighting areas that require attention to strengthen the vocational relevance and quality of Civil Technology education.

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Declarations

Ethics approval and consent to participate

This study was reviewed and approved by Tshwane University of Technology Human Research Ethics Committee (TUT HREC) on 30 January 2025, under reference number HREC2024 = 10=002-HUM. This study was conducted in accordance with the ethical guidelines of the Declaration of Helsinki. Permission to conduct the study was also obtained from the Gauteng Department of Education (GDE) and participating schools. Writtern informed consent was obtained from all participants before data collection. Participants were informed of the purpose and procedures of the study, their voluntary participation, their right to withdraw from the study at any time without consequence, and the measures taken to protect their confidentiality and anonymity.

Consent for publication

The authors confirm that all human research participants provided informed consent for the publication of the results, including images and reflective journals. Participants were informed that their anonymized data would appear in a peer-reviewed journal, and they consented to the dissemination of findings under the condition that their identities would remain strictly confidential.

Competing Interests

The author declares that there are no competing interests.

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Author Contribution

WQ conceptualised the study, conducted the literature review, collected and analysed the data, and prepared the manuscript. TM contributed to the supervision of the study, interpretation of findings and manuscript revisions. All authors read and approved the final version of the manuscript.

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Data Availability

The datasets generated and analysed during the current study are not publicly available due to confidentiality and ethical restrictions but are available from the corresponding author on reasonable request.

References

1. Abdulayeva A. The Role of Lesson Planning and Design in the Learning Process. «Dulaty Univ Хабаршысы» ғылыми журналы. 2024;267–74. https://doi.org/10.55956/XHPI2655.

2. Adhikari T. Enhancing quality of basic level education through demonstration method. Triyuga Acad J. 2024;3(1):190–207. https://doi.org/10.3126/taj.v3i1.71980.
3. Amish M. Enhancing workplace skills through work-based learning in engineering education. Int J innovative Sci Res Technol. 2024;9(7):1983–90.
4. Assassi T, Tafazoli D, Rouaghe F, Bouaziz M. Bridging the Upside Down: A Grounded Theory Quest in Esp Teacher Education and Professional Development. Available at SSRN 5192794. https://ssrn.com/abstract=5192794
5. Assem HD, Nartey L, Appiah E, Aidoo JK. A review of students' academic performance in physics: Attitude, instructional methods, misconceptions and teachers' qualification. Eur J Educ Pedagogy. 2023;4(1):84–92. 10.24018/ejedu.2023.4.1.551.
6. Barrios HEM, Roys EYM, Maestre BO, Araujo HAA. Contributions to the application of non-participant observation as a research technique. Power Syst Technol. 2024;48(4):174–85.
7. Billett S. Guiding vocational learning. Developing vocational expertise. Routledge; 2020. pp. 226–46.
8. Chappell A. Safe practice, risk assessment and risk management. A practical guide to teaching Physical Education in the Secondary School. Routledge; 2020. pp. 129–47.
9. Dayi N, Mtshali TI, Sephokgole RD. Exploring Electrical Technology Teachers' Enactment of TPACK in The Teaching of Programmable Logic Controllers (PLCs). OIDA Int J Sustainable Dev. 2026;19(06):209–20.
10. Department of Basic Education. (2011). Curriculum Assessment Policy Statements (CAPS) - Civil Technology. download.aspx? Id = 44617 https://www.education.gov.za/Portals/0/CD/National%20Curriculum%20Statements%20and%20Vocational/CAPS%20Civil%20Tech%20Final%20bleed%2 ver=2015-05-18-154416000
11. El-Henawy W. Effects of Cognitive Apprenticeship Model on Preservice Teachers' Knowledge and Preparedness for UDL-Based Early Elementary EFL Instruction. Port Said J Educational Res. 2026;5(2):122–58. 10.21608/psjer.2026.485988.1079.
12. Ghosh A, Ray Chaudhury A, Sinha M. Does vocational education and training act as a safety net in labour markets? Some recent evidence from India. Empir Res Vocat Educ Train. 2026;18(1):8. https://doi.org/10.1186/s40461-026-00208-9.
13. Harris F, McCaffer R, Baldwin A, Edum-Fotwe F. Modern construction management. Wiley; 2020.
14. Iyamuremye E, Burns D. Concrete-Pictorial-Abstract instruction: enhancing students' learning motivation and achievement in mathematics. Cogent Educ. 2025;12(1):2558303. https://doi.org/10.1080/2331186X.2025.2558303.
15. Jackson D, Shan H, Meek S. Enhancing graduates' enterprise capabilities through work-integrated learning in co-working spaces. High Educ. 2022;84(1):101–20. https://doi.org/10.1007/s10734-021-00756-x.
16. Kana N, Letaba P. The reshaping of curriculum transformation to address the 21st-century skill sets and employment prospects during the Fourth Industrial Revolution era: A case of the South Africa TVET colleges. South Afr J High Educ. 2024;38(2):157–75. https://doi.org/10.20853/38-2-5854.
17. Kargbo M, Amakali AT, Machava S. The adaptability of vocational education curricula to the evolving labour market needs in China: Challenges and strategies. Asian J Educ Social Stud. 2026;52(1):45–60. https://doi.org/10.9734/ajess/2026/v52i12759.
18. Lin HC, Hwang GJ, Chou KR, Tsai CK. Fostering complex professional skills with interactive simulation technology: A virtual reality-based flipped learning approach. Br J Edu Technol. 2023;54(2):622–41. https://doi.org/10.1111/bjet.13268.
19. Magagula MM, Awodiji OA. The implications of the fourth industrial revolution on technical and vocational education and training in South Africa. Social Sci Humanit Open. 2024;10:100896. https://doi.org/10.1016/j.ssaho.2024.100896.
20. Mhlanga PT, Khoza SD, Skosana N. Exploring the Effectiveness of Practical Assessment Tasks Towards Skills Development in Mechanical Technology Subject. J Curriculum Stud Res. 2023;5(2):136–50. https://doi.org/10.46303/jcsr.2023.22.
21. Mhlongo KM, Khoza SD, Skosana NM. The Significance of Hand Tool Skills in the Fourth Industrial Revolution: A Focus on the Construction Concept. Jurnal Penelitian Dan Pengkajian Ilmu Pendidikan: E-Saintika. 2023;7(1):1–17. https://doi.org/10.36312/esaintika.v7i1.1026.
22. Morris DL. Rethinking science education practices: Shifting from investigation-centric to comprehensive inquiry-based instruction. Educ Sci. 2025;15(1):73. https://doi.org/10.3390/educsci15010073.
23. Msimango SM. (2024). Digitization of civil technology practical lessons for project-based learning at Ekurhuleni east, South Africa. In EDULEARN24 Proceedings (pp. 1843–1852). IATED. 10.21125/edulearn.2024.0550
24. Msimango SM. (2026). Civil technology teachers' qualities of effective teaching when conducting construction specialisation simulations at Ekurhuleni East District. https://hdl.handle.net/20.500.14519/2969
25. Msimango SM, Mtshali TI, Khoza SD. Equipping Civil Technology Teachers with Hands-On Skills and Educational Resources for Effective Teaching of Practical Lessons. Res Social Sci Technol. 2024;9(2):341–58. https://doi.org/10.46303/ressat.2024.40.
26. Mtshali TI, Singh-Pillay A. (2023). The enhancement of pedagogical capital by civil technology teachers when engaged with practical assessment task: A curriculum transformation legacy. Journal of Curriculum Studies Research, 5(2), 1–22. https://hdl.handle.net/20.500.14519/2812
27. Nkwanyane TP, Makgato M, Ramaligela SM. Inquiry into students' perceptions of civil and building construction curricula in South African TVET Colleges. Univers J Educational Res. 2022;10(6):369–77. 10.13189/ujer.2022.100601.
28. Oladele OK. Kinesthetic learning: Hands-on learning and active engagement. Available here; 2024.
29. Onikoyi OA, Onikoyi YRA, Bankole OL, Nafiu AA. (2025). Provision and Management of Instructional Resources in Ogun State Secondary Schools: Challenges and Solutions. Eduvis: Jurnal Manajemen Pendidikan Islam, 10(2), 53–70. https://doi.org/10.47453/eduvis.v10i2.3535
30. Oviawe JI, Uwameiye R, Uddin PS. Bridging skill gap to meet technical, vocational education and training school-workplace collaboration in the 21st century. Int J Vocat Educ Train Res. 2017;3(1):7–14.

31. Padhi S, Biswal KK, Tripathy M. Developing Effective Assessment Methods and Feedback Tools. KUNAL BOOKS; 2026. p. 263.
32. Pharamela S, Singh-Pillay A. Technical and Vocational Education and Training College Lecturers and 21st-Century Skills: Awareness and Implications for Teaching Practices. J Tech Educ Train. 2025;17(2):182–96.
33. Qwabe W, Mtshali TI, Sephokgole D. (2026). Civil Technology Teachers' Preparation Skills for Practical Lessons. https://doi.org/10.58230/27454312.2960
34. Regmi BP. Qualitative Research Design: A Discussion on its Types. Res J. 2024;9(1):37–45. https://doi.org/10.3126/rj.v9i1.74415.
35. Rintala H, Nokelainen P. Vocational education and learners' experienced workplace curriculum. Vocations Learn. 2020;13(1):113–30.
36. Rivai FA, Rahmawati N. Workshop, Assistance, and Capacity Building in the Development of Teaching Materials Based on 21st-Century Learning. AL GHAZALI: Jurnal Pendidikan Dan Pemikiran Islam. 2025;5(2):247–62. https://doi.org/10.69900/ag.v5i2.470.
37. Sánchez-García R, Reyes-de-Cózar S. Enhancing project-based learning: A framework for optimizing structural design and implementation—A systematic review with a sustainable focus. Sustainability. 2025;17(11):4978. https://doi.org/10.3390/su17114978.
38. Shekh J, Sadiq H. A Meta-Analysis of OSHA Safety Training Programs and their Impact on Injury Reduction and Safety Compliance in US Workplaces. Int J Sci Interdisciplinary Res. 2024;5(2):559–92. https://doi.org/10.63125/8zxw0h59.
39. Skiba R. (2025). Frameworks and models for working safely and health and safety training in vocational education and training for High-Risk occupations.
40. Stephen OO, Festus OO. Utilization of work-based learning program to develop employability skill of workforce (craftsmen) in construction industry towards industrial development. Indonesian J Educational Res Technol. 2022;2(3):179–88. https://doi.org/10.17509/ijert.v2i3.43970.
41. Storonyanska I, Benovska L, Patytska K, Ivashko O, Chulipa I. Redesigning sustainable vocational education systems to respond to global economic trends and labor market demands: Evidence from EU countries on SDGs. Sustainability. 2025;17(21):9530. https://doi.org/10.3390/su17219530.
42. Tajik O, Golzar J, Noor S. (2025). Purposive sampling. Int J Educ Lang Stud, 1–9.
43. Vears DF, Gillam L. (2022). Inductive content analysis: A guide for beginning qualitative researchers. Focus on Health Professional Education: A Multi-Professional Journal, 23(1), 111–127. https://search.informit.org/doi/10.3316/informit.455663644555599
44. Walters-Williams J. H-CUP: Increasing higher order thinking skills levels through a framework based on cognitive apprenticeship, universal design and project-based learning. Creative Educ. 2022;13(9):2878–902. https://doi.org/10.4236/ce.2022.139181.
45. Wang C, Zhu M, Zakaria SAS. Cross-modal deep learning enhanced mixed reality accelerates construction skill transfer from experts to students. Sci Rep. 2025;15(1):34462. https://doi.org/10.1038/s41598-025-17656-0.
46. Wismansyah AR, Kadir AR, Baja S, Amar MY. Sustainable vocational education models for industrial revolution role in development of job market absorption in Tangerang City, Indonesia. J Infrastructure Policy Dev. 2024;8(6):3958. https://doi.org/10.24294/jipd.v8i6.3958.
47. Yin RK. Case study research and applications. Volume 6. Thousand Oaks, CA: sage; 2018. pp. 200–24.
48. Zhao Y, Ko J. Vocational teachers' perceptions on workplace learning in facilitating students' professional engagement in the context of industry-university collaboration in China. J Workplace Learn. 2024;36(4):282–97. https://doi.org/10.1108/JWL-12-2023-0197.
49. Zitha I, Mokganya G, Sinthumule O. (2023). Lecturers' Experiences with Digital Assessments and Continuity of Digital Transformation in the Higher Education. 10.20944/preprints202307.2037.v1

Figures

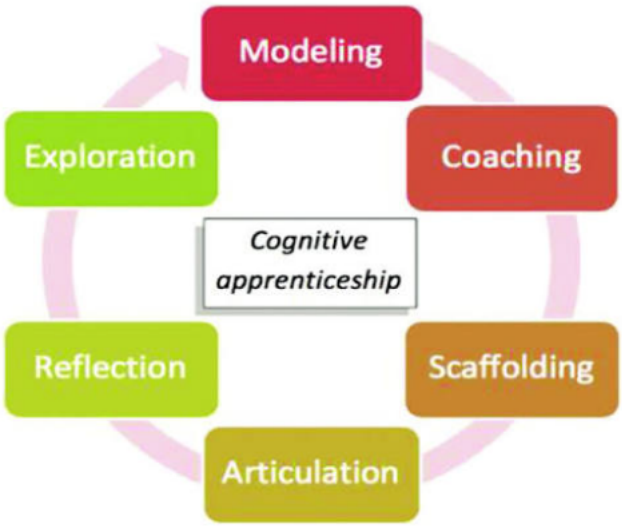


Figure 1

Figure 1: A Cognitive apprenticeship model

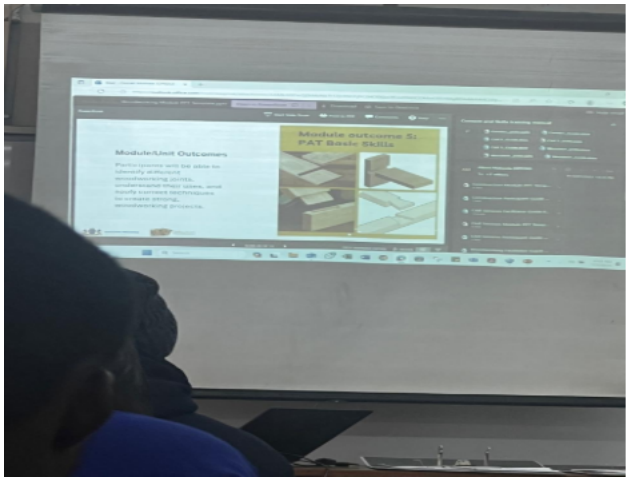


Figure 2

Figure 1: Teacher A PowerPoint slides of a basic skills for woodworking joints



Figure 3

Figure 2: Teacher C presenting in the workshop



Figure 4

Figure 3: Teacher G lesson presentation on a chalkboard

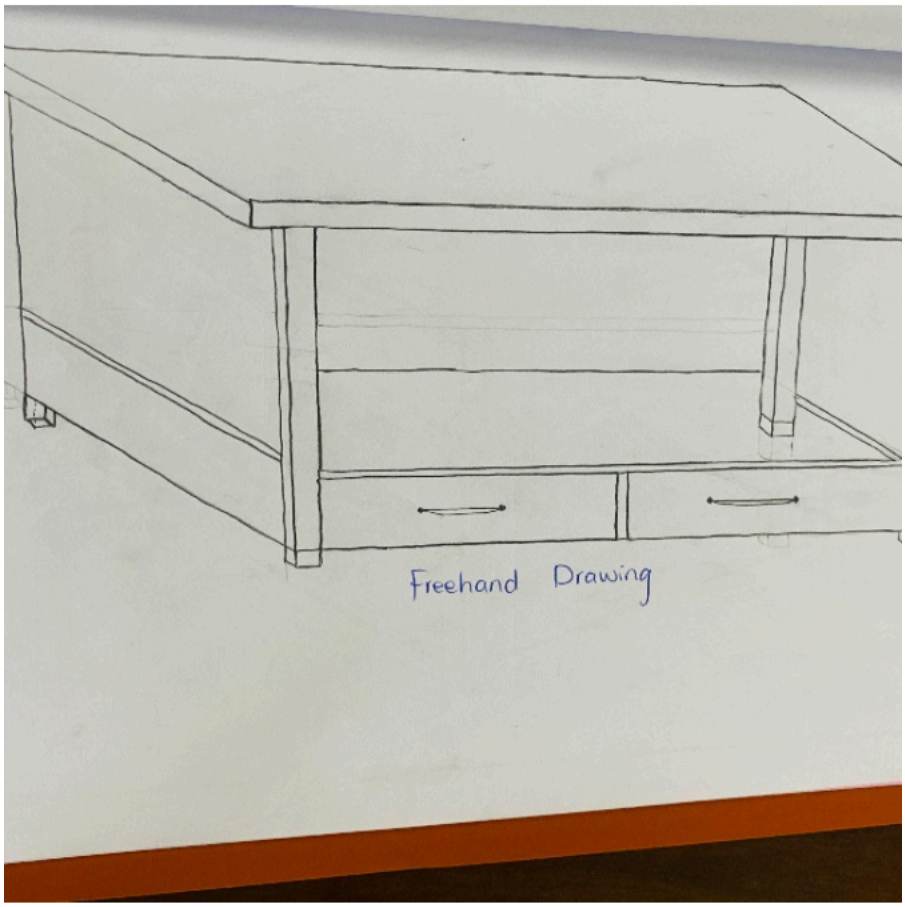


Figure 5

Figure 4: Drawing of a wooden table by Teachers A's learner



Figure 6

Figure 5: Teacher D demonstrating to the learner on how to apply soldering torch



Figure 7

Figure 6: Teacher E example of door frame with hinges and mortise lock.



Figure 8

Figure 7: Teacher F show the learners how to make joints for a wooden table.



Figure 9

Figure 8: Learners at Teacher K's workshop observing the demonstration practical task.



Figure 10

Figure 9: Learner at Teacher K’s workshop applying a soldering torch to pipes.