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Research Article

Reconceptualising Summative Assessment for Sustainable Design and Technology Teacher Development in Zimbabwe

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Abstract
Student wellness and professional competence in Design and Technology (D&T) within Continuous Professional Teacher Development Programs (CPTDPs) are influenced by the design and implementation of summative assessment (SA). While conventional assessments often emphasise rote learning, sustainable and technology-enhanced approaches can foster higher-order skills, creativity, and real-world problem-solving aligned with national development priorities. This study investigated the nature of SA practices in D&T CPTDPs in Zimbabwe, explored students' and facilitators' perceptions of their effectiveness, and identified strategies to enhance assessment in line with sustainability pedagogy, technological integration, and Education 5.0 and Vision 2030 objectives. A qualitative, narrative inquiry approach was employed, involving interviews with facilitators, focus group discussions with students, and document analysis of assessment policies, moderation reports, and curriculum materials. Data were analysed thematically and interpreted through the lens of the Technological Pedagogical Content Knowledge (TPACK) framework and sustainability pedagogy, providing insights into both educator capacity and the alignment of assessment with sustainable, higher-order competencies. Findings indicate a persistent dominance of traditional, examination-focused SA, supplemented inconsistently by project-based and applied tasks. Participants reported that conventional assessments constrained creativity, problem-solving, and sustainability-oriented learning, although instances of practical, community-based tasks demonstrated partial alignment with intended outcomes. Barriers included limited technological competence, insufficient institutional support, and constrained assessment literacy. Strategies for improvement highlighted the need for multimodal, technology-enhanced, and authentic assessments, coupled with professional development, policy alignment, and infrastructure support. In conclusion, while current SA practices provide a baseline for evaluating learning, reforms are required to foster higher-order, sustainable competencies in D&T. Integrating technology, sustainability principles, and supportive institutional frameworks can enhance student learning, innovation, and alignment with national priorities, providing actionable guidance for educators, institutions, and policymakers.

Keywords: Continuous Professional Teacher Development, Design and Technology Education, Summative Assessment, Sustainability Pedagogy, TPACK Framework

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1. INTRODUCTION

Education systems worldwide are increasingly emphasising sustainability, technology, and innovation, reshaping expectations of what students should know and be able to do. The Sustainable Development Goals (SDGs), particularly SDG 4, call for inclusive, equitable, and quality education that promotes lifelong learning and transferable competencies beyond content mastery (UNESCO, 2016). Concurrently, the Fourth Industrial Revolution (4IR), characterised by advances in artificial intelligence, automation, digital connectivity, and emerging technologies, is transforming labour markets and redefining

the skills required for meaningful participation in contemporary economies (Schwab, 2016). These developments have intensified calls for education systems to prioritise creativity, problem-solving, technological fluency, adaptability, and responsible innovation.

In response, international organisations such as UNESCO and the Organisation for Economic Co-operation and Development (OECD) advocate assessment systems that move beyond knowledge recall to capture higher-order, transversal, and sustainability-oriented competencies (OECD, 2023; UNESCO, 2025). These frameworks emphasise balanced assessment approaches in which formative and summative functions are coherently aligned to support learning, inform certification, and prepare students for complex, uncertain futures. Consequently, curriculum, pedagogy, and assessment are increasingly viewed as interdependent components that must evolve together to address sustainability and technological change (Voogt et al., 2013).

Design and Technology (D&T) is an interdisciplinary subject that integrates creative design processes, practical skills, and technological knowledge to solve real-world problems (Garreta-Domingo & Hernández-Leo, 2018). It draws on principles from engineering, science, and the arts to promote innovation, critical thinking, and problem-solving in authentic contexts. Within educational settings, D&T emphasises the development of functional products and systems while fostering sustainability awareness and technological literacy aligned with contemporary societal and economic needs (Pavlova, 2013). D&T is therefore well positioned to operationalise these imperatives. Through problem framing, iterative design, material and technological engagement, and contextualised problem-solving, D&T can cultivate competencies central to sustainability and innovation. Within Continuous Professional Teacher Development Programmes (CPTDPs), D&T serves as both a subject and a pedagogical space where teachers can model practices integrating technological, pedagogical, and sustainability considerations. However, SA mediates this potential. While SA measures achievement of learning outcomes, it often remains dominated by time-bound examinations, limiting its capacity to capture complex design thinking, creativity, and sustainability-oriented problem-solving (Rianti et al., 2024).

In Zimbabwe, some CPTDPs have incorporated formative assessment elements, including model-making, prototyping, and practical design tasks, yet these are frequently marginalised in final summative judgments. This disconnect between how facilitators are encouraged to teach and how learning is assessed raises questions about the sustainability and relevance of current SA practices. Despite national policies such as Education 5.0 and Vision 2030, which emphasise innovation, industrialisation, and sustainable development, empirical evidence on how SA in D&T CPTDPs aligns with these priorities is limited. Moreover, although the Technological Pedagogical Content Knowledge (TPACK) framework offers a lens for understanding technology integration, its application to SA in resource-constrained professional development contexts remains underexplored.

This study, therefore, critically examines SA practices in D&T CPTDPs in Zimbabwe, focusing on their alignment with sustainability principles, technology integration, and higher-order skill development. By foregrounding facilitators and students' perspectives, it aims to provide empirical evidence to inform assessment reform, professional development design, and policy implementation in D&T education.

1.1. Research Questions

1.1.1. Main Research Question

What strategies can enhance sustainable assessment practices in D&T CPTDPs in Zimbabwe to foster sustainability and higher-order skills development?

1.1.2. Sub-Research Questions

This study was guided by the following research questions:

1. What SA practices are currently employed in D&T within CPTDPs in Zimbabwe?
2. How do D&T students and CPTDP facilitators perceive the effectiveness of current SA practices in fostering higher-order skills, sustainability, and long-term learning?

3. What strategies can be adopted to enhance SA in D&T CPTDPs so as to align with sustainability pedagogy, technology-enhanced assessment, and national development priorities articulated in Education 5.0 and Vision 2030?

1.2. Literature Review

1.2.1. Sustainable Summative Assessment

Sustainable SA extends beyond grading to evaluate learning outcomes while fostering long-term capability, adaptability, and relevance beyond immediate instructional contexts (Hadzhikoleva et al., 2025). Unlike conventional SA, which often prioritises rote memorisation, sustainable SA emphasises higher-order competencies such as creativity, problem-solving, critical thinking, and responsible innovation. Key features include multimodal assessment (projects, portfolios, applied tasks), integration of digital tools to support efficiency and feedback, and the inclusion of formative elements within summative processes. Sustainable SA is also equitable and context-sensitive, accommodating diverse learners and resource variations.

In D&T education, sustainable SA is particularly relevant due to the discipline's focus on practical engagement, iterative design, and technological problem-solving. When aligned with sustainability principles, SA can evaluate both technical proficiency and students' capacity to design environmentally responsible, socially responsive, and economically viable solutions. In Zimbabwe, such approaches resonate with national priorities under Education 5.0 and Vision 2030, which emphasise innovation, industrialisation, and sustainable development.

1.1.2. Technology-Enhanced Assessment and TPACK

The integration of technology in assessment is a critical enabler of sustainable SA. The TPACK framework conceptualises effective teaching as the intersection of content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK), emphasising their integration in instructional design and assessment (Mishra & Koehler, 2006). Research indicates that educators' TPACK influences their ability to design multimodal, authentic assessments such as digital portfolios, simulations, and project-based tasks that foster higher-order skills (AlOkaily, 2023).

In the Zimbabwean context, studies indicate that although educators recognise the value of SA, D&T assessment practices within CPTDPs remain largely content-driven and examination-oriented (Daka et al., 2021). This orientation prioritises the recall of theoretical knowledge over the development of practical and higher-order skills, thereby limiting the transformative potential of SA. Furthermore, systemic challenges, including limited assessment literacy, inadequate resources, and insufficient policy guidance, restrict educators' ability to design and implement authentic, competency-based assessments. These constraints reflect broader gaps in both pedagogical and technological knowledge, as well as inconsistencies in the operationalisation of SA policy.

1.1.3. Educators' Perceptions and Practices in SA

Educators' perceptions significantly shape assessment design and implementation. When assessments are perceived as fair, valid, and aligned with instructional goals, educators are more likely to use assessment data productively to support learning (Brookhart, 2017; Black & Wiliam, 2018). Conversely, externally imposed or misaligned assessments can constrain innovation and reduce professional agency. Educators' perceptions play a critical role in shaping the design and implementation of institution-based assessment. Within the framework of Assessment for Learning, assessment is conceptualised as an ongoing, formative process that supports student learning through feedback, reflection, and adaptation of teaching strategies (Black & Wiliam, 2018). When educators perceive assessment as fair, valid, and aligned with instructional goals, they are more likely to integrate assessment meaningfully into pedagogy and use evidence of learning to inform instruction (Brookhart, 2017). In such cases, SA functions not merely as a tool for evaluation but as a mechanism for enhancing learning outcomes. Conversely, when assessments are externally imposed, overly standardised, or misaligned with classroom realities, they may constrain pedagogical innovation and diminish educators' sense of professional agency.

From a TPACK perspective, effective SA practices require educators to integrate content knowledge, pedagogical strategies, and appropriate assessment and technological tools. In D&T, this integration is particularly important, as the subject emphasises creativity, problem-solving, and practical application of knowledge. However, limitations in any component of TPACK, especially assessment literacy and technological integration, can undermine the effectiveness of SA practices.

Despite growing recognition of SA as a tool for improving learning, there remains a significant gap between policy intentions and classroom practices in Zimbabwean D&T education. Specifically, there is limited empirical evidence on how educators' perceptions influence the integration of TPACK-informed assessment strategies within CPTDP contexts. Addressing this gap is essential for understanding how SA can be repositioned to support innovation, sustainability, and skills development in resource-constrained educational environments.

1.1.4. Moderation, Credibility, and Barriers

Credibility in SA depends on assessment design and moderation processes that ensure fairness, reliability, and validity (Brookhart, 2017). In CPTDPs, external moderation and cross-institutional standardisation enhance trustworthiness. However, moderated assessments in Zimbabwe often privilege procedural and theoretical knowledge over authentic application, creativity, and reflective practice (Tandi & Chigerwe, 2025). This highlights a persistent tension between maintaining assessment credibility and promoting sustainability-oriented, higher-order competencies, reinforcing the need to balance standardisation with innovation.

1.1.5. Alignment with Global and National Educational Imperatives

Global frameworks emphasise aligning SA with sustainability, equity, and lifelong learning (Black & Wiliam, 2018; OECD, 2023). In D&T, authentic, performance-based SA captures students' ability to engage in design thinking, solve real-world problems, and apply technological knowledge creatively (Gulikers et al., 2018; Segers & Dochy, 2001). While Zimbabwean CPTDPs have introduced practical projects, portfolios, and applied tasks (Daka et al., 2021), implementation remains inconsistent, with assessment often reverting to examination-dominated models.

The literature also emphasises the importance of integrating technology and sustainability pedagogy into assessment to foster innovation, applied learning, and higher-order skills. By combining TPACK with sustainability pedagogy, educators can design SA that develops students' capacity to produce future-oriented, socially and environmentally responsible solutions, aligning assessment practices with Education 5.0 and Vision 2030. This dual theoretical lens provides a foundation for examining current practices, perceptions, and potential strategies to enhance SA in D&T CPTDPs.

1.1.6. Identified Gaps

Despite the growing body of literature on sustainable and technology-enhanced SA, empirical research within D&T CPTDPs remains limited. There is insufficient understanding of how educators and students perceive the effectiveness of SA in fostering higher-order and sustainability-oriented competencies.

Furthermore, little is known about the practical implementation of multimodal, technology-enhanced, and sustainability-aligned assessment approaches within these contexts. There is also a lack of contextually grounded strategies for reforming SA practices to ensure alignment with national development priorities, global educational imperatives, and the demand for future-oriented competencies. These gaps collectively justify the present study, which seeks to investigate current SA practices, explore stakeholder perceptions, and identify strategies for enhancing sustainable, technology-enhanced assessment in D&T CPTDPs.

1.1.7. Theoretical Framework

This study integrates the TPACK framework and sustainability pedagogy to examine SA practices in D&T within CPTDPs. TPACK conceptualises effective teaching as the intersection of content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK), emphasising their integrated application in instructional design and assessment (Koehler & Mishra, 2009; Mishra & Koehler, 2006). In this study, TPACK guided the analysis of SA practices by highlighting how educators combine content, pedagogy, and technology to design assessments that foster higher-order skills.

Sustainability pedagogy foregrounds teaching and assessment practices that promote environmental responsibility, social equity, and economic viability (Dutra, 2025). It provided a lens to evaluate whether SA tasks encouraged the development of future-oriented, socially responsible competencies aligned with Education 5.0 and Vision 2030.

Collectively, these frameworks enabled the study to examine both educator capacity and assessment design. TPACK illuminated the role of technological and pedagogical knowledge in shaping assessment practices, while sustainability pedagogy clarified whether assessments promoted applied, innovative, and sustainable professional skills. This dual lens informed data collection, coding, and interpretation, ensuring that findings link assessment practices to both technological competence and sustainability-oriented learning outcomes.

2. METHODS

2.1. Research Design

This study adopted a constructivist qualitative research paradigm, which foregrounds participants' lived experiences and recognises knowledge as socially constructed within specific contexts (Creswell & Poth, 2018; Lincoln & Guba, 1985). This paradigm was appropriate for exploring how D&T students and facilitators understand, enact, and evaluate SA practices within CPTDPs in Zimbabwe.

Aligned with this paradigm, a qualitative research approach was employed to capture in-depth insights into participants' perceptions, practices, and meanings related to SA, sustainability, and technology integration. A qualitative case study design was selected, focusing on D&T CPTDPs offered at a selected university in Zimbabwe. Case study research enables holistic examination of contemporary educational practices within real-life contexts (Yin, 2018), allowing exploration of SA as embedded within institutional, pedagogical, and policy environments. This design facilitated integration of empirical findings with the TPACK framework and sustainability pedagogy, supporting analysis of both content and pedagogical dimensions of assessment practices.

2.2. Participants

The study involved 20 participants: 15 D&T students enrolled in, or recently graduated from, CPTDPs, and 5 CPTDP facilitators responsible for assessment design and moderation. Purposive sampling (Patton, 2015) was used to select participants with direct experience of SA practices in D&T CPTDPs, ensuring alignment with the research objectives. The sample size was sufficient to achieve data saturation, as recurring themes were observed across interviews, focus group discussions (FGDs), and document analysis. The sample size was sufficient to achieve data saturation, as recurring themes were observed across interviews, focus group discussions (FGDs), and document analysis. Participants ranged in age from 20 to over 50 years and included 12 female and 8 male educators, with teaching experience ranging from fewer than five years to more than fifteen years. This diversity provided a broad range of professional perspectives on SA practices, enhancing the credibility and transferability of the findings. Demographic characteristics of participants are summarised in Table 1.

2.3. Research Instruments

Data were collected using semi-structured interviews, focus group discussions (FGDs), and document analysis to ensure triangulation and a comprehensive understanding of summative assessment (SA) practices.

Semi-structured interviews were conducted with five CPTDP facilitators, each lasting between 45 and 60 minutes. These interviews explored key aspects such as assessment design, alignment with curriculum requirements, integration of sustainability and higher-order skills, moderation practices, as well as perceived challenges and opportunities for improving assessment practices. The interview guide comprised fifteen questions, including: "*Can you describe the types of SA practices used in your program?" and "How could technology or digital tools be incorporated to improve SA practices in D&T*?"

FGDs were conducted with a purposive sample of 15 D&T students in two sessions, each lasting between 60 and 75 minutes. The discussions focused on students' experiences with SA, including opportunities to demonstrate creativity and problem-solving, perceptions of fairness and relevance, and the usefulness of feedback provided. Sample questions included: "*How would you evaluate the SA tasks used in your D&T CPTDP program?*" and "*To what extent do these assessments allow you to demonstrate creativity, problem-solving, and sustainability awareness?*"

Document analysis was conducted on assessment instruments, moderation reports, and institutional policy documents. This analysis examined the nature and types of documented assessments, the extent to which content, pedagogical, and technological knowledge were integrated, the incorporation of sustainability-oriented competencies and higher-order thinking skills, and the mechanisms in place for feedback and continuous improvement.

All interviews and FGDs were audio-recorded with informed consent and transcribed verbatim. Instruments were piloted with two non-participant facilitators and three students to ensure clarity, relevance, and reliability.

2.4. Procedures

Ethical clearance for the original study, *"Understanding Student Wellness in Continuous Teacher Professional Development Programs in Zimbabwe: A Multi-Dimensional Approach,"* was obtained from the Research Ethics Committee (reference number NUST/IRB/2025/142). The present article is based on a secondary qualitative analysis conducted under this approved protocol. Informed consent was obtained from all participants prior to data collection. Confidentiality and anonymity were ensured with pseudonyms, and all data were securely stored in password-protected files accessible only to the research team. Participants were informed of their right to withdraw at any time without penalty.

Data collection procedures followed a sequential and systematic process. Semi-structured interviews with CPTDP facilitators were scheduled in advance and conducted in quiet, private locations on campus. Each interview lasted between 45 and 60 minutes and was audio-recorded with participants' consent. Field notes were taken to capture non-verbal cues and contextual observations.

FGDs were conducted with D&T students in two sessions comprising 7 and 8 participants, respectively. Each session lasted between 60 and 75 minutes. The FGDs were moderated by the researcher using a semi-structured guide (described in Section 2.3), allowing flexibility for probing and clarification. This format facilitated interaction among participants and enabled the exploration of shared and divergent experiences of summative assessment.

Document analysis was conducted concurrently with interviews and FGDs. Relevant documents, including assessment instruments, marking rubrics, moderated scripts, and institutional policy documents, were collected and systematically reviewed using a document analysis framework (see Section 2.3). This process enabled the corroboration and contextualisation of data obtained from participants.

All interviews and FGDs were transcribed verbatim. The data were then organised and prepared for thematic analysis, as described in Section 2.5.

2.5. Data Analysis

Data were analysed using thematic analysis following Braun and Clarke's (2006) six-phase approach. This involved familiarisation with transcripts, generation of initial codes guided by research questions and TPACK and sustainability pedagogy frameworks, searching for themes, reviewing and refining themes to ensure coherence, defining and naming themes, and producing a report integrating evidence from interviews, FGDs, and document analysis.

Trustworthiness was ensured by addressing credibility, dependability, confirmability, and transferability (Lincoln & Guba, 1985). Credibility was enhanced through triangulation, prolonged engagement, and member checking; dependability through maintaining a detailed audit trail; confirmability through reflective journaling and peer debriefing; and transferability through rich contextual descriptions of participants and research setting.

3. RESULTS

To explore current SA practices and perceptions in D&T CPTDPs, data from semi-structured facilitator interviews, FGDs, and document analysis were synthesised and thematically presented in this section. This thematic presentation highlights how assessments are designed, implemented, and experienced, including their alignment with curriculum objectives, incorporation of sustainability-oriented competencies, and promotion of higher-order skills. Verbatim excerpts from facilitators, students, and documents are provided to illustrate key findings and demonstrate convergence and divergence of perspectives.

The study involved 15 students and 5 facilitators, as outlined in Table 1. The diversity of participants in terms of age, gender, and teaching experience provided a broad range of perspectives on SA practices in D&T CPTDPs. Quotations are coded to indicate participant type, allowing for clear comparison while maintaining confidentiality.

Table 1. Demographic Characteristics of Participants (N = 20)

Characteristic	Category	Number of Participants
Participant type	D&T CPTDP students	15
	CPTDP facilitators	5
Gender	Male	8
	Female	12
Age range	20–29 years	3
	30–39 years	11
	40–49 years	1
	50+ years	5
Teaching experience	0–5 years	6
	6–10 years	9
	11–15 years	3
	15+ years	2

To ensure anonymity while distinguishing perspectives, student participants are referred to as S1–S15, and facilitators as F1–F5 throughout the findings. These codes are used when presenting quotations to indicate whether the comment comes from a student or a facilitator. This coding system allows for a clear comparison of perspectives between the two groups while maintaining participant confidentiality.

3.1. Current Summative Assessment Practices in D&T CPTDPs

Analysis of data from facilitator interviews, student perspectives, and document analysis revealed several themes that characterise SA practices in D&T within CPTDPs.

Theme 1: Predominance of traditional examination-based assessment

The findings indicate that SA in D&T CPTDPs is largely dominated by traditional written examinations. Although alternative forms of assessment, such as projects, portfolios, and school-based

assessments (SBAs), are present within the curriculum, their implementation appears inconsistent and often secondary to examinations. Facilitators consistently emphasised the central role of examinations in determining student performance, with one noting that *"mostly we use examinations as a way of weighing the students' understanding of the module"* (F3).

Student participants reinforced this view, highlighting that assessment practices tend to prioritise rote memorisation over creativity and deeper understanding. For instance, one student observed that *"there's more of essay writing… there's no room for creativity in the exam room"* (S2), while another remarked that summative assessments are primarily focused on passing rather than knowledge expansion.

Document analysis further corroborated these findings, showing that assessment instruments predominantly emphasise theoretical knowledge at the expense of practical competence.

Theme 2: Partial integration of practical, sustainability-oriented, and heritage-based assessment

Despite the dominance of examination-based assessment, the findings also reveal evidence of efforts to integrate practical and contextually relevant assessment tasks aligned with sustainability and heritage-based curriculum principles. Both facilitators and students highlighted instances where assessment required the application of theoretical knowledge to real-world situations. For example, one student explained, *"A case in point is when we did a module on graphic products. We learned how to design a business card. As of today, I have designed business cards for my clients"* (S1), illustrating the potential for authentic and practice-oriented learning.

Similarly, facilitators emphasised the inclusion of community-based design tasks, with one noting that *"projects refer to practical solutions to the problems faced in our local communities. There should be a prototype of the artefacts to be designed to solve the problem"* (F4). These excerpts suggest that elements of sustainability and heritage-based education are being incorporated into assessment practices.

However, document analysis revealed a critical limitation in the implementation of these approaches. In several instances, modules intended to develop practical and sustainability-oriented competencies were assessed primarily through theoretical examinations. This misalignment indicates that while the curriculum aspires to promote applied and contextually relevant learning, the assessment practices do not consistently provide students with opportunities to demonstrate these competencies in practice. Consequently, a disconnect persists between intended curriculum outcomes and enacted assessment practices.

Theme 3: Structural and implementation challenges affecting SA practices

The effectiveness of current SA practices is further constrained by a range of structural and implementation challenges. Facilitators highlighted time constraints as a major barrier, with one explaining that *"time management is difficult, and we were not in a position to complete projects within the given timeframe"* (F4). This limitation restricts the depth and quality of practical assessment.

Students also raised concerns about the inability of current assessment approaches to capture higher-order skills. One participant stated that *"summative assessments do not necessarily test problem-solving… modules such as Design projects require skills testing, but there's no evidence of creativity and critical thinking being demonstrated"* (S6). In addition, participants pointed to the limited integration of technology as a missed opportunity to improve assessment processes. A student noted that *"technology could be used to improve summative assessment by using digital tools to mark the assessment. This would remove human factors like favoritism"* (S3). These findings suggest that systemic and resource-related constraints continue to hinder the effectiveness of SA practices.

3.2. Perceptions of the Effectiveness of Current SA Practices

While the preceding section has outlined the dominant SA practices in D&T CPTDPs, it is equally important to consider how these practices are experienced and interpreted by participants. The findings reveal a range of perspectives reflecting both the strengths and limitations of current approaches, particularly in relation to their capacity to foster higher-order thinking, sustainability competencies, and long-term learning.

Theme 1: Perceived strengths of current SA practices

Some participants viewed current SA practices as useful in evaluating students' understanding and providing a comprehensive picture of learning outcomes. Students acknowledged the role of assessment in helping lecturers gauge their progress, with one stating that *"I find them useful because they give the lecturer a full picture of how a student has understood the topic"* (S7).

Facilitators similarly highlighted the value of employing multiple assessment methods, noting that *"because we are not using one type of assessment, we use in-class tests, projects, and institution-based assessments to get the true worth of the student"* (F1). These perspectives suggest that SA practices are perceived as effective in assessing foundational knowledge and overall performance.

Theme 2: Perceived limitations in fostering higher-order skills, sustainability, and long-term learning

Despite these strengths, participants expressed significant concerns regarding the limitations of current SA practices. A dominant critique was that examinations do not adequately promote creativity, innovation, or critical thinking. One student remarked that *"exams do not encourage creativity or innovation as they focus on reproducing knowledge rather than applying it"* (S3), highlighting the narrow scope of assessment. Others pointed to the lack of opportunities for feedback and revision, with one noting that *"there's no room for correction through revision of failed papers"* (S5), which limits opportunities for deeper learning.

Document analysis further supported these perceptions, indicating that while moderation processes are in place, they do not actively promote innovation in assessment. For example, it was noted that moderation reports are documented but have not raised issues regarding the nature of examinations given. These findings suggest that current SA practices are largely oriented towards assessment of learning rather than fostering long-term, transformative learning.

3.3. Strategies for Enhancing SA in D&T CPTDPs

Building on the identified limitations of current practices, the study explored strategies for enhancing SA in D&T CPTDPs. The findings point to a range of approaches aimed at aligning assessment with sustainability pedagogy, technology-enhanced learning, and national development priorities, particularly within the framework of Education 5.0 and Vision 2030.

Theme 1: Adoption of multi-modal and authentic assessment approaches

Participants strongly advocated for the adoption of more diverse and authentic forms of assessment. Facilitators emphasised the need to move beyond traditional examinations to include portfolios, presentations, and project-based tasks. One facilitator proposed that they would want to *"include portfolios and exhibitions where independent people judge the work"* (F5). These approaches were viewed as more effective in capturing students' creativity, innovation, and practical competencies.

Theme 2: Integration of technology-enhanced assessment

The integration of technology was identified as a key strategy for improving assessment practices. Participants highlighted the potential of digital tools to support creativity, enhance transparency, and improve efficiency. One facilitator noted that *"students should be encouraged to use digital tools and platforms to showcase their creativity and innovation"* (F3), pointing to the role of technology in transforming assessment practices. These insights suggest that technology-enhanced assessment can better align D&T education with contemporary industry and educational demands.

Theme 3: Alignment with sustainability and real-world problem-solving

Participants also emphasised the importance of aligning assessment with real-world challenges and sustainability principles. Students highlighted the need for assessment tasks that reflect societal realities,

with one stating that *"examination questions should be taken from prevailing societal problems"* (S2). This approach was seen as essential for promoting relevance, engagement, and sustainability-oriented thinking.

Theme 4: Strengthening institutional support and assessment systems

Participants consistently stressed the need for stronger institutional support to enable the effective implementation of improved SA practices. Several challenges were identified, particularly relating to time constraints, feedback mechanisms, and resource availability, all of which were seen as significant barriers to meaningful assessment reform. For instance, one facilitator highlighted the constraints associated with limited time, noting that *"time management is difficult, and we could not complete projects within the given timeframe* (F4), suggesting that structural limitations directly affect the quality and depth of assessment.

In addition, concerns were raised regarding the adequacy of feedback provided to students. A student remarked that *"there's no room for correction through revision of failed papers"* (S8), indicating that current systems do not sufficiently support formative development within summative processes. This lack of iterative feedback limits opportunities for improvement and deeper learning.

Resource-related challenges were also evident, particularly in relation to the integration of technology and practical work. As one facilitator observed, *"technology could be used to improve summative assessment, but we are limited in terms of resources"* (F1), highlighting the gap between potential innovation and actual implementation.

Document analysis further reinforced these concerns, pointing to inconsistencies in policy implementation and support structures. For example, it was noted that *moderation reports are documented but have not raised issues on the nature of examinations given*, suggesting that while quality assurance mechanisms exist, they do not actively drive improvement or innovation in assessment practices.

Collectively, these findings indicate that without adequate institutional support, including sufficient time allocation, robust feedback systems, and access to appropriate resources, efforts to reform SA practices are likely to remain limited in impact. This underscores the importance of systemic and policy-level interventions in enabling meaningful and sustained assessment transformation.

4. DISCUSSION

The findings of this study reveal a persistent dominance of traditional, examination-oriented SA practices within D&T CPTDPs, despite growing recognition of the need for more authentic, sustainability-oriented, and technology-enhanced approaches. This section interprets these findings through the lens of the TPACK framework and sustainability pedagogy, drawing on recent scholarship to explain the underlying dynamics shaping assessment practices.

The continued reliance on traditional examination-based assessment can be attributed to a combination of institutional, epistemological, and capacity-related factors. Examinations remain embedded within higher education systems due to their perceived objective, standardisation, and administrative efficiency, particularly in contexts characterised by large student numbers and limited resources.

From a theoretical standpoint, this persistence can be explained through the TPACK framework, which conceptualises effective teaching as the integration of technological, pedagogical, and content knowledge (Ouyang et al., 2025). Where technological knowledge is underdeveloped, educators are less able to design innovative assessment strategies, resulting in continued reliance on traditional pedagogical approaches. This imbalance is further reinforced by systemic constraints, including limited access to digital tools and insufficient institutional support (Voogt et al., 2013).

Recent studies also highlight that integrating sustainability into teaching requires both pedagogical transformation and technological competence. The emerging concept of Sustainability TPACK (S-TPACK) demonstrates that without adequate teacher preparedness and institutional alignment, the implementation of innovative, sustainability-oriented practices remains uneven (Hernández-Campos et al., 2025). Thus, the persistence of examination-dominated assessment reflects structural, knowledge-based, and resource-related limitations rather than mere resistance to change.

A notable finding is that participants continue to rely on assessment practices they themselves perceive as inadequate. This paradox can be understood as a function of constrained agency within institutional systems. Educators may recognise the value of authentic, multi-modal assessment, but time pressures, workload demands, and resource shortages limit their ability to implement alternative approaches.

Within the TPACK framework, effective integration of technology into assessment requires not only access to tools but also alignment with pedagogical goals. Where educators lack technological pedagogical knowledge (TPK), they struggle to design digital portfolios, simulations, or collaborative online projects, and default to familiar, manageable methods (AlOkaily, 2023). Limited digital competence mediates the effect of progressive pedagogical orientations, meaning that even sustainability-minded teachers may continue using traditional assessments (Voogt et al., 2013).

The findings reveal a misalignment between curriculum intentions and assessment practices, particularly for sustainability. Sustainability pedagogy emphasises experiential learning, critical thinking, and engagement with real-world problems (Dutra, 2025). However, when assessment is predominantly theoretical, students are denied opportunities to demonstrate these competencies meaningfully.

Research underscores the importance of integrating sustainability across pedagogy and assessment. The S-TPACK framework highlights that sustainability should intersect with both technological and pedagogical knowledge, not treated as an add-on (Hernández-Campos et al., 2025). Teachers' sustainability orientation is closely linked to their ability to design transformative learning experiences, but this is constrained by digital competence limitations (Voogt et al., 2013). In D&T CPTDPs, the limited use of authentic assessment undermines both sustainability learning outcomes and alignment with national development priorities such as Education 5.0 and Vision 2030.

4.1. Practical Implications for Policy, Institutions, and Professional Development

The findings point to the need for a coordinated, multi-level response. Institutions should provide time for project-based assessment, invest in digital infrastructure, and standardise flexible assessment frameworks. Capacity building in TPACK is essential for enabling educators to implement multi-modal, technology-enhanced assessment. Policymakers should align assessment regulations with sustainability and innovation goals, enabling authentic and practice-based SA rather than solely relying on examinations. Continuous professional development programs should offer targeted training in digital tools, pedagogical strategies for sustainability, and multi-modal assessment design (AlOkaily, 2023). Collaborative and context-sensitive professional development is critical to ensure effective implementation. Meaningful reform requires addressing both individual capacity and systemic constraints. Without sufficient support structures, technological competence, and policy alignment, efforts to transform assessment will remain fragmented and limited in impact.

5. CONCLUSION

This study examined SA practices in D&T within CPTDPs in Zimbabwe, focusing on current practices, participants' perceptions, and potential strategies for improvement. Findings indicate a persistent dominance of traditional, examination-focused assessments, with practical and project-based tasks implemented inconsistently. While some integration of sustainability-oriented and heritage-based assessments was evident, theoretical evaluation in several modules limited students' opportunities to demonstrate applied competencies.

Participants' perceptions revealed a paradox. Although facilitators and students recognised the limitations of traditional assessments, particularly in fostering creativity, higher-order thinking, and sustainability competencies, they continued to rely on these approaches. This reliance is largely explained by systemic constraints, including time pressures, resource limitations, and insufficient technological competence, reflecting gaps within the TPACK framework and limited operationalisation of sustainability pedagogy.

Strategies proposed by participants to enhance SA included incorporating multi-modal, project-based, and authentic assessment tasks, integrating technology to facilitate creativity and fairness, and aligning assessments with real-world sustainability challenges. These strategies emphasise the importance of systemic support, institutional capacity building, and targeted professional development to improve assessment practices and student learning outcomes.

5.1. Limitations of the Study

Despite its contributions, this study has several limitations. First, data were collected from one CPTDP site and participants, which may constrain the generalisability of findings to all D&T programs in Zimbabwe. Second, the study relied primarily on self-reported perceptions from students and facilitators, which may be subject to social desirability bias or selective recall. Third, document analysis focused on available curriculum materials and moderation reports; certain internal institutional processes or informal practices may not have been captured. Finally, while the study integrates theoretical frameworks such as TPACK and sustainability pedagogy, it does not empirically measure the effectiveness of technology-enhanced assessment interventions, leaving a gap for further empirical validation.

5.2. Recommendations for Future Research

Building on the identified limitations and key findings of this study, several avenues for future research emerge. There is a need to broaden the scope of inquiry by including a larger and more diverse sample of CPTDPs across Zimbabwe. Such an approach would enhance the representativeness of findings and provide a more comprehensive understanding of summative assessment practices within D&T education.

Future research could also focus on the empirical evaluation of innovative assessment approaches, particularly the implementation of technology-enhanced and multi-modal summative assessments. Investigating how these approaches influence student learning outcomes, creativity, and the development of sustainability-oriented competencies would provide valuable insights for both policy and practice.

In addition, longitudinal studies would be beneficial in tracing the impact of evolving assessment practices over time. Such studies could explore how sustained changes in assessment design affect student performance, professional growth, and the acquisition of higher-order and sustainability-related skills.

Comparative research across different educational contexts could further enrich understanding by highlighting how systemic, cultural, and policy environments shape assessment practices in D&T programs. Insights from such cross-context analyses may inform the adaptation of best practices to local contexts.

Finally, there is a need for more in-depth exploration of facilitator capacity, particularly in relation to technological pedagogical knowledge and digital competence. Understanding how these factors influence the implementation of innovative and sustainability-oriented assessment practices could support targeted professional development initiatives.

In conclusion, while current summative assessment practices in D&T CPTDPs provide a foundation for evaluating learning, they remain insufficient to foster higher-order thinking, creativity, and sustainability competencies. Addressing systemic constraints, enhancing facilitator capacity, and integrating technology and sustainability principles into assessment design are critical steps toward aligning teacher education with Education 5.0 and Vision 2030 priorities. These steps will ultimately contribute to more relevant, innovative, and impactful D&T education in Zimbabwe.

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collected under this approved protocol. All participants provided informed consent, and confidentiality and anonymity were maintained throughout the research process.

Data Availability Statement. The data that support the findings of this study are available from the corresponding authors upon reasonable request. Access is subject to restrictions to protect participant confidentiality, as the dataset contains sensitive qualitative interviews collected under an approved ethics protocol, National University of Science and Technology, reference number NUST/IRB/2025/142.

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REFERENCES

AlOkaily, R. (2023). *Learner-centered instructional design and evaluation: Principles for flexible, ubiquitous, agnostic learning in higher education*. Routledge. https://doi.org/10.4324/9781003317234

Black, P., & Wiliam, D. (2018). Classroom assessment and pedagogy. *Assessment in Education: Principles, Policy & Practice, 25*(6), 551–575. https://doi.org/10.1080/0969594X.2018.1441807

Brookhart, S. M. (2017). *How to give effective feedback to your students* (2nd ed.). ASCD.

Cabbeke, B., Adams, B., Rotsaert, T., & Schellens, T. (2025). Collaborative design through authentic design challenges: Preservice teachers' perceptions of digital competence development and SQD-aligned supports. *Education Sciences, 15*(10), 1331. https://doi.org/10.3390/educsci15101331

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Sage Publications.

Daka, H., Mulenga-Hagane, M. L., Mukalula-Kalumbi, M., & Lisulo, S. (2021). Making summative assessment effective. *European Modern Studies Journal, 5*(4), 224-237. https://dspace.unza.zm/handle/123456789/8339

Dutra, A. (2025). *Critical pedagogy for a sustainable future: Investigating Paulo Freire's influence on education for sustainable development* [Master's thesis, Uppsala University]. https://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-548798

Eyal, L. (2025). Developing and validating an AI TPACK assessment framework: Enhancing teacher educators' professional practice through authentic artifacts. *Education Sciences, 15*(11), 1452. https://doi.org/10.3390/educsci15111452

Garreta-Domingo, M., & Hernández-Leo, D. (2018). Education, technology and design: A much needed interdisciplinary collaboration. In *Designing for the User Experience.* Springer. https://doi.org/10.1007/978-3-319-94794-5_2

Gulikers, J. T. M., Runhaar, P., & Mulder, M. (2018). An assessment innovation as flywheel for changing teaching and learning. *Journal of Vocational Education & Training, 70*(2), 212–231. https://doi.org/10.1080/13636820.2017.1394353

Hadzhikoleva, S., Hadzhikolev, E., Gaftandzhieva, S., & Pashev, G. (2025). A conceptual framework for multi-component summative assessment in an e-learning management system. *Frontiers in Education, 10*, 1656092. https://doi.org/10.3389/feduc.2025.1656092

Hernández-Campos, M., Gonzalez-Torres, A., & García-Peñalvo, F. J. (2025). Learning outcomes evaluation through learning analytics systems in higher education: A systematic literature review. *SAGE Open, 15*(1), 1-17. https://doi.org/10.1177/21582440251347374

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)? *Contemporary Issues in Technology and Teacher Education, 9*(1), 60–70. Retrieved from https://citejournal.org/volume-9/issue-1-09/general/what-is-technological-pedagogicalcontent-knowledge

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage Publications.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Organisation for Economic Co-operation and Development. (2018). *Education at a glance 2018: OECD indicators*. OECD Publishing. https://doi.org/10.1787/eag-2018-en

Organisation for Economic Co-operation and Development. (2023). *OECD digital education outlook 2023: Toward effective digital education ecosystems*. OECD Publishing. https://doi.org/10.1787/c74f03de-en

Ouyang, F., Chen, S., & Shao, X. (2026). Process and summative assessment of groups' collaborative knowledge-building. *Journal of Computing in Higher Education, 38*, 360–385. https://doi.org/10.1007/s12528-025-09437-5

Patton, M. Q. (2015). *Qualitative research & evaluation methods* (4th ed.). Sage Publications.

Rianti, R., Aziz, Z. A., & Aulia, M. (2024). Incorporating higher order thinking skills into English summative assessments. *English Review: Journal of English Education, 12*(1), 353–360. https://doi.org/10.25134/erjee.v12i1.9301

Schwab, K. (2016). *The Fourth Industrial Revolution*. World Economic Forum.

Segers, M., & Dochy, F. (2001). New assessment forms in problem-based learning: The value-added of the students' perspective. *Studies in Higher Education, 26*(3), 327–343. https://doi.org/10.1080/03075070120076291

Tandi, C., & Chigerwe, W. (2025). Embracing pedagogical shifts in Zimbabwean teachers' colleges: A critical evaluation of institutional preparedness for change. In C. Tandi, M. Mawere, W. Zivawe, & R. Mavunga (Eds.), *Pedagogics, curriculum transformation, and the future of teachers' colleges in Zimbabwe* (pp. 301–334). Langaa RPCIG. https://doi.org/10.2307/jj.30089701

UNESCO Institute for Statistics. (2025). *Harmonizing learning assessments to close Africa's learning data gaps*. UNESCO. https://www.unesco.org/en/articles/harmonizing-learning-assessments-close-africas-learning-data-gaps

UNESCO. (2016). *Global education monitoring report 2016: Education for people and planet: Creating sustainable futures for all*. UNESCO Publishing. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000245752

Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & van Braak, J. (2013). Technological pedagogical content knowledge: A review of the literature. *Journal of Computer Assisted Learning, 29*(2), 109–121. https://doi.org/10.1111/j.1365-2729.2012.00487.x

Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Sage Publications.