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BRIDGING THEORY AND PRACTICE: INVESTIGATING TEACHERS' CHALLENGES IN THE MAKING PHASE OF THE TECHNOLOGY DESIGN PROCESS

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A B S T R A C T

This study investigated the challenges Grade 9 Technology teachers face in facilitating the making phase of mini-Practical Assessment Tasks (mini-PATs), a central component of the Senior Phase Technology curriculum. Although the design process underpins Technology Education, limited research has examined how teachers guide learners in translating theoretical designs into physical artefacts. This gap has left uncertainties regarding the pedagogical and contextual barriers that constrain effective facilitation of hands-on learning. Guided by the constructivist paradigm and the 9E instructional model, the study explored how teachers support learners in applying prior knowledge during the Investigation, Design, Making, Evaluation, and Communication (IDMEC) cycle. A qualitative case study design involved ten purposively selected Technology teachers, with semi-structured interviews and non-participant classroom observations. Data were audio-recorded and thematically analysed, with verbatim excerpts illustrating key findings. Results revealed persistent challenges, including inadequate resources, limited facilities, and low teacher confidence in managing practical tasks. Many teachers struggled to link learners' prior knowledge to hands-on activities, resulting in superficial engagement and restricted skill development. The study contributes to Technology Education by illuminating the under-explored complexities of facilitating the making phase and provides evidence-based recommendations, including targeted professional development, improved resources, and strategies to integrate theory and practice to enhance teacher competence and learners' problem-solving skills.

1. Introduction

In South Africa, the Senior Phase Technology curriculum for Grades 7–9 comprises four content strands: Structures, Processing, Mechanical Systems and Control, and Electrical Systems and Control. This curriculum is designed to introduce learners to foundational engineering and technological concepts through an integrated, project-based approach that promotes design thinking and hands-on engagement (Department of Basic Education, 2011). Central to this approach is the design process, which encompasses the stages of Investigation, Design, Making, Evaluation, and Communication (IDMEC). This process underpins all content strands and is instrumental in fostering learners' problem-solving abilities, creativity, and practical skills. Practical skills, in particular, are best developed through activities that involve interaction with tools and equipment (Maeko, 2025). Additionally, the curriculum emphasises the importance of integrating indigenous knowledge and sustainable practices, encouraging learners to consider the environmental and societal impacts of technological solutions (DBE, 2011). According to Kubheka (2018), the making process, problem-solving, educational resources, and teamwork are key elements that contribute to learners' creative development during Mini Practical Assessment Tasks (Mini-PATs), highlighting the value of structured, collaborative, and hands-on learning experiences.

Within Technology Education, the making phase represents a critical phase of the design process, where learners bring their ideas to life by constructing artefacts using appropriate tools, materials, and techniques. It bridges theoretical understanding with practical application, offering opportunities for learners to engage deeply with content while developing technical competence. For this stage to be successful, teachers must possess strong content knowledge, practical skills, and the ability to guide learners safely and effectively through construction activities (Nkwanyane & Monyuku, 2025). Furthermore, the making phase provides a platform for learners to develop critical thinking and collaborative skills, as they work together to solve complex problems and refine their designs (Gómez et al., 2013).

Research highlights the importance of teachers' knowledge and skills in facilitating the design process (Schwichow et al., 2016). However, many Technology teachers face challenges in effectively supporting the making phase. Studies by Kola (2022) and Rauscher (2016) indicate that teachers often lack the expertise required to guide learners in building artefacts, negatively affecting the quality of project outcomes. Similarly, Blose & Ndlovu (2023) report ongoing difficulties in delivering the practical component of the Technology curriculum, particularly in implementing mini-Practical Assessment Tasks (mini-PATs), which demand creativity and technical proficiency in solving real-world problems. Although the Department of Basic Education (DBE, 2011) recommends a pedagogical sequence that introduces theory before practice, many teachers struggle to support learners during the making phase. This gap is frequently linked to insufficient teacher training, limited access to resources, and a lack of confidence in managing practical tasks (Nkosi & Mtshali, 2024). Magolego et al., (2023) further emphasise the need for supporting teachers with model lessons and pedagogical strategies to improve the implementation of the making process.

Given the centrality of the making phase in achieving the objectives of Technology Education, this study seeks to explore the extent to which teachers are equipped to facilitate this phase in Senior Phase classrooms. By focusing specifically on the making phase, the study aims to identify the enablers and barriers that influence teachers' capacity to guide learners in constructing meaningful technological solutions.

In the South African Senior Phase Technology curriculum, the making phase of the design process plays a crucial role in bridging theoretical understanding with practical application. However, many Technology teachers experience difficulties in effectively facilitating this stage due to limited content knowledge, inadequate practical skills, and insufficient training. These challenges negatively impact learners' ability to construct artefacts and demonstrate creativity and technical competence in mini-Practical Assessment Tasks (mini-PATs). Despite curriculum guidelines emphasising a balance between theory and practice, gaps remain in teachers' ability to guide learners through safe and meaningful construction activities. Therefore, this study intends to exprore the factors that enable or hinder teachers' effective facilitation of the making process in Senior Phase Technology classrooms.

The purpose of this study is to investigate how Senior Phase Technology teachers facilitate the making phase of the design process in Grade 9 Technology classroom. Specifically, it seeks to identify the factors that enable or hinder teachers' ability to guide learners in constructing technological artefacts, and to propose strategies for enhancing teacher capacity to implement this phase effectively, thereby improving learners' practical skills, problem-solving abilities, and engagement in Mini Practical Assessment Tasks (mini-PATs). The study is aimed to:

(a) Assess teachers' competence in facilitating the making phase of the Technology design process.
(b) Identify factors influencing teachers' effective implementation of the making process.

2. Theoretical Framework

To explore how Grade 9 Technology teachers facilitate the making phase of the mini-Practical Assessment Tasks (mini-PATs), this study draws on the theory of constructive teaching as outlined by Amineh & Asl (2015) and is further guided by the 9E Instructional Model developed by Ramaligela et al (2019). Amineh & Asl (2015) describe constructivist teaching as a learner-centred approach in which teachers must move beyond traditional methods and create learning environments that challenge learners to construct knowledge through active engagement. According to Shah (2019), learning in constructivist settings occurs as learners interact, reflect, and engage meaningfully in tasks. In the context of Technology Education, particularly during the making phase, this implies that teachers must guide learners in applying prior knowledge to build artefacts, solve problems practically, and reflect on their process and outcomes. The making phase offers a rich opportunity for learners to question, explore, and refine their understanding through hands-on activity, which is consistent with constructivist principles.

While constructivism provides a broad pedagogical lens, it does not specify how teachers can facilitate each stage of the making process, particularly making in a structured manner. To address this, the study integrates the 9E Instructional Model as a framework for analysing how constructivist teaching is operationalised. According to Ramaligela et al. (2019), the 9E model, comprising Elicit, Engagement, Exploration, Explanation, Elaboration, Evaluation, Enlightening, Enclosure, and Exchange offer a practical structure aligned with the IDMEC design process. These phases support progressive learning and mirror the iterative nature of the design process, especially during the making phase, where learners move from conceptualisation to realisation. The 9E model thus provides a systematic approach to evaluating how teachers support learners in constructing artefacts, applying prior knowledge, and solving real-world problems during the making phase. This dual framework enables the study to investigate how constructivist teaching strategies are embedded in the facilitation of the making process within the mini-PAT.

3. Research Methodology

Qualitative methods have become essential for gaining deep insights into complex educational phenomena (Lim, 2025). Accordingly, this study adopted a qualitative research approach, which, as Ugwu and Eze (2023) note, seeks to understand how individuals interpret and make sense of their experiences and environments. Stake (2010) further emphasises that qualitative research relies on rich, detailed descriptions and contextually grounded interpretations. This approach was selected to explore Technology teachers' ideas, opinions, and experiences in facilitating Mini–Practical Assessment Tasks (Mini-PATs). A case study design was employed to enable an in-depth exploration and nuanced understanding of a small group of participants (Suchita et al., 2023; Goredema et al., 2024). For ethical reasons, all participants were assigned pseudonyms, labeled Teacher 1 to Teacher 10, to protect their identities throughout the study.

To achieve the objectives of the study, non-numerical data were collected through semi-structured interviews, non-participant classroom observations, and detailed field notes (Ugwu & Eze, 2023). These methods complemented one another, providing a holistic understanding of the phenomenon. The interviews captured teachers' personal reflections, beliefs, and perceived challenges, while the observations illustrated how these perspectives were enacted in classroom practice. Field notes further enriched the data by documenting contextual details such as classroom dynamics, non-verbal cues, and environmental factors that might not emerge in interviews. As attested by Zahle (2021), field notes are invaluable for capturing real-time classroom interactions, supporting analysis of teacher practices, and providing rich context to complement interview and document data.

Careful attention was given to data storage and access to ensure the security and integrity of all research materials. Interview data were password-protected, and observation records and field notes were stored on a secure, approved platform accessible only to the researchers. Collectively, these procedures ensured that the data were credible, ethically managed, and grounded in multiple sources of evidence.

3.1 Data Collection

(a) Semi - Structured interviews
Semi-structured interviews were conducted to gather in-depth data on Technology teachers' instructional practices, challenges, and classroom experiences (Szombatová, 2016). This method allowed flexibility for participants to express their views freely while maintaining focus on key research questions. All interviews were audio-recorded to ensure accurate data capture, including tone, pauses, and other vocal nuances essential for interpreting meaning and intent.

(b) Non - Participant Observations
Non-participant observation is a qualitative research method in which the researcher observes participants without becoming actively involved in the activities being studied (Sholihiin, 2020). In this study, non-participant observation was used to complement the interview data and provide first-hand insights into how teachers facilitated Mini–Practical Assessment Tasks (Mini-PATs) in their classrooms. The researcher observed lessons unobtrusively, focusing on teaching strategies, learner engagement, and classroom dynamics. Detailed field notes were kept to record unfolding activities, patterns of interaction, and pedagogical decisions as they occurred, thereby enriching the understanding of teachers' instructional practices in authentic classroom contexts.

3.2 Sampling and Participants

The study involved ten purposively selected Grade 9 Technology teachers. Purposive sampling was considered appropriate as it enabled the selection of participants who could provide rich and relevant insights into the phenomenon under investigation. In this approach, individuals are chosen based on their alignment with the research objectives (Makwana et al., 2023). Selection criteria included accessibility and active involvement in teaching Technology at the senior phase.

All ten teachers participated in the interview phase. Following preliminary analysis of the interview data, four teachers were purposefully selected for classroom observations: two who reported facing significant challenges in facilitating Mini-PATs, and two who reported minimal challenges. This purposive sub-sampling ensured variation in experience and perspectives, thereby enhancing the depth, credibility, and trustworthiness of the data. Table 1 provides a summary of the participants, including their years of teaching experience, participation in interviews and observations, and the level of challenges they reported in facilitating Mini-PATs.

Table 1. Profile of grade 9 technology teacher participants

Participant	Teaching Experience (Years)	Interview Participation	Classroom Observation	Levels of Reported Challenges
Teacher 1	5	Yes	Yes	Minimal
Teacher 2	6	Yes	Yes	Significant
Teacher 3	10	Yes	No	-
Teacher 4	7	Yes	No	-
Teacher 5	8	Yes	Yes	Significant
Teacher 6	5	Yes	Yes	Minimal
Teacher 7	8	Yes	No	-
Teacher 8	6	Yes	No	-
Teacher 9	6	Yes	No	-
Teacher 10	5	Yes	No	-

3.3 Data Analysis

Data analysis is a crucial component of research that involves collecting, transforming, cleaning, and modeling data to generate meaningful and effective results that address the study's objectives (Alem, 2020). In this study, data from both interviews and observations were analysed thematically to identify recurring patterns, ideas, and relationships. The audio-recorded interviews were transcribed verbatim and examined textually, with direct quotations used to substantiate emerging themes. Similarly, observation notes were organized into narrative accounts that described classroom dynamics, instructional practices, and contextual factors that shaped teaching and learning processes.

The observation data were further analysed thematically to capture variations in teachers' approaches to facilitating the making stage. Observation notes were coded according to the key stages of the IDMEC model "Investigation, Design, Making, Evaluation, and Communication". Initial codes focused on teachers' instructional strategies, learner engagement, and the use of prior knowledge. These were then grouped into broader categories that reflected pedagogical practices and challenges. Through iterative comparison and refinement, themes were developed that revealed how teachers activated learners' prior knowledge, supported practical construction, and integrated the various stages of the Mini-PAT. This analytical process provided a coherent understanding of classroom practices and highlighted the fragmented nature of teaching approaches observed across the making phase of the design process.The integration of data from multiple sources enhanced triangulation, thereby increasing the validity and trustworthiness of the findings.

3.4 Ethical Issues

Ethics encompasses the moral principles that guide the responsible conduct of research (Mirza et al., 2023). In adherence to established ethical protocols, ethical clearance was obtained from the Turfloop Research Ethics Committee (TREC), ensuring compliance with accepted research standards. This approval facilitated permission from the Limpopo Department of Basic Education, followed by the Waterberg District Office (Palala Circuit), granting access to the participating schools and respondents. Informed consent was subsequently obtained from the Grade 9 Technology teachers who took part in the study. Prior to data collection, participants were duly informed of their involvement to ensure voluntary participation and preparedness when the research instruments were administered (Semin et al., 2024).

3.5 Data Validation

To ensure the trustworthiness and credibility of the study, several data validation strategies were employed throughout the research process. The study adhered to key quality criteria to ensure trustworthiness, namely triangulation, credibility, transferability, dependability, and confirmability (Ahmed, 2024).

(a) Triangulation
In qualitative research, triangulation is an essential element of credibility (Grant et al., 2024).The study used methodological triangulation by combining semi-structured interviews and non-participant classroom observations. Comparing findings from both methods allowed the researcher to cross-verify insights about teachers' facilitation of mini-PATs, reducing potential bias and enhancing the depth of understanding.

(b) Credibilty
Participants were given the opportunity to review their interview responses for accuracy and clarity. This step ensured that the interpretations reflected teachers' intended meanings and experiences.

(c) Tranferability
The study employed detailed field notes and verbatim interview excerpts to provide context-rich descriptions of classroom practices and teacher perspectives. This depth of detail enables readers to grasp the complexity of the teaching and learning environment, thereby enhancing the transferability of the findings.

(d) Confirmability
The study incorporated reflective notes to track personal assumptions, biases, and decision-making throughout data collection and analysis. This reflexive practice helped ensure that the findings were rooted in participants' perspectives rather than influenced by the researcher's preconceptions.

4. Results and Discussion

The purpose of this study was to explore the challenges experienced by Grade 9 Technology teachers in facilitating the making phase as prescribed in the Senior Phase Technology curriculum. Specifically, the study aimed to identify factors such as teachers' content knowledge, pedagogical skills, and availability of resources that influence their ability to guide learners through the Investigation, Design, Making, Evaluation, and Communication (IDMEC) process. The findings from interviews and classroom observations are presented below.

4.1 Interview Results

Table 2 presents data from Grade 9 Technology Education teachers interviews on how they activated learners' prior knowledge during the making phase of the design process.

Table 2. Summary of interview data on how teachers activated learners' prior knowledge during the making phase

Participant	Activation of Learners' Prior Knowledge	Theme	Level of Reported Challenge
Teacher 1	Linked prior experiences to new making tasks through discussion	Effective use of prior knowledge	Minimal
Teacher 2	Promoted transfer of earlier design knowledge to making activities	Effective use of prior knowledge	Significant

Participant	Activation of Learners' Prior Knowledge	Theme	Level of Reported Challenge
Teacher 3	Assessed prior knowledge but relied on procedural guidance during making	Limited use of prior knowledge	-
Teacher 4	Provided step-by-step guidance with limited reflection on prior learning	Effective use of prior knowledge	-
Teacher 5	Linked demonstrations to prior investigations to reinforce design and safety concepts	Limited use of prior knowledge	Significant
Teacher 6	Emphasised procedural demonstration over activating prior conceptual understanding	Effective use of prior knowledge	Minimal
Teacher 7	Prioritised procedural demonstration over prior conceptual understanding	Limited use of prior knowledge	-
Teacher 8	Prompted learners to recall prior design and measurement concepts for making tasks	Effective use of prior knowledge	-
Teacher 9	Used a directive teaching style with minimal reference to prior learning	Limited use of prior knowledge	-
Teacher 10	Prioritised task completion with minimal connection to prior learning	Limited use of prior knowledge	-

Table 2 revealed contrasting practices among Grade 9 Technology teachers in how they activated learners' prior knowledge during the making phase of the design process. Two main patterns emerged.

Theme 1: Teachers effectively using prior knowledge

Five of the ten participants (Teachers 1, 2, 4, 6, and 8) demonstrated deliberate strategies to build on learners' existing knowledge and experiences. These teachers connected making tasks to earlier stages of the design process, such as investigation and design, and used the phase to assess learners' conceptual understanding through practical application. For instance, Teacher 1 explained, *"I ask learners what they did in primary school as a project. Making means arranging a structure or product and presenting it; that's how I assess their prior knowledge."* Similarly, Teacher 2 noted, *"Making involves doing it with your own hands. Learners use information from earlier investigation and making phases. For example, when making a bridge, they use cardboard and wires to show water flowing under and cars passing above."*

These examples illustrate how some teachers actively encouraged learners to connect prior experiences to current construction tasks, fostering continuity from earlier stages of the making stage. Such approaches reinforced understanding of design principles and safety procedures while promoting ownership and engagement in learning. These practices align with Ramaboea et al. (2022) and the Department of Basic Education (2011), who emphasise that scaffolding learning through prior knowledge strengthens conceptual development and skill transfer. Moreover, hands-on engagement and reflection on previous experiences support problem-solving and iterative learning, as argued by Warr et al. (2020).

Theme 2: Limited use of learners' prior knowledge

The remaining five participants (Teachers 3, 5, 7, 9, and 10) primarily relied on procedural guidance, providing step-by-step instructions with minimal connection to learners' prior experiences or earlier stages of the making phase. Teacher 3 explained, *"Learners feel comfortable when I facilitate. I use diagnostic assessments to check what they can do, but often they don't know where to start, so I guide them through tasks like building a house."* Similarly, Teacher 5 noted, *"I usually start with paper models, for example, when building bridges. Once learners have an idea, I let them use any material they prefer."*

These responses indicate that, although diagnostic assessments were sometimes used to gauge learners' capabilities, the making phase was largely task-driven rather than concept-driven. Teachers adopting this approach prioritised the completion of construction tasks, often at the expense of encouraging reflection or linking activities to learners' prior knowledge. Such practices suggest limited scaffolding, which may constrain conceptual growth and the development of independent problem-solving skills. These findings align with concerns raised by Kola (2022) and Rauscher (2016), who note that many Technology teachers face challenges in effectively integrating the stages of the design process. The observed disconnect between activating prior knowledge and guiding practical execution may further inhibit learners' critical thinking and creativity (Stasovskyi, 2024; Schwichow et al., 2016).

The data reveal a clear dichotomy: while half of the teachers effectively leveraged learners' prior knowledge to inform and guide the making phase, the other half treated it as an isolated activity. This fragmented approach highlights gaps in understanding or training regarding the pedagogical role of prior knowledge in Technology education. As emphasised by the DBE (2011) and scholars such as Gómez et al. (2013), bridging theoretical knowledge and practical application is essential for effective project-based learning.

4.2 Observations Results

Classroom observations of four teachers revealed that while some were able to activate learners' prior knowledge during the investigation and design stages of the making phase, most struggled to extend this into the making phase, which is critical for hands-on construction and problem-solving.

- Investigation and Design stages: Teachers used visual aids and interactive discussions to elicit prior experiences, consistent with the constructivist approach (Amineh & Asl, 2015) and the 9E Instructional Model (Ramaligela et al., 2019). Learners engaged with content through collages, sketches, and discussion, though activities often focused on replication rather than innovation.
- Making phase: Observations revealed that teachers largely provided procedural instructions without linking tasks to learners' previous work. This disrupted the constructive learning cycle, limiting opportunities for learners to refine ideas and develop deep understanding.
- Evaluation stage: While some teachers incorporated presentations and peer feedback, these practices did not fully compensate for the gaps in the making phase. The lack of integration across stages suggests a fragmented approach to Mini-PAT, where each phase is treated in isolation.

These observations underscore the importance of deliberate pedagogical strategies that connect prior knowledge, design thinking, and hands-on application. Aligning teaching practices with constructivist principles and structured models such as the 9E Instructional Model can enhance learners' critical thinking, creativity, and problem-solving (Warr et al., 2020; Shah, 2019). Targeted professional development is needed to strengthen teachers' ability to integrate the making phase of the design process.

4.3 Theoretical Integration and Critical Reflection

Integrating the findings within the dual framework of constructivism and the 9E Instructional Model provides a deeper understanding of teachers' pedagogical practices. Constructivist theory explains why learner-centred, knowledge-building engagement is crucial, while the 9E model offers a structured lens to examine how such engagement unfolds through progressive stages. Teachers who aligned with both frameworks demonstrated stronger facilitation of Elicit, Engage, Explore, and Elaborate phases, effectively activating prior knowledge and promoting hands-on learning. In contrast, those who relied on procedural teaching reflected limited theoretical grounding, engaging mainly in the Explain phase without supporting learner reflection or extension.

The findings highlight the need for deliberate teacher professional development that integrates theory and structured pedagogy. Teachers should be trained to use the 9E model as a roadmap for facilitating constructivist learning in Technology Education ensuring that each design process phase builds upon the previous one and culminates in meaningful reflection and innovation. By linking constructivist principles (Amineh & Asl, 2015) with the 9E instructional structure (Ramaligela et al., 2019), this study underscores that effective facilitation of the making phase requires more than procedural guidance; it demands intentional scaffolding, reflection, and active learner participation. When properly enacted, this dual framework transforms the making phase into a rich context for fostering creativity, critical thinking, and practical problem-solving skills at the heart of Technology Education.

5. Conclusion

This study explored the challenges experienced by Grade 9 Technology teachers in facilitating the design process within the mini-Practical Assessment Tasks (mini-PATs), with a particular focus on the making phase. The design process, which includes the stages of investigation, design, making, evaluation, and communication, is intended to engage learners in hands-on, problem-solving activities that integrate both theoretical and practical knowledge. However, the findings revealed several challenges that limit the effective facilitation of this process in the classroom. While some teachers demonstrated the ability to elicit and apply learners' prior knowledge during the investigation and design stages, many struggled to maintain this continuity in the making phase. For half of the teachers observed, the making phase was approached as a disconnected phase, focused on procedural execution rather than on deepening learners' understanding or reinforcing earlier learning. As a result, learners were not consistently supported in applying their prior investigations and design concepts to the actual construction of artefacts.

The challenges identified include a lack of clear pedagogical strategies, limited integration across the stages of the design process, and insufficient use of learners' prior knowledge to guide practical work. These gaps hinder learners' ability to engage critically and creatively with tasks, reducing the effectiveness of the design process as a tool for developing technological literacy. The study highlights the need for targeted support and professional development to equip teachers with the skills to facilitate each stage of the design process effectively. Strengthening teachers' capacity to link theory with practice, especially during the making phase is essential for fostering meaningful, learner-centred engagement in Technology Education.

6. Recommendation

Based on the findings of this study, several recommendations are proposed to address the challenges Grade 9 Technology teachers face in facilitating the design process, particularly the making phase. Professional development programmes should focus on strengthening teachers' understanding of the design process as a continuous and interconnected cycle rather than as a series of isolated stages. Training should specifically emphasise the importance of ensuring smooth transitions from the Investigation and Making phases to the Making phase so that each phase meaningfully builds upon the previous one. Such programmes should also provide teachers with practical strategies to link theoretical content with hands-on application, ensuring that learners develop both conceptual understanding and technical competence. A key finding of this study was the inconsistent use of learners' prior knowledge during practical activities. Teachers therefore need to adopt deliberate strategies to activate and apply learners' prior learning at different stages of the design process. This can be achieved through diagnostic assessments that identify learners' existing understanding, reflective questioning that prompts learners to connect prior experiences to new tasks, and learner-centred discussions that encourage knowledge sharing. These approaches not only enhance learner engagement but also promote deeper conceptual understanding and the practical application of knowledge.

Furthermore, strengthening teachers' pedagogical content knowledge (PCK) remains essential for effective Technology teaching. Professional learning opportunities should focus on equipping teachers with both technical skills and pedagogical strategies that foster creativity, critical thinking, and problem-solving. Mentoring and peer coaching can help teachers refine these skills in authentic classroom contexts, while exposure to model lessons can demonstrate how PCK supports the facilitation of the design process, particularly the making phase. Equally important is the provision of adequate teaching resources and facilities. Schools and education authorities must ensure that teachers have access to appropriate tools, materials, and workspace to conduct practical activities effectively. Without such resources, the teaching of Technology Education risks becoming overly theoretical and detached from its intended practical orientation. Investment in well-equipped workshops and equitable resource distribution across schools is therefore critical to supporting hands-on learning.

Collaborative professional learning communities (PLCs) should also be encouraged to create platforms where teachers can share resources, discuss challenges, and exchange effective facilitation methods. These communities can foster peer learning, innovation, and professional reflection, allowing teachers to jointly address common difficulties encountered during the design process. Regular peer observations and collaborative reflection sessions can further support continuous professional growth and pedagogical improvement. Finally, formative assessment and reflective practice should be embedded across all stages of the design process. Formative assessment enables teachers to monitor learner progress, provide timely feedback, and guide improvement through strategies such as observation checklists, peer evaluations, and learner journals. Reflection, both individual and collaborative, allows teachers to evaluate their instructional approaches and make informed adjustments based on classroom experiences.

In summary, the successful facilitation of the design process in Technology Education depends on teachers' ability to connect theory with practice, activate learners' prior knowledge, and integrate each stage of the process into a coherent learning experience. Targeted professional development, adequate resources, collaborative support structures, and reflective teaching are all essential in helping teachers deliver more integrative, learner-centred, and effective instruction that develops learners' problem-solving and critical thinking skills.

Conflicts of Interest

The authors declare no conflict of interest regarding the publication of the paper.

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