The Overtone of Digitalization: Integrating Digital Tools in the Teaching and Learning Process within the Technical and Vocational Education and Training (TVET) Sector in Mauritius

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ABSTRACT

The Technical and Vocational Education and Training (TVET) sector in Mauritius is undergoing a transformative shift driven by the integration of digital tools into teaching and learning. Using a qualitative conceptual synthesis approach, the study draws on global and local evidence to examine how digital tools reshape teaching and learning in Mauritian TVET. This study employs the metaphor of "overtone" to conceptualize how digitalization enriches and amplifies pedagogical practice, institutional culture, and societal outcomes within TVET. Drawing on global literature, African regional perspectives, Mauritian policy documents, and local institutional case studies (Polytechnics Mauritius and MITD), this article synthesizes evidence to identify both opportunities and challenges in digital transformation. The findings indicate that digital tools enhance learner engagement, flexibility, inclusivity, and alignment with industry requirements, while persistent barriers exist in infrastructure, teacher digital competence, and sustainability. The study contributes to academic discourse by offering a framework for inclusive, resilient, and industry-responsive digital TVET in Mauritius, with implications for policy, practice, and future research (Adams & Brown, 2021; Choy & Dell, 2020; Euler, 2013).

Keywords: TVET, Mauritius, digital tools, pedagogy, overtone, vocational training, ICT in education

INTRODUCTION

Technical and Vocational Education and Training (TVET) is pivotal to national development, equipping learners with practical skills aligned to labor market needs (Ministry of Education, 2022). In Mauritius, TVET contributes significantly to workforce readiness in an increasingly digital and globalized economy. Traditionally, vocational education relied heavily on face-to-face demonstrations, hands-on workshops, and physical apprenticeships. However, the integration of digital tools—ranging from learning management systems (LMS) to virtual and augmented reality (VR/AR) simulations—has begun to reshape pedagogical approaches and institutional practices (Radianti, Majchrzak, Fromm, & Wohlgenannt, 2020). This transformation can be understood through the metaphor of "overtone." In music, overtones enrich the fundamental note, creating resonance and depth. Analogously, digitalization introduces pedagogical, institutional, and societal overtones, amplifying learning experiences, fostering inclusivity, and promoting innovation (Laurillard, 2013). Mauritius, committed to digital development under its Vision 2030 and aligned with Sustainable Development Goal 4, views ICT integration in TVET as a key strategy for national competitiveness and human capital development (World Bank, 2022). The purpose of this paper is to explore the overtone of digitalization in Mauritian TVET, critically examining the benefits, challenges, and implications of digital tool adoption. By combining conceptual analysis with local and international case studies, the article provides a framework to guide future research and policy, bridging theory with practical implementation strategies.

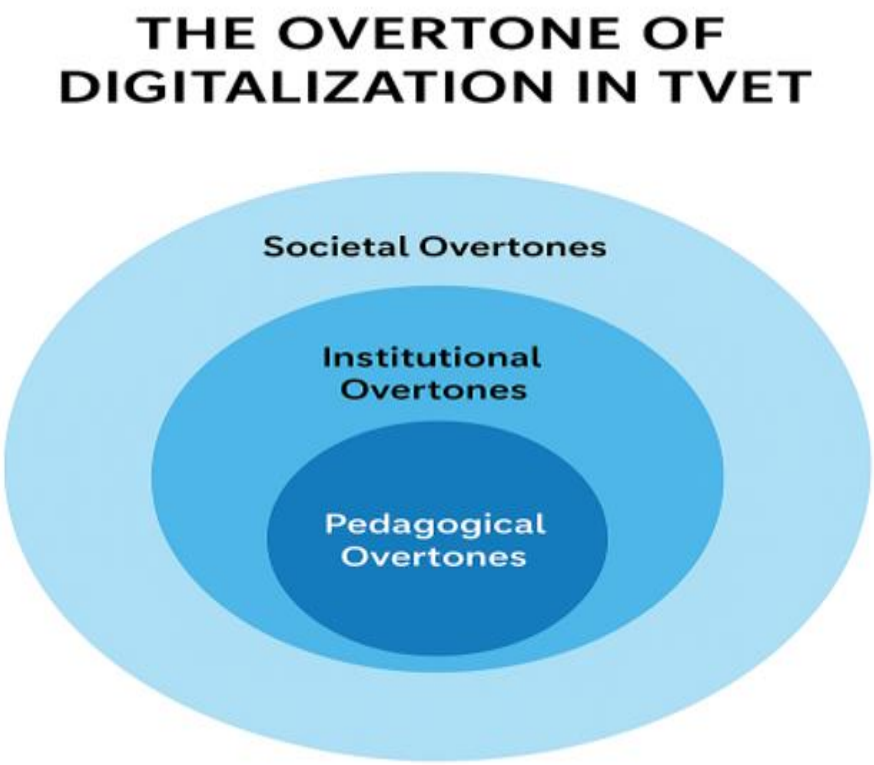

Figure 1 - The Overtone Framework of Digitalization in TVET Conceptual Diagram

LITERATURE REVIEW

Digitalization in TVET has been explored globally and regionally, revealing significant trends, frameworks, and implications for teaching and learning. Worldwide, TVET systems are rapidly adopting digital tools to meet Industry 4.0 demands. Germany's dual vocational system integrates online simulations with workplace learning, providing flexible pathways for apprentices and emphasizing competency-based assessments (Euler, 2013). Singapore's Institute of Technical Education (ITE) employs VR and industry partnerships to bridge classroom learning and real-world application, ensuring high employability outcomes for graduates (Choy & Dell, 2020). Digitalization enhances engagement, supports flexible learning, and aligns skill development with modern industry needs (UNESCO-UNEVOC, 2021). Regional examples in Africa, including Rwanda and Kenya, have demonstrated the potential of digital tools to improve access, reduce geographic disparities, and develop essential digital skills, although challenges related to infrastructure and teacher readiness remain (World Bank, 2022; UNESCO, 2023).

The theoretical frameworks underpinning digital learning are diverse. The SAMR model (Puentedura, 2013) provides a roadmap from simple substitution of traditional methods to transformative uses of technology that redefine learning tasks. Constructivist learning theory (Vygotsky, 1978) emphasizes active knowledge construction through engagement with digital platforms, simulations, and collaborative tools. Connectivism (Siemens, 2005) positions learners as nodes in a digital knowledge network, highlighting the importance of peer-to-peer and expert connections. Activity Theory (Engeström, 1987) offers insights into how learner interactions with tools, peers, and institutions shape outcomes, while the Diffusion of Innovation theory (Rogers, 2003) explains the adoption trajectory of educational technologies within institutions. These frameworks collectively provide the foundation for understanding how digital tools can generate pedagogical overtones that extend beyond classroom instruction (Laurillard, 2013).

The concept of overtone in pedagogy captures the ripple effects of digital innovation. Digital tools influence teaching culture, learner motivation, institutional identity, and engagement with the broader community. Studies indicate that when effectively integrated, digitalization enhances collaborative learning, problem-solving, and critical thinking (Adams & Brown, 2021). Mauritius has prioritized ICT as a driver of socio-economic growth, with the Education and Human Resources Strategy Plan (2022–2030) advocating for increased digital adoption

in TVET and the broader education system (Ministry of Education, 2022). COVID-19 further accelerated e-learning adoption, demonstrating the necessity of resilient digital infrastructure and trained educators (Tan & Lee, 2020).

METHODOLOGY

This study employs a qualitative conceptual synthesis approach, drawing upon multiple secondary sources to develop a comprehensive understanding of digitalization in Mauritian TVET. Peer-reviewed journal articles, policy documents, institutional reports, and regional studies were systematically reviewed. Inclusion criteria focused on studies conducted between 2010 and 2023, relevance to digital tool integration, and applicability to TVET contexts. Exclusion criteria included articles lacking empirical or conceptual rigor, or those not addressing digital pedagogy or technology-enhanced learning. The selected data were analyzed thematically, with coding applied to identify patterns, trends, challenges, and opportunities in the adoption of digital tools (Khan & Gupta, 2019). Themes were grouped under pedagogical, institutional, and societal dimensions to reflect the overtone framework. Triangulation of global, regional, and local case studies enhanced the validity of insights (Radianti et al., 2020). While primary data collection was not undertaken, this approach provides a rigorous foundation for conceptual development and informs the design of future empirical studies, including mixed-method and longitudinal research. A conceptual synthesis was selected due to the evolving nature of digital adoption in TVET, allowing integration of diverse theoretical and empirical insights.

Digital Tools in Mauritian TVET

Mauritian TVET institutions utilise a variety of digital tools. Learning Management Systems such as Moodle and Google Classroom centralize course materials, assessments, and communication, enabling blended learning and providing flexible access to resources (Ministry of Education, 2022). Simulation software offers safe, cost-effective environments for skill practice, reducing material use and risk in technical training (Tan & Lee, 2020). VR and AR applications enhance experiential learning in healthcare, automotive, and hospitality courses, improving retention and learner confidence (Radianti et al., 2020). Digital collaboration platforms like Zoom, Microsoft Teams, and Google Meet facilitate interactive projects, group discussions, and digital communication skills development (Adams & Brown, 2021). Emerging AI-based tools, gamified modules, and digital twins personalize learning experiences and simulate complex technical processes, although high costs and infrastructure limitations constrain widespread adoption (Khan & Gupta, 2019). These tools collectively contribute to a richer, more interactive learning environment, consistent with the overtone framework.

The Overtone of Digitalization

The overtone of digitalization in TVET encompasses pedagogical, institutional, and societal dimensions, illustrating how technological interventions resonate beyond immediate learning outcomes to influence broader educational and economic landscapes. Pedagogically, digital tools facilitate a shift from teacher-centered instruction to learner-centered approaches, enabling inquiry-based, collaborative, and experiential learning (Laurillard, 2013). For example, VR and simulation technologies provide immersive, hands-on experiences, while LMS platforms support self-paced and interactive learning, enhancing engagement and knowledge retention. Additionally, digital tools allow educators to track learner progress in real time, tailor instruction to individual needs, and foster critical thinking, problem-solving, and digital literacy skills essential for the 21st-century workforce (Adams & Brown, 2021; Tan & Lee, 2020).

Institutionally, digitalization creates overtones that extend to curriculum design, organizational culture, and administrative processes. Incorporating technology into TVET programs requires rethinking traditional curricula, integrating digital competencies alongside technical skills, and adapting assessment strategies to accommodate new modes of learning (Choy & Dell, 2020). Institutional overtones also include investment in infrastructure, professional development for faculty, and the creation of a culture that embraces innovation and continuous improvement. Furthermore, digital tools enable better data collection, performance tracking, and decision-making at the administrative level, leading to more efficient and responsive educational systems.

Societal and economic overtones arise as digitalization enhances the employability of graduates, aligns skills with global industry trends, and contributes to national economic development. Digital TVET programs equip learners with competencies relevant to Industry 4.0, such as automation, digital collaboration, and technical problem-solving, increasing their competitiveness in the labor market (UNESCO-UNEVOC, 2021; World Bank, 2022). Socially, digitalization promotes inclusivity by offering flexible learning opportunities to students in remote or underserved areas and providing alternative pathways for adult learners or those with disabilities (UNESCO, 2023). Moreover, it encourages collaboration between educational institutions, industry partners, and government agencies, fostering innovation ecosystems that extend beyond classrooms and workshops.

The overtone framework thus emphasizes the interrelated impacts of digital tool adoption across multiple levels of the TVET ecosystem. Pedagogical, institutional, and societal benefits reinforce one another, creating a synergistic effect that amplifies the value of digital interventions. Recognizing these overtones allows policymakers, educators, and stakeholders to design holistic digital strategies that not only enhance teaching and learning but also strengthen institutional resilience and contribute to national development goals (Euler, 2013; Laurillard, 2013). In essence, digitalization acts as a catalyst for systemic transformation, generating ripple effects that influence pedagogy, institutional practices, workforce readiness, and social equity in Mauritius and beyond.

This section provided a detailed analysis of pedagogical, institutional, and societal impacts, highlighting the ripple effects and systemic benefits of digital tool adoption in TVET.

Challenges in Mauritius

Despite the benefits, several challenges impede digital adoption in Mauritian TVET. Infrastructure disparities, particularly in rural areas, limit equitable access to digital platforms (Ministry of Education, 2022). Teacher capacity remains a significant barrier; instructors with strong technical skills often lack training in digital pedagogy, resulting in inconsistent integration and occasional resistance (Adams & Brown, 2021). Socio-economic inequalities, gender gaps, and limited access to devices exacerbate the digital divide (UNESCO, 2023). Policy implementation is constrained by fragmented oversight, inadequate funding, and limited evaluation mechanisms, affecting sustainability. Additionally, high costs associated with VR, AR, AI, and simulation software pose significant challenges for scaling and maintenance (Tan & Lee, 2020).

Findings & Case Studies

The analysis of case studies reveals the overtone of digitalization operating at multiple levels within TVET Polytechnics Mauritius has implemented a comprehensive digital integration strategy, incorporating the Learning Management Systems (LMS) Classe 365 to facilitate blended learning. The institution has observed increased student engagement, particularly in theoretical modules delivered online, allowing learners to access content at their own pace and participate in discussion forums and collaborative projects (Ministry of Education, 2022). However, variations in digital literacy among students have resulted in inconsistent learning outcomes, necessitating targeted digital skills workshops and mentorship programs. Additionally, faculty members have received periodic training in LMS utilization and e-pedagogy, though some instructors remain hesitant to fully adopt digital methods due to familiarity with traditional teaching approaches.

The Mauritius Institute of Training and Development (MITD) piloted a virtual reality (VR) program for automotive and mechanical training. This initiative involved immersive VR simulations that replicate real-world workshop scenarios, allowing students to practice complex tasks such as engine diagnostics, assembly, and safety protocols without the risks associated with physical equipment (Radianti, Majchrzak, Fromm, & Wohlgenannt, 2020). Preliminary evaluations indicate improvements in learner retention, confidence, and skill acquisition. However, the pilot faced challenges including high initial investment costs, technical maintenance, and limited availability of VR-compatible hardware. MITD has explored partnerships with private technology providers to mitigate these issues and enhance scalability. The case highlights the critical balance between technological sophistication and practical feasibility within resource-constrained environments.

Singapore's Institute of Technical Education (ITE) provides a benchmark for successful large-scale digital integration in TVET. ITE combines VR, AR, simulation software, and AI-driven personalized learning platforms to support competency-based education (Choy & Dell, 2020). Sustained investment in teacher professional development ensures instructors are adept at leveraging digital tools, while close industry partnerships align curriculum with evolving workplace requirements. ITE's model emphasizes continuous evaluation, feedback loops, and iterative improvement, resulting in high graduate employability and alignment with Industry 4.0 standards. Lessons for Mauritius include the importance of embedding digital pedagogy in institutional culture, ensuring ongoing support for instructors and learners, and developing robust partnerships with industry to maintain relevance and sustainability. While Mauritius is progressing steadily, comparative insights from Singapore highlight the potential of sustained investment and policy alignment in achieving full-scale transformation

Collectively, these case studies illustrate the potential and challenges of digital tool adoption in TVET. They highlight the need for strategic planning, adequate resource allocation, and continuous monitoring to maximize the pedagogical, institutional, and societal benefits of digitalization. Furthermore, they underscore the importance of context-sensitive implementation, as solutions effective in one setting may require adaptation to local technological, cultural, and economic conditions (Tan & Lee, 2020).

This diagram visualizes the major categories of digital tools—LMS, VR/AR, simulations, and AI—and their pedagogical uses.

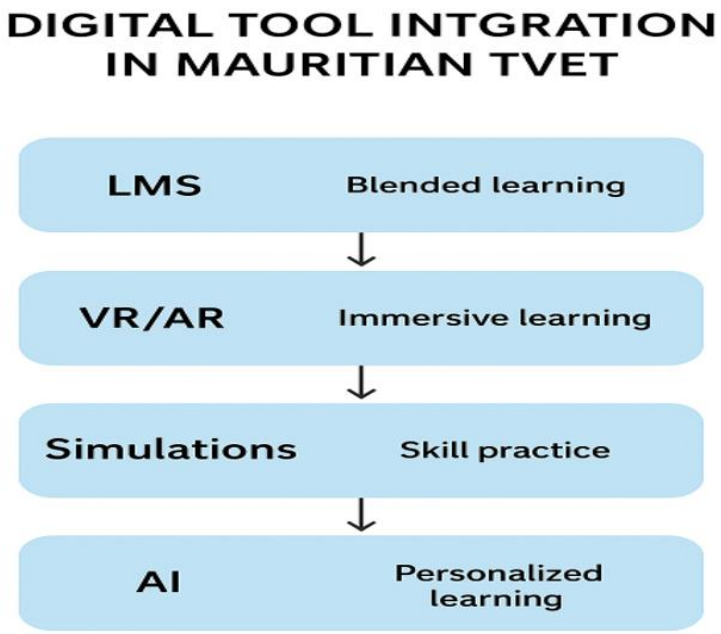

Figure 2 Digital Tool Integration in Mauritian TVET

Table 1: Comparative Overview of Case Studies

Institution	Digital Tools Used	Key Outcomes	Challenges
Polytechnics Mauritius	LMS, Google Classroom	Improved engagement, flexible learning	Digital literacy gaps
MITD	Virtual Reality (VR)	Enhanced retention, hands-on experience	High costs, maintenance issues
ITE Singapore	VR, AI, simulations	High employability, strong industry link	Requires sustained funding

Policy Implications and Recommendations

Effective policy responses should focus on expanding digital infrastructure, ensuring nationwide broadband access and device availability for disadvantaged learners (World Bank, 2022). Professional development programs are essential for continuous instructor training in digital pedagogy (Adams & Brown, 2021). Public-private partnerships can align training with evolving workplace requirements and technological trends (Khan & Gupta, 2019). Equity and inclusivity measures should target rural students, women, and socio-economically disadvantaged groups (UNESCO, 2023). Monitoring and evaluation frameworks are necessary to assess the effectiveness, sustainability, and impact of digital initiatives (Puentedura, 2013). Strategic planning should integrate digitalization within long-term national and institutional TVET strategies (Ministry of Education, 2022).

LIMITATIONS AND FUTURE DIRECTIONS

While this study provides a robust conceptual framework for understanding the digital transformation of TVET in Mauritius, it is constrained by its reliance on a qualitative conceptual synthesis approach. Although this methodology is valuable for theoretical framing and integrative analysis, it does not involve primary data collection such as interviews or surveys with TVET instructors, learners, or administrators. Consequently, the conclusions drawn about persistent obstacles—particularly teacher digital competency, infrastructural limitations, and institutional readiness—remain generalized and macro-level. They provide a strategic overview rather than detailed, ground-level insights necessary for immediate institutional reform.

Future research should aim to empirically and quantitatively validate the proposed "Overtone Framework." Surveys, focus groups, and longitudinal studies involving TVET educators and students could capture the lived realities of digital adoption and its pedagogical impact. Furthermore, this framework should be translated into actionable policy blueprints for the Mauritian Ministry of Education, focusing on targeted infrastructure investment and a nationwide digital upskilling program for TVET faculty. Beyond Mauritius, researchers are encouraged to explore how the framework can be adapted to other island or small-state economies within the African region, promoting regional digital transformation and resilience across comparable TVET ecosystems.

CONCLUSION AND FUTURE RESEARCH

Digitalization in Mauritian TVET represents a transformative journey, generating pedagogical, institutional, and societal overtones that enhance learning, foster innovation, and improve employability (Laurillard, 2013; Siemens, 2005). By introducing the overtone metaphor, this study contributes a novel conceptual lens for understanding the multidimensional impact of digitalization in vocational education. While infrastructure, teacher readiness, and policy coherence present challenges, the benefits of strategic digital integration are substantial. Investments in digital tools, professional development, and industry collaboration can position Mauritius as a regional leader in TVET innovation (UNESCO-UNEVOC, 2021). Future research should adopt mixed-method and longitudinal designs to evaluate learning outcomes, institutional performance, and socio-economic impacts, ensuring that digital transformation is both sustainable and inclusive (Tan & Lee, 2020).

As Mauritius advances toward a knowledge-based economy, digitalized TVET can serve as a cornerstone for lifelong learning, innovation, and sustainable employment. The overtone of digitalization thus extends beyond classrooms, resonating through institutions, industries, and communities.

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