Distinguishing Technical Education from Technical Teacher Education within the Global TVET Frameworks: A Systemic Delineation using a Qualitative Approach

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Received: 26 December 2025
Received in revised form: 24 January 2026
Accepted: 25 January 2026
Published: 10 March 2026

ABSTRACT

This study systematically delineates Technical Education (TE) from Technical Teacher Education (TTE) within global Technical and Vocational Education and Training (TVET) frameworks. It analyses international organizations' conceptualisations of TVET, critically examines the dual competency theory for TVET teachers, and compares global TTE models (consecutive vs. concurrent). Using a qualitative comparative design and thematic analysis of statutory documents from Nigeria and the United States, the research reveals distinct roles, objectives, pedagogical approaches, and competency requirements for TE and TTE. Findings shows that TE focuses on direct skill acquisition for workforce entry, while TTE cultivates pedagogical and leadership capabilities for teachers. This delineation is vital for developing coherent policies that enhance TVET quality and relevance globally, emphasising the interdependence between effective TE outcomes and robust TTE as critical components of TVET.

Keywords:
Technical education; Technical teacher education; TVET; Dual competency; Global frameworks

Introduction

Technical and Vocational Education and Training (TVET) is critical for global economic growth and social equity because it provides essential employment and entrepreneurship skills for its recipients (Secretariat, 2022). The Global economies, marked by rapid technological change and evolving labour markets, require ongoing adaptation in TVET systems for relevance and effectiveness (Legg-Jack & Ndebele, 2022; Mitchell & Buntic, 2022). This transformation shows the need to distinguish between "Technical Education" (TE), which provides industry-ready vocational skills, and "Technical Teacher Education" (TTE), which trains educators to deliver this instruction (Ianos & Tebeanu, 2018). As noted by Ismail et al (2017), Bünning and Schmidt (2017), and Wafula et al. (2013), both are vital to TVET, but their differing objectives and methods necessitate thorough examination to enhance vocational education quality and impact globally. The distinction between these two facets of TVET is significant for policy makers, educational institutions, and industry stakeholders to develop coherent strategies that address skill mismatches and enhance workforce preparedness (Dubey & Noronha, 2025).

According to Bünning and Schmidt (2017), the inherent complexity of TVET, which blends practical skills with theoretical knowledge, places unique demands on its educators, making the quality of TTE a central determinant of the entire system's quality assurance. Without adequately prepared technical teachers, the effectiveness of technical education programmes is significantly compromised, leading to a workforce that may lack the advanced skills required by modern industries (Kebede & Asgedom, 2024; Ismail et al., 2017; Wafula et al., 2013). This study aims to systematically delineate TE from TTE within global TVET frameworks. It explored how international organizations conceptualise TVET, delve into the critical theory of dual competency for TVET teachers, and provide an overview of the prevalent global models for TTE by a comparative analysis of the United State and Nigeria. In clarifying these interconnected yet distinct components, the research seeks to contribute to a clearer understanding of TVET ecosystems, facilitating the development of more effective TTE programmes and ultimately enhancing the quality and relevance of TE worldwide. The emphasis on distinguishing these elements is not to separate them, but rather to

understand their unique contributions and synergistic relationship in building a robust and responsive TVET system capable of meeting future challenges (Riyanda et al., 2021).

Statement of the Problem

The current global landscape emphasises the critical role of TVET in developing skilled workforces and promoting economic growth. Despite the acknowledged importance of TVET, a significant challenge lies in the imprecise systemic delineation between TE (the direct instruction of industry-specific skills to learners) and TTE (the specialised training of individuals who will, in turn, teach these industry-specific skills) within global TVET frameworks. This lack of clear distinction seemed to have led to several interconnected problems that hinder the overall effectiveness and quality of TVET systems worldwide. Firstly, ambiguity in conceptualising TVET across international bodies such as UNESCO, the World Bank, and the Commonwealth Secretariat, and others results in varied interpretations and operationalisations of its core objectives and components. While there is a common thread of skill acquisition and workforce preparedness, these divergences can lead to inconsistent policy development and programme implementation across different regions and countries. This inconsistency in the researchers view, can further exacerbate the challenges in establishing standardised curricula and quality assurance mechanisms for both TE and TTE. Secondly, the critical theory of "dual competency" for TVET teachers, the simultaneous requirement for deep industry mastery and effective pedagogical expertise, is often poorly realised in practice by several regions and countries. Many TVET teachers struggle to maintain currency with rapidly evolving industry practices while also developing and applying advanced teaching methodologies. Challenges in achieving and sustaining this dual qualification include weak student admission criteria for TTE programmes, irrelevant curricula that are too theory-focused, and limited resources for practical training and continuous professional development. This deficiency in dual competency directly impacts the quality of technical education delivered, as teachers may lack either the up-to-date practical skills demanded by industry or the pedagogical prowess to effectively impart knowledge and skills to students.

Thirdly, the prevalent global models for TTE, namely "consecutive" (industry-first) and "concurrent" (integrated) approaches as clarified earlier, each present distinct advantages and challenges, yet their comparative effectiveness and optimal application are not consistently understood or implemented. While the consecutive model leverages industry experience, it often struggles with providing adequate pedagogical training. Conversely, the concurrent model integrates pedagogical and subject matter training from the outset but may lead to insufficient depth in either area. Without a clear understanding of which model best suits specific contexts and how to mitigate their respective shortcomings, TVET systems face difficulties in producing teachers who are both technically proficient and pedagogically sound. And finally, the absence of a comprehensive systemic delineation between TE and TTE within the broader TVET framework further obscures their synergistic relationship and impedes the development of coherent and effective policies. This lack of clarity can lead to fragmented efforts, where TE programmes might be well-designed but taught by underprepared instructors, or where TTE programmes fail to align with the real-world demands of industries served by TE. Consequently, this error compromises the ability of TVET systems to effectively address skill mismatches, promote workforce readiness, and adapt to the demands of dynamic labour markets and technological advancements.

Literature Review/Theoretical Framework

As noted earlier, TVET plays a critical role in economic development and societal progress by equipping individuals with employable skills (Mitchell & Buntic, 2022; Ianos & Tebeanu, 2018). The global landscape of TVET is continuously evolving, driven by rapid technological advancements and changing labour market demands (Mitchell & Buntic, 2022; Riyanda et al., 2021). Understanding the distinct roles and interdependencies within TVET, particularly between TE and technical teacher TTE is fundamental for effective policy and programme development in this important area. According to Bünning and Schmidt (2017) and (Wafula et al., 2013), this delineation is essential for ensuring a competent workforce and quality educational provision. TVET is broadly recognised as an integral part of education systems aimed at preparing individuals for the world of work (Ianos & Tebeanu, 2018). International organisations like United Nations Educational, Scientific, and Cultural Organisation (UNESCO) and the World Bank (WB) provide foundational definitions and frameworks for TVET, emphasising its role in skill acquisition, productivity enhancement, and poverty reduction (Ianos & Tebeanu, 2018). UNESCO's TVET Strategy (2016-2021) underscores its orientation towards the world of work and the acquisition of employable skills (Ianos & Tebeanu, 2018). The

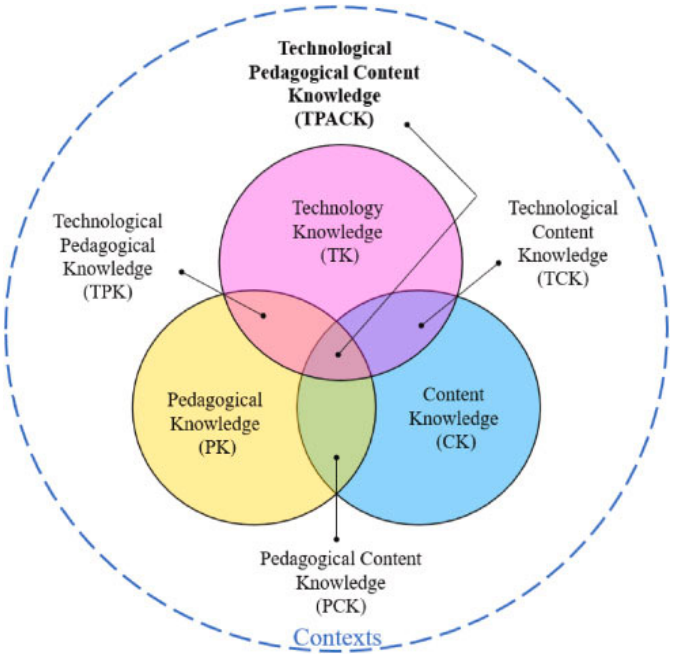
e-ISSN 2600-8572 | DOI: https://doi.org/10.11113/itlj.v10.209

Commonwealth Secretariat also emphasised TVET importance in equipping youth and adults with necessary skills for employment and entrepreneurship to achieve sustainable development (Secretariat, 2022). According to Chinedu et al (2023), this includes promoting a sustainability-literate professional who can make environmentally friendly, socially acceptable, and economically viable decisions.

Different countries and organizations may interpret and operationalise TVET slightly differently, leading to variations in its key components (Breugel, 2016). However, the core objective remains consistent as posited by Salleh and Sulaiman (2020) and (Wafula et al., 2013), which is to provide individuals with the technical and vocational skills required by various industries. According to Mitchell and Buntic (2022), this includes an emphasis on practical application and hands-on experience, distinguishing it from purely academic education. The shift towards a "new paradigm" in TVET further emphasises innovative learning and adaptation to evolving job markets, where some occupations diminish while new ones emerge (Riyanda et al., 2021).

The concept of dual competency in TVET teachers is paramount, reflecting the unique demands of vocational education. Dual-qualified teachers possess both profound industrial experience and sound pedagogical knowledge (Buraka et al., 2024). Buraka et al further observed that this duality enables them to effectively close the gap between theoretical instruction and practical application in real-world work environments. For instance, a TVET teacher needs to understand the specific skills and knowledge required in a particular vocational area (industry mastery) and simultaneously know how to effectively impart that knowledge and skill to students (pedagogical expertise) (Li, 2022). The development pathway for dual-qualified teachers is comprehensive and multi-faceted, encompassing academic education, industry experience, and teaching practice (Buraka et al., 2024). Challenges often arise in achieving this dual qualification, such as maintaining currency with industry practices and integrating practical experience into teaching methodologies (Buraka et al., 2024; Li, 2022). For instaance, in Ethiopia, the challenges include weak student admission criteria, irrelevant curriculum, theory-focused training, and limited resources, which hinder the preparation of competent TVET teachers (Kebede & Asgedom, 2024). In Malaysia, similar issues regarding insufficient competence among TVET teachers have been identified (Ismail et al., 2017). The Technological Pedagogical Content Knowledge (TPACK) model is highly relevant here, illustrating the integrated forms of knowledge required by effective educators (Schmid et al., 2024). TPACK posits that effective teaching with technology requires an understanding of how technology, pedagogy, and content intersect (Schmid et al., 2024) (see Figure 1).

Figure 1
TPACK Model (Schmid et al., 2024)



e-ISSN 2600-8572 | DOI: https://doi.org/10.11113/itlj.v10.209

This model in the words of Schmid et al (2024) shows that Technological Pedagogical Content Knowledge (TPCK) sits at the intersection of Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK). For TVET teachers, TK involves understanding various technologies relevant to their vocational field, PK encompasses teaching methods and learning theories, and CK represents subject-matter expertise in their specific trade (Schmid et al., 2024). The integration of these elements ensures that TVET teachers can not only perform technical tasks but also teach them effectively using appropriate technological and pedagogical approaches (Schmid et al., 2024; Legg-Jack & Ndebele, 2022). According to (Kovalchuk et al (2025) and Legg-Jack and Ndebele (2022), the increasing digitalisation of education further emphasises the need for teachers to possess strong digital competencies and integrate digital technologies into their training.

Global Models of TTE: An Overview of "Consecutive" (Industry-First) vs. "Concurrent" (Integrated) Teacher Training

Technical Teacher Education (TTE) programmes generally follow two main models which are i) concurrent and ii) consecutive (Yusuf, 2022; Dinçer & Bikmaz, 2020; (Poviliūnas, 2020; Zuzovsky & Donitsa-Schmidt, 2017). Zuzovsky and Donitsa-Schmidt (2017) stated that these models define the structure and sequencing of disciplinary studies (content knowledge) and pedagogical studies (teaching methods). In the concurrent model, disciplinary studies and pedagogical studies are integrated and taught simultaneously over the course of the training programme (Dinçer & Bikmaz, 2020; Zuzovsky & Donitsa-Schmidt, 2017). This means that aspiring TVET teachers pursue their subject-matter expertise (e.g., in engineering, electronics, or in any vocational area) alongside their pedagogical training from the outset (Dinçer & Bikmaz, 2020). For example, a student might spend four to five years at a training institution, learning both the technical subject and how to teach it (Dinçer & Bikmaz, 2020). This model is often supported by contemporary political power (Poviliūnas, 2020).

This approach allows for a continuous integration of theoretical knowledge with pedagogical application, potentially leading to a more holistic understanding of teaching within the specific vocational domain ((Dinçer & Bikmaz, 2020; Zuzovsky & Donitsa-Schmidt, 2017). It can promote a stronger teacher identity and an earlier focus on the teaching profession (Yusuf, 2022). The Concurrent Training and Reflection Model (CTRM) for in-service teachers, which integrates structured research methodology training with real-time classroom reflection, exemplifies how concurrent learning can enhance competencies (AL-Thani et al., 2025). Critics of this model argues that this might not allow for a deep enough immersion in either the subject matter (industry-specific area) or pedagogical theory compared to specialised, sequential training (Zuzovsky & Donitsa-Schmidt, 2017) However, other studies have shown that concurrent TTE programmes can be effective in developing teaching performance and professional attitudes, particularly in areas like research competencies (AL-Thani et al., 2025; Zuzovsky & Donitsa-Schmidt, 2017).

The consecutive model typically involves individuals first completing a degree in their subject-matter area (e.g., a bachelor's degree in engineering, technology, or a specific trade) and then pursuing pedagogical training in a separate programme, often a one-year certification programme (Dinçer & Bikmaz, 2020; Zuzovsky & Donitsa-Schmidt, 2017)). According to Dinçer and Bikmaz (2020), this model essentially follows an "industry-first" approach, which strictly requires that individuals acquire deep technical expertise (industry-specific knowledge) before transitioning into teaching the same technical area. This model often seems to attract professionals who have already gained significant practical experience in their respective industries, bringing valuable real-world understanding into the classroom (Zuzovsky & Donitsa-Schmidt, 201; Klee & Andar, 2016). It is particularly beneficial for TVET, where industry experience is highly valued for imparting practical skills and understanding current industry standards (Buraka et al., 2024; Klee & Andar, 2016). For instance, in Afghanistan, TVET teachers often lack work experience in the private or public sector, highlighting the need for mechanisms to gain such experience (Klee & Andar, 2016). A primary challenge of this model as observed by Kebede and Asgedom (2024) and Bullough and Gitlin, 1994), is that individuals from a professional background might lack formal pedagogical training, leading to difficulties in classroom management, curriculum design, and student assessment. In this regard, the pedagogical formation and certification programme aims to address this critical gap, but the short duration (e.g., one year as used by countries adopting it) may not fully equip them with comprehensive teaching skills (Dinçer & Bikmaz, 2020). Some research indicates that while consecutive programmes can prepare teachers well in subject content, they may be perceived as less effective in pedagogical aspects compared to concurrent models (Yusuf, 2022).

e-ISSN 2600-8572 | DOI: https://doi.org/10.11113/itlj.v10.209

Both the concurrent and consecutive models have their strengths and weaknesses in preparing TVET teachers. The choice between these models often depends on national educational policies, available resources, and the specific demands of the TVET sector (Wenyu et al., 2024; Porcher & Trampe, 2024). Germany which use the dual TE system, for example, faces a high demand for TVET teachers and has developed various initial TVET teacher education programmes to address this (Porcher & Trampe, 2024). Also, Sino-German cooperation in vocational teacher training illustrates the complexities of aligning different national approaches (Wenyu et al., 2024). Ultimately, the effectiveness of either model is significantly influenced by the quality of the curriculum, the resources available for practical training, and continuous professional development opportunities for TVET teachers (Ismail et al., 2017; Yunos et al., 2016; Wafula et al., 2013).

Objectives of the Study

The primary objective for this research is to provide a clear distinction between TE from TTE within the Global TVET Frameworks. Specifically, the study seeks:

1. To systematically analyse and compare the conceptualisations of TVET as defined by international organizations such as UNESCO, the World Bank, and the Commonwealth Secretariat, identifying commonalities and divergences in their emphasis on skill acquisition, economic development, and workforce preparedness.
2. To critically examine the theory of dual competency for TVET teachers, exploring the interplay between industry mastery and pedagogical expertise required for effective industry-specific instruction.
3. To provide a comparative overview of global models for TTE, specifically differentiating between "consecutive" (industry-first) and "concurrent" (integrated) teacher training approaches.
4. To delineate the distinct roles, objectives, pedagogical approaches, and competency requirements of TE versus TTE within the global TVET framework.

Methods

Research Design

This study adopts a qualitative comparative research (QCR) design, utilising thematic analysis as described by Bruan and Clarke (2006) as the primary analytical tool. This design was selected to move beyond a descriptive policy comparison and further allowing for a systematic exploration of the structural and philosophical variations between Technical Education (TE) and Technical Teacher Education (TTE) across divergent national contexts, specifically narrowing the focus on Nigeria and the United States. In line with the requirements for qualitative rigour of this nature, the study treats the various statutory documents used not merely as literature, but as primary data sources that reflect the authoritative mandates of the respective states (Yusuf, 2022).

Data Sources

The study employed purposive sampling to identify "information-rich" statutory documents from key regulatory bodies representing the two dominant global TVET models of teacher preparation which are i) the Concurrent Model and ii) the Consecutive Model. For the Concurrent Model, the Nigerian dataset was compiled from the National Directory of Accredited Programmes (NDAP) published by the National Board for Technical Education (NBTE, 2021), the Benchmark Minimum Academic Standards (BMAS) issued by the National Universities Commission (NUC), and the Professional Standards for Nigerian Teachers (PSNT) established by the Teachers Registration Council of Nigeria (TRCN), and the National Commission for Colleges of Education (NCCE). Representing the Consecutive Model, the United States dataset was sourced from the Texas Education Agency (TEA, n.d.) Administrative Code governing Career and Technical Education (CTE)and the relevant Occupational Requirement Frameworks published by the U.S. Bureau of Labour Statistics (BLS).

e-ISSN 2600-8572 | DOI: https://doi.org/10.11113/itlj.v10.209

Data Analysis and Coding Procedure

The study employed a rigorous six-phase recursive Thematic Analysis process established by Braun and Clarke (2006). The first phase involved Familiarisation and Data Cleaning, where the researchers performed an initial vertical reading of each statutory document to identify and isolate segments pertaining to curriculum structures, entry prerequisites, and certification requirements. During the second phase, Initial Coding (Open Coding), these raw data segments were assigned descriptive labels; for instance, phrases such as "2-5 years industry experience" within U.S. regulatory documents were coded as (Prior Trade Mastery), while mentions of "educational psychology" in Nigerian frameworks were coded as (Pedagogical Grounding). This was followed by Phase 3: Theme Construction, where related codes were collated into broader candidate themes, such as grouping the codes (Prior Trade Mastery) and (Practitioner License) under the emergent theme "The Industry-First Mandate." In Phase 4: Reviewing and Mapping, these preliminary themes were systematically cross-checked against the original dataset to validate their accuracy and ensure a clear conceptual distinction, evident in the text of the NBTE and TEA guidelines, and between themes like "Instructional Leadership" (characteristic of Technical Teacher Education) and "Technical Task Performance" (characteristic of Technical Education). The process culminated in Phase 5: Definition and Naming, wherein the themes were refined, clearly defined, and organised into the final analytical pillars for comparison: Curricular Content Pillars, Entry Thresholds, and Assessment Authenticity.

Analytical Framework

The study utilised a Comparative Matrix to maintain analytical focus and prevent the analysis from devolving into a general literature review as shown in Table 1. This structured framework ensured that all claims presented in the results were directly derived from the documentary evidence. The matrix was organised around three specific "Units of Analysis": Logical Goal (contrasting the stated purpose of the programme, i.e., job entry versus teacher certification), Prerequisite Focus (differentiating specific entry requirements, such as academic credits versus industry experience), and Assessment Mode (distinguishing the method for validating competency, such as practical trade tests versus teaching practice evaluations). To further enhance trustworthiness and qualitative credibility and mitigate the risk of a purely "descriptive policy comparison," the study implemented investigator triangulation. The three authors independently coded a defined subset of the documents to establish inter-coder agreement. Any discrepancies that arose during theme construction were then resolved through discussion and consensus. This systematic procedure ensures that the resulting findings are empirically grounded in the primary documentary data rather than being a product of subjective interpretation or a synthesis of existing literature.

Table 1

Comparative Matrix of Systemic Delineation (TE vs. TTE)

Analytical Pillar	Technical Education (TE)	Technical Teacher Education (TTE)	Data Attribution (Sources)
Primary Mandate	Workforce Readiness: Delivery of specific occupational skills for immediate job entry.	Instructional Capacity: Professionalising instructors and building pedagogical leadership.	Nigeria: NBTE (2021) USA: BLS (2025)
Curricular Focus	Psychomotor Mastery: Hands-on workshop practice and technical safety standards.	Vocational Pedagogy: Curriculum design, classroom management, and human learning theories.	Nigeria: NUC/BMAS USA: TEA Administrative Code
Entry Thresholds	Academic Readiness: Direct entry from secondary school based on credit completion.	Industry Mastery: Mandatory 2–5 years of full-time trade experience and licensure.	Nigeria: NCCE Standards USA: TEA Certification Rules
Practical Immersion	SIWES/Internship: Short-term industrial exposure during the academic session.	Teaching Practice (TP): Supervised classroom instruction and lesson efficacy evaluation.	Nigeria: TRCN (2023) USA: ACTE Standards
Assessment Mode	CBT / Performance: Authentic performance of	Reflective Evaluation: Instructional effectiveness and	Nigeria: NBTE /TRCN USA: TEA

	technical tasks via trade tests.	professional qualifying exams (PQE).	
Analytical Pillar	Technical Education (TE)	Technical Teacher Education (TTE)	Data Attribution (Sources)
Primary Mandate	Workforce Readiness: Delivery of specific occupational skills for immediate job entry.	Instructional Capacity: Professionalising instructors and building pedagogical leadership.	Nigeria: NBTE (2021) USA: BLS (2025)

Results

Comparative Analysis of TVET Conceptualisations Across International Organisations

Table 2 shows that all three organisations shift from "industrial-age" vocational training to "lifelong learning." UNESCO views TVET as a human right and a pillar for social justice, highlighting skills for "just transitions" into green and digital economies.

Table 2
Qualitative Synthesis of International TVET Conceptualisations

Organisation	Primary Emphasis	Key Strategic Pillar	Delineation of TE and TTE
UNESCO	Social Justice & Sustainability: TVET as a driver for inclusive, green, and digital transitions (UNESCO, 2022).	Human Rights: Ensuring equitable access to skills for "just transitions" in a changing global climate.	Focuses on the "Quality of Interaction" between learner and teacher as the system's core success factor.
World Bank	Economic Productivity: TVET as a tool for poverty reduction and global competitiveness (World Bank, n.d.).	Market Alignment: Reducing the "skills gap" by ensuring technical education meets the direct needs of the private sector.	Identifies TTE as the primary leverage point for system reform; without professional teachers, technical investment fails (Tanaka et al., 2023).
Commonwealth Secretariat	Youth Empowerment: Focusing on the high percentage of youth in member states and their transition to work.	Labour Mobility: Standardising qualifications and frameworks to allow skilled workers to move between Commonwealth nations.	Emphasises Instructional Capacity Building to ensure that certificates obtained in one region remain valid and high-quality in another.

The World Bank focuses on TVET's economic efficiency, seeing it as a tool for poverty reduction and productivity through market-driven skills. The Commonwealth Secretariat acts as a bridge, emphasising "youth empowerment" and standardising qualifications for labour mobility.

Interplay between Industry Mastery and Pedagogical Expertise in TVET Teaching

As shown in Table 3, the theory posits that effective industry-specific instruction is impossible without the simultaneous mastery of Tacit Industry Knowledge (the "tricks of the trade" gained through wage-earning experience) and Vocational Pedagogy (the science of transmitting that skill).

Table 3
Analysis of the Theory of Dual Competency

Dimension of Competency	Component: Industry Mastery (TE)	Component: Pedagogical Expertise (TTE)	Interplay for Effective Instruction
Source of Authority	Practical Experience: Derived from years of wage-earning work and industry	Educational Theory: Derived from Educator Preparation Programmes (EPP) and teaching	The teacher uses industry authority to provide "authentic" context to theoretical lessons.

	licensure (Texas Education Agency, n.d.).	practice (UNESCO-UNEVOC, n.d.).	
Knowledge Type	Tacit Knowledge: Non-codified skills, workplace safety culture, and "real-world" problem solving.	Explicit Knowledge: Codified instructional strategies, curriculum design, and assessment methods.	The teacher codifies their tacit industry experience into a structured curriculum for the learner.
Assessment Focus	Technical Proficiency: The ability to perform a task to industry standards (e.g., producing a perfect weld).	Instructional Efficacy: Ability to measure learner progress and manage classroom dynamics.	Effective instruction is achieved when technical tasks are assessed using pedagogical rubrics.
Risk of Imbalance	The "Craftsman" Teacher: May possess high skill but lacks the ability to differentiate instruction for diverse learners.	The "Academic" Teacher: May understand teaching methods but lacks the technical currency to keep up with industry shifts.	Dual Competency: Achieved when the instructor remains a "practitioner-educator" through regular industry calibration.

In the U.S, the theory is often implemented through a "sequential" approach, mastery first, and pedagogy second, ensuring that the instructor's technical currency is authentic. In Nigeria, the "concurrent" model attempts to build both simultaneously, though this often faces the challenge of ensuring students gain enough industrial depth during their academic training.

Comparative Analysis of Consecutive and Concurrent Technical Teacher Education Models

As shown in Table 4, the Consecutive Model is predicated on the "Trade-First" philosophy, where an individual is first socialised into an industrial profession, gaining years of wage-earning experience before receiving pedagogical training.

Table 4

Qualitative Comparison of Global TTE Models

Feature	Consecutive Model (e.g., USA)	Concurrent Model (e.g., Nigeria)
Philosophical Basis	Trade-First: Technical mastery is a prerequisite for teacher training.	Integrated: Technical and pedagogical training happen simultaneously.
Entry Requirement	Extensive industry experience (2–5 years) and trade licensure (Texas Education Agency, n.d.).	Academic credits (WAEC/NABTEB/NECO) directly from secondary school (NBTE, 2021).
Curricular Structure	Focuses almost exclusively on pedagogy, as the candidate is already a master of the trade.	A hybrid curriculum of trade workshop practice and education courses (NCE/B.Sc. Ed).
Industry Immersion	Pre-professional: Achieved through prior full-time employment in the sector.	Intra-curricular: Achieved through schemes like SIWES (Orikpe, 2013).
Primary Strength	High technical credibility and authentic "real-world" industrial perspective.	Faster throughput of qualified teachers; strong pedagogical grounding from the start.
Primary Weakness	Difficulty in recruiting high-earning industry experts into lower-paid teaching roles.	Graduating "teachers of theory" who may lack deep, practical industry mastery.

This ensures high technical currency but often faces challenges in pedagogical "re-tooling." Conversely, the Concurrent Model integrates trade skills and teacher education into a single tertiary programme. While this creates a high volume of teachers with strong educational theory, it often risks producing graduates with shallow industrial "tacit knowledge" due to limited exposure to real-world workshop environments.

e-ISSN 2600-8572 | DOI: https://doi.org/10.11113/itlj.v10.209

Comparative Analysis of Roles, Pedagogies, and Competency Requirements in Technical Education and Technical Teacher Education

The delineation as shown in Table 5 reveals that while TE is "product-oriented" (the product being a skilled technician or tradesperson), TTE is "process-oriented" (the process being the effective transmission of skills).

Table 5

Qualitative Delineation of TE versus TTE (U.S vs Nigeria)

Dimension	Technical Education (TE)	Technical Teacher Education (TTE)
Primary Role	Workforce Supplier: Producing skilled labour for specific industrial sectors (e.g., welders, nurses, carpenters, Masons, cooks etc.).	Instructional Engine: Producing the "teachers of teachers" and shop-floor instructors.
Core Objective	Occupational Mastery: Achieving high proficiency in trade-specific tasks and safety protocols.	Instructional Leadership: Developing the ability to design curricula, manage labs, and evaluate learning.
Pedagogical Approach	Competency-Based Training (CBT): Focus on "learning by doing" and repetitive practical drills (Riyanda et al., 2021).	Vocational Pedagogy (VP): Focus on "learning to teach," involving lesson efficacy and student management (Kebede & Asgedom, 2024).
Competency Requirement	Technical Proficiency: Mastery of tools, industry standards, and workshop safety.	Dual Competency: The unique intersection of industry mastery and pedagogical expertise (Tanaka et al., 2023).
Assessment Model	Performance-Based: Practical exams and trade tests (e.g., NABTEB or NOCTI).	Reflective Evaluation: Teaching practice supervision, lesson plan efficacy, and peer reviews.
Dimension	Technical Education (TE)	Technical Teacher Education (TTE)

Pedagogically, TE relies on instructional demonstration and workshop-based practice to achieve psychomotor mastery. In contrast, TTE employs reflective practice and meta-cognition, where the learner (the future teacher) must understand not just how to perform a task, but the cognitive and instructional design required to teach that task to others.

Discussions

The first objective aimed to analyse and compare the conceptualisations of TVET by international organisations. The findings reveal both commonalities and divergences in their approaches. UNESCO emphasises TVET as a human right and a cornerstone for social justice, particularly in facilitating "just transitions" to green and digital economies. In contrast, the World Bank (WB) prioritises economic efficiency, viewing TVET as a means for poverty reduction and increased productivity through market-driven skills. The Commonwealth Secretariat acts as an intermediary, focusing on "youth empowerment" and standardising qualifications to enhance labour mobility (Commonwealth Secretariat, 2022). Despite these distinct primary emphases, a significant commonality across all three organisations is their collective shift from an "industrial-age" vocational training paradigm to one centred on "lifelong learning" (Riyanda et al., 2021).

The second objective critically examined the theory of dual competency for TVET teachers, exploring the interplay between industry mastery and pedagogical expertise. The analysis shows that effective industry-specific instruction necessitates the simultaneous acquisition of Tacit Industry Knowledge, which encompasses the practical "tricks of the trade" gained through real-world experience, and Vocational Pedagogy (VP), which is the science of effectively transmitting those skills (Li, 2025; Ianos & Tebeanu, 2018). The study further illustrates this theory through national implementations where in the U.S., a "sequential" approach is often adopted, prioritising industry mastery before pedagogical training to ensure authentic technical currency. Conversely, Nigeria typically employs a "concurrent" model, attempting to develop both competencies simultaneously, though this approach frequently faces challenges in ensuring students gain sufficient industrial depth during their academic training (Kebede & Asgedom, 2024; Teferi & Gu, 2024).

e-ISSN 2600-8572 | DOI: https://doi.org/10.11113/itlj.v10.209

The third objective provided a comparative overview of global models for TTE, specifically differentiating between "consecutive" (industry-first) and "concurrent" (integrated) teacher training approaches. The Consecutive Model as used in the U.S, based on a "Trade-First" philosophy, requires individuals to gain substantial wage-earning experience in an industrial profession before undertaking pedagogical training. According to Bünnin and Schmidt (2017), while this model ensures high technical currency, it often presents challenges in the pedagogical "re-tooling" of experienced professionals. In contrast, the Concurrent Model used in Nigeria, integrates both trade skills and teacher education into a single post-secondary education programme. This approach, as observed by Ismail et al (2017) and Wafula et al. (2013) is effective in producing a high volume of teachers with strong educational theory but risks yielding graduates with shallow industrial "tacit knowledge" due to limited exposure to authentic real-world workshop environments.

Finally, the fourth objective delineated the distinct roles, objectives, pedagogical approaches, and competency requirements of TE versus TTE. The discussion clearly establishes that TE is fundamentally "product-oriented," with the ultimate product being a skilled technician or tradesperson. TTE, however, is "process-oriented," focusing on the effective transmission of skills (Mitchell & Buntic, 2022; Salleh & Sulaiman, 2020). Pedagogically, TE primarily relies on instructional demonstration and hands-on workshop-based practice to achieve psychomotor mastery in learners. TTE, on the other hand, employs reflective practice and meta-cognition, requiring future teachers to not only understand how to perform a task but also to grasp the cognitive and instructional design principles necessary to effectively teach that task to others (Schmid et al., 2024; Chinedu et al., 2023). This distinction emphasised that the quality of TE outcomes is directly constrained by the quality of TTE, further showing the critical importance of robust teacher education in the overall global TVET system.

Conclusion

This study systematically distinguished Technical Education (TE) from Technical Teacher Education (TTE), showing their fundamental differences despite intrinsic links. TE focuses on direct industry-specific skill acquisition for workforce entry, while TTE cultivates pedagogical and leadership capabilities for teachers in industry-specific skill contexts. This distinction is important for developing coherent policies, as the quality of TE outcomes is directly constrained by TTE quality. The "interdependence paradox" reveals that unbalanced investment in one without corresponding investment in the other yields suboptimal results. Moving beyond simplistic conflation is essential for enhancing the quality and relevance of TVET systems globally, necessitating clear policies that address the unique demands of each field.

Limitations and Future Studies

The main limitation is the geographic scope, focusing on the U.S. and Nigeria. While they represent the "consecutive" and "concurrent" models, these two countries don't capture the full diversity of global TVET systems, like Germany's "dual system" or East Asia's centralised models. The study relies on qualitative analysis of documents and frameworks. Thus, findings reflect how systems are designed on paper and not how they work in practice in workshops and classrooms. Also, rapid technological disruption, especially AI integration, means some technical competency requirements may change faster than policy documentation can update. This paper recommends critical areas for future TVET research. First, empirical impact assessments are needed; researchers should conduct quantitative studies on teacher training models and student employment rates. Scholars should also explore digital pedagogy integration in TTE curricula amid the sector's "Digital Transformation." Research should focus on competencies for teaching in Virtual Reality (VR) laboratory and automated environments. From a policy perspective, an economic analysis of the wage gap is suggested to identify barriers preventing industry experts from joining TTE. This research should assess the effectiveness of incentives like industry-funded teaching chairs or tax credits for transitioning master practitioners. Lastly, a cross-regional comparison in Africa, especially between Anglophone and Francophone TVET in West Africa, would provide more light on colonial legacies affecting TE and TTE within these regions currently.

e-ISSN 2600-8572 | DOI: https://doi.org/10.11113/itlj.v10.209

Conflict of Interest

The authors of this study declare that there is no conflict of interest regarding the publication of this work.

Acknowledgement

The authors acknowledge the statutory documents and policy frameworks from NBTE, NUC, TRCN, NCCE, TEA, and the U.S. Bureau of Labor Statistics that informed the analysis in this study.

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