

## BRIDGING THE DIGITAL DIVIDE: ENHANCING WORKFORCE READINESS THROUGH TECHNOLOGY INTEGRATION IN KENYAN TVET INSTITUTIONS

Author

Caroline Wamando Irungu 

Author's Email: [karolyngoro@gmail.com](mailto:karolyngoro@gmail.com)

Dedan Kimathi University of Technology, Kenya.

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### Abstract

The purpose of this paper is to investigate the extent to which digital technologies enhance workforce readiness at Nyandarua National Polytechnic, using the Technological Pedagogical Content Knowledge (TPACK) framework as a theoretical lens. The population of the study included trainees, trainers, administrators and ICT staff at Nyandarua National Polytechnic. A total sample of 384 respondents from this population was determined using Fisher's formula. The study adopted a descriptive survey design. Sampling was done through a stratified random sampling method to select trainees and trainers across departments. Purposive sampling was used to target ICT staff and council members due to their specialised roles. Data was collected through structured questionnaires, interview guides and document analysis. Quantitative data were analysed using SPSS, while qualitative responses were thematically coded. Findings reveal that 28.8 per cent of trainers integrate digital technology in teaching, constrained by infrastructural limitations, uneven departmental adoption, and gaps in trainer competence, particularly in digital pedagogy and industry exposure. Gender disparities in digital engagement persist, though signs of narrowing are evident. There is limited involvement of industry stakeholders in shaping digital curricula. Recommendations include targeted investment in digital infrastructure, mandatory digital pedagogy training for trainers, curriculum reform to embed digital literacy, and strengthened industry-academic partnerships. The findings suggest the urgent need for deliberate and well-structured interventions that meet institutional needs. Additionally, it contributes to policy discourse on inclusive digital transformation in TVET and its strategic role in preparing learners for a technology-driven workforce.

**Key terms:** Digital technology, education leadership, industry collaboration, trainer development, workforce readiness.

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## 1.0 INTRODUCTION

This paper investigates the extent to which digital technologies enhance workforce readiness among trainees at Nyandarua National Polytechnic. It also contributes to the broader policy discourse on inclusive digital transformation in Technical and Vocational Education and Training (TVET), and its strategic role in preparing learners for a technology-driven workforce.

Digital technology refers to the use of electronic tools, resources, and devices, such as Learning Management Systems (LMS), Virtual Reality (VR), and Augmented Reality (AR) to process and store data, and to support the delivery of educational content. These technologies do not operate in isolation; they are closely linked to education leadership. Effective leadership plays a vital role in setting the vision, policies, and strategies for digital integration, fostering a culture of innovation, and ensuring relevance in training delivery – all of which contribute to workforce readiness.

Another critical dimension is industry collaboration. Partnerships between training institutions and industry are essential for aligning curricula with market needs and offering apprenticeship programmes that provide learners with practical experience. These collaborations also facilitate feedback loops that help institutions remain responsive to labour market demands.

Trainer capacity is equally central to this discussion. Continuous professional development, digital literacy, and exposure to emerging pedagogical methods are crucial for sustaining effective technology integration. Without these, trainers may struggle to deliver content that meets the evolving expectations of employers.

These contexts underscore the need to examine the gaps and opportunities in digital technology adoption at Nyandarua National Polytechnic, with a view to assessing the readiness of learners for employment in a digitally driven economy.

Globally, education is recognised as a fundamental human right and a cornerstone of sustainable development. According to the World Bank, education contributes to poverty eradication, gender equality, improved health outcomes, and social stability. These principles are echoed in the United Nations Sustainable Development Goal 4, which advocates for inclusive and equitable quality education for all by 2030 (UNESCO, 2023).

In Kenya, significant progress has been made in expanding access to primary and secondary education. However, challenges persist in aligning educational outcomes with labour market needs. The introduction of the Competency-Based Curriculum (CBC) in 2017 marked a strategic shift towards practical skills development. Central to this reform is the prioritisation of TVET, which aims to equip learners with industry-relevant skills and foster youth employability.

TVET institutions are increasingly recognised as engines of economic growth, particularly in addressing youth unemployment, which stands at approximately 67 per cent (Federation of Kenya Employers [FKE], 2023). Countries such as Germany, Singapore, and Finland have demonstrated the effectiveness of TVET through strong industry collaboration, government support, and digital innovation. In Kenya, the government has invested in expanding TVET infrastructure, offering financial support through scholarships,

and aligning curricula with industry needs. The establishment of the Technical and Vocational Education and Training Authority (TVETA) under the TVET Act of 2019 further underscores the commitment to quality and relevance in vocational education.

Despite these efforts, a persistent mismatch remains between the skills acquired in TVET institutions and those demanded by the job market. This gap is exacerbated by limited digital infrastructure, inadequate trainer capacity, and insufficient integration of technology into teaching and learning. Kibuku et al. (2020) highlight barriers such as outdated ICT laboratories, low internet access in rural institutions, limited electrification, and quality issues.

In light of these challenges, this study examines the influence of digital technology on workforce readiness at Nyandarua National Polytechnic. Specifically, it explores three core areas: the relevance of training resources to workplace requirements; the qualifications and digital preparedness of trainers; and the extent of digital technology integration in teaching and learning. By identifying gaps and opportunities in these domains, the study aims to propose actionable strategies to align TVET training with evolving industry demands and contribute to inclusive, technology-driven educational reform.

## 2.0 LITERATURE REVIEW

### Theoretical Framework: TPACK in TVET Contexts

The Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra & Koehler (2006), offers a comprehensive lens for understanding the integration of digital technology in education. It posits that effective teaching in the digital age requires the intersection of three core domains: content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). In the context of Technical and Vocational Education and Training (TVET), this framework is particularly relevant, as vocational education demands not only mastery of technical content but also the ability to deliver it through hands-on, digitally mediated instruction.

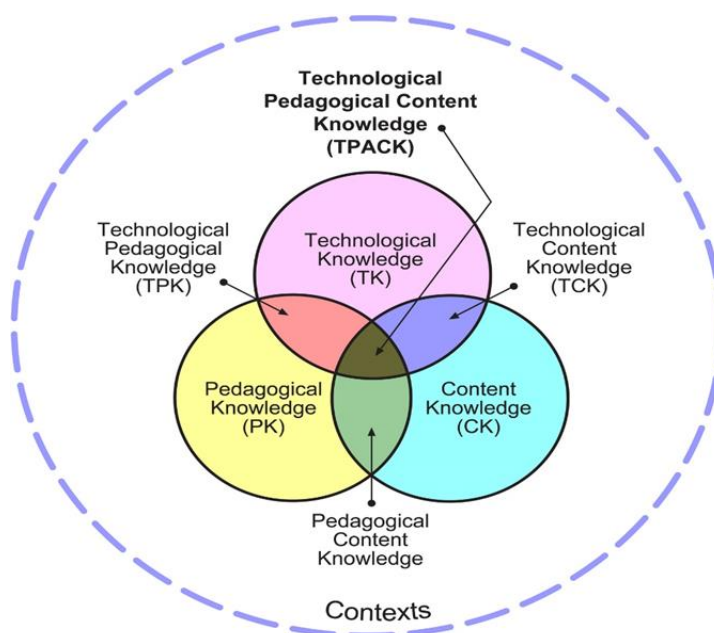


Figure 1: The TPACK Framework and its Knowledge Components (Mishra & Koehler, 2006)

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Koehler and Mishra (2009) emphasised that TPACK is not merely about knowing how to use technology, but understanding how it interacts with pedagogy and content to enhance learning outcomes. In TVET institutions, this means trainers must be equipped to use simulation software, virtual labs, and e-learning platforms in ways that reinforce practical competencies. However, studies in sub-Saharan Africa suggest that many trainers lack the integrated knowledge required to apply TPACK effectively, often due to limited exposure to digital tools and insufficient professional development (Waihura et al., 2019). Waihura et al. (2019)'s survey of urban Kenyan institutions revealed significant gaps in trainers' technological knowledge, though it did not explore rural contexts or long-term implementation challenges, underscoring the need for further research on trainer readiness and pedagogical integration.

## Global Perspectives on Digital TVET Transformation

Globally, the integration of digital technologies into TVET has been accelerated by the demands of the Fourth Industrial Revolution (4IR), which necessitates a workforce proficient in digital, cognitive, and interpersonal skills. Countries such as Germany, Singapore, and Finland have pioneered digital transformation in vocational education through strategic investments and policy reforms.

Germany's dual-system model blends classroom instruction with industry-based training, supported by digital platforms and simulation tools (Deissinger, 2015). Deissinger's qualitative analysis revealed strong alignment between policy and practice, though scalability remains a challenge in decentralised systems. Singapore's Skills Future initiative leverages smart classrooms, AI-driven adaptive learning, and national learning management systems to personalise vocational training and promote lifelong learning (Yen Lee et al., 2023). Yen Lee et al. (2023) conducted a mixed-methods study combining policy analysis with stakeholder interviews, demonstrating the effectiveness of digital tools in enhancing learner autonomy.

In Finland, digitalisation in TVET is underpinned by a competency-based curriculum and strong collaboration between educational institutions and industry. The use of virtual reality (VR), augmented reality (AR), and gamified learning environments has enhanced student engagement and skill acquisition, particularly in engineering and healthcare. However, these innovations are supported by robust infrastructure and sustained funding, conditions that may not be replicable in lower-income contexts.

These international models demonstrate that successful digital integration in TVET requires more than infrastructure, it demands coherent policy frameworks, industry partnerships, and continuous capacity building for educators. Yet, few studies have examined how such frameworks can be adapted to resource-constrained environments, particularly in sub-Saharan Africa.

## Regional Trends in Africa

Across Africa, the digitalisation of TVET is gaining momentum, albeit unevenly. The African Union's Continental Strategy for TVET (2020–2030) advocates for the adoption of digital learning platforms, online certification, and mobile-based training to bridge skill gaps and improve accessibility (African Union, 2021). Countries such as Rwanda and South Africa have made notable progress, with Rwanda's Vision 2050 emphasising ICT integration in education and South Africa's White Paper on Post-School Education promoting digital transformation in vocational institutions.

In Nigeria, partnerships between TVET institutions and industry have facilitated the development of digital curricula and online training modules. Aman (2023), using a case study approach, identified barriers such

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as limited internet penetration and low digital literacy among trainers and students. This paper makes a contribution by attempting to address some of the contextual challenges identified in Aman's study. These challenges must be addressed to ensure equitable access to digital TVET.

Kenya has taken proactive steps through the National Education Sector Plan (NESP) and Vision 2030, which prioritise ICT integration in education. The introduction of the Competency-Based Education and Training (CBET) framework has further catalysed digital adoption by promoting learner-centred and industry-driven approaches. However, despite these reforms, a persistent mismatch remains between the skills acquired in TVET institutions and those demanded by the job market. The Federation of Kenya Employers (FKE, 2023) reported that many graduates lack job-relevant competencies, particularly in emerging sectors such as ICT, manufacturing, and construction. This mismatch is exacerbated by outdated curricula, limited industry involvement, and insufficient digital infrastructure in rural regions.

## Digital Pedagogies in TVET

Digital pedagogies such as blended learning, flipped classrooms, and game-based instruction are increasingly being adopted in TVET institutions to enhance engagement and learning outcomes. Blended learning combines face-to-face instruction with online resources, offering flexibility and promoting self-paced learning. Hashim and Hamidon (2022), through a quasi-experimental study, found that blended learning improves retention and performance in technical subjects by allowing students to revisit complex concepts through digital modules. However, their research focused on urban polytechnics and did not address scalability or trainer preparedness in rural settings.

The flipped classroom model, where learners engage with theoretical content before attending practical sessions, has gained traction in vocational education. Cevikbas and Argun (2017) conducted a longitudinal study in Turkish vocational schools and argued that this approach enables trainers to focus on skill development and personalised guidance during class time. Schmidt and Ralph (2016), using a comparative analysis, further highlighted that flipped classrooms foster critical thinking and collaborative learning, essential competencies in modern workplaces.

Despite the pedagogical benefits, the adoption of these models in Kenya remains limited due to infrastructural constraints and resistance to change. Many trainers are unfamiliar with digital teaching strategies and lack access to the necessary tools and platforms. This contributes to the broader issue of skills mismatch, as graduates are not adequately prepared for technology-driven work environments.

## Trainer Competence and Industry Engagement

Trainer competence is a cornerstone of effective TVET delivery. In countries with robust vocational systems, trainers undergo extensive pedagogical and industry-based training to ensure alignment with labour market demands. In Kenya, however, studies reveal that many trainers possess academic qualifications but lack practical experience and digital teaching skills (Kipchirchir & Ng'eno, 2024). Their survey-based study found that while trainers were confident in subject matter delivery, few had received formal training in digital pedagogy or industry collaboration.

Professional development programmes are often sporadic and poorly funded, limiting trainers' exposure to emerging technologies and instructional innovations. This gap affects the quality of training and contributes directly to the skills mismatch between graduates and industry expectations. Mirieri (2018)

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emphasised the importance of linking TVET to market demands through continuous trainer upskilling and curriculum reform. However, Mirieri's study relied on self-reported data, which may not fully capture institutional constraints or regional disparities.

Industry engagement is equally critical. In successful models, employers play an active role in curriculum development, assessment, and training delivery. In Kenya, industry collaboration is often limited to internship placements, with minimal involvement in shaping digital curricula. Strengthening these partnerships can enhance the relevance of training programmes and ensure that students acquire competencies that are immediately applicable in professional settings. As noted by Vera Technical (2023), the lack of alignment between TVET curricula and industry needs continues to hinder graduate employability, particularly in high-demand sectors such as ICT and manufacturing.

## Equity and Inclusion in Digital TVET

Equity and inclusion are essential considerations in the digital transformation of TVET. While gender disparities remain a prominent challenge, particularly in rural areas, other dimensions of exclusion also shape access to digital learning. Shaouf (2018), through a mixed-methods study, noted that women often face barriers related to confidence, cultural norms, and limited exposure to digital tools, which affect their participation in technology-driven education.

In Kenya, rural students frequently encounter infrastructural limitations such as unreliable electricity, poor internet connectivity, and a lack of access to digital devices, which hinder their participation in online and blended learning environments. According to the Kenya Institute of Curriculum Development (KICD, 2022), urban TVET institutions are more likely to benefit from ICT investments and digital innovation pilots, while rural centres lag behind due to budgetary constraints and logistical challenges.

Students with disabilities also face systemic barriers in accessing digital TVET. A study by the National Gender and Equality Commission (NGEC, 2021) found that most vocational institutions lack assistive technologies and inclusive digital platforms, limiting participation for learners with visual, auditory, or mobility impairments. This exclusion is compounded by a lack of trained personnel and inclusive pedagogical strategies.

Income disparities further exacerbate digital exclusion. Learners from low-income households often struggle to afford devices, data bundles, or transport to centres with digital infrastructure. The Ministry of Education (2023) reported that while digital learning initiatives have expanded, affordability remains a major barrier to equitable access, particularly in marginalised communities.

Inclusive strategies such as mentorship programmes, gender-sensitive digital literacy training, subsidised device provision, and universal design principles can help bridge these gaps. Ensuring that all students, regardless of gender, geographic location, disability status, or socioeconomic background, have equal access to digital resources is vital for fostering a fair and equitable education system. However, few studies have evaluated the long-term impact of these interventions or their scalability in low-resource settings, particularly within the Kenyan TVET context, highlighting a critical area for future research.

## 3.0 METHODOLOGY

This study employed a descriptive survey design to investigate the influence of digital technology on workforce readiness at Nyandarua National Polytechnic. The design was chosen for its suitability in capturing perceptions, attitudes, and experiences of respondents regarding digital integration in TVET. The target population comprised 2,053 trainees, 53 trainers, 2 ICT technicians, 2 Heads of Department, 2 Deputy Principals (D.P. Academics and D.P. Finance), 1 Principal and 1 member of the governing council. Stratified random sampling was used to select trainees and trainers from various departments, ensuring representation across disciplines. Purposive sampling was employed for administrators, ICT technicians, and council members due to their specialised roles relevant to this study. The sample size for trainees was calculated using Fisher's formula at a 95 per cent confidence level, yielding 384 respondents, out of which 309 were returned, yielding a response rate of 80.46 per cent, which is considered robust for in-person surveys (Fowler, 2018).

### Fisher's Formula for Trainees

$$n = z^2 pq / d^2$$

Where n=minimum sample size to maximise precision of estimate

z=the standard normal deviate (1.96) which corresponds to 95 per cent confidence level

p= proportion of trainees with defined characteristics under study at NYNP

q=1-p d=degree of accuracy, 0.05

$$n = (1.96)^2 (.50) (.50) / (.050)^2$$

$$n = 384$$

Data collection instruments included structured questionnaires administered to trainees, trainers, and ICT staff. Interview guides targeted Heads of Departments, Deputy Principals, Principal and Council Members. Quantitative data were analysed using SPSS to generate descriptive statistics such as means, frequencies, and standard deviations, while qualitative data were thematically coded to identify patterns related to digital integration, trainer qualifications and resource adequacy. Ethical considerations were strictly observed by seeking informed consent from participants, ensuring voluntary participation, and maintaining confidentiality. Data use was restricted to academic purposes.

## 4.0 FINDINGS AND DISCUSSION

This section presents the findings from the survey conducted at Nyandarua National Polytechnic. The results are organised according to the study's three core objectives: relevance of training resources, trainer qualifications, and digital technology integration. Quantitative data are summarised using descriptive statistics, while qualitative insights are woven into the interpretation.

### Response Rate and Reliability

Out of 384 questionnaires administered, 309 were returned, yielding a response rate of 80.46 per cent. This is considered high for institutional surveys and supports the generalisability of the findings (Fowler, 2018).

**Table 1: Reliability Statistics**

Statistic	Value
Cronbach's Alpha	0.816
Number of Items	49

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A Cronbach's Alpha of 0.816 indicates strong internal consistency of the research instrument, validating the reliability of the data collected.

## Objective 1: Relevance of Training Resources

Respondents were asked to rate the relevance and adequacy of training resources in relation to workplace demands.

**Table 2: Relevance of Training Resources**

Statement	Mean	Agreement %	Std. Dev
Relevance of Training Resources	3.62	57.93%	1.12
Regular Update of Learning Resources	3.41	51.46%	1.22
Adequacy of Modern Equipment	3.01	35.28%	1.23
Sufficiency of Digital Materials	2.94	38.51%	1.31
Opportunities for Industry Interaction	3.20	43.37%	1.20

The highest-rated item was the general relevance of training resources (Mean = 3.62), suggesting that the curriculum broadly aligns with workplace expectations. This finding is consistent with the claims made in the literature that content knowledge (CK) is sufficiently addressed within the TPACK framework. However, the adequacy of modern equipment (Mean = 3.01) and sufficiency of digital materials (Mean = 2.94) were rated significantly lower, resonating with the concerns highlighted by Waihura et al. (2019), noting most TVET institutions grapple with the challenge of limited access to modern technologies.

Qualitative feedback from interviews revealed that students often rely on outdated technologies and lack access to simulation software, limiting their ability to practise industry-relevant skills, thus reinforcing the literature's emphasis on the evident mismatch between the skills acquired by trainees and market demands (FKE, 2023; Khakina, 2024). Trainers noted that while theoretical content is regularly updated, practical resources lag behind due to budgetary constraints, thus limiting trainees' readiness for the job market.

## Objective 2: Trainer Qualifications

Trainer competence was assessed across five dimensions: academic qualifications, practical experience, professional development, digital integration, and impact on employability.

**Table 3: Trainer Qualifications**

Statement	Mean	Agreement %
Academic Qualifications	3.41	51.5%
Practical Experience	3.19	41.8%
Professional Development Participation	2.93	32.1%
Digital Integration Skills	2.80	28.8%
Impact on Employability	3.40	51.5%

Academic qualifications were deemed sufficient (Mean = 3.41), which closely aligned with the literature. Practical experience and digital integration skills, on the other hand, were notably weaker, with only 28.8 per cent of the respondents agreeing to effectively use digital tools in teaching. The findings support the

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evidence from Kipchirchir and Ng'eno (2024), who noted that trainers often lack industry exposure and digital teaching capabilities, reflecting a gap in the technological knowledge (TK) aspect of the TPACK framework.

Additionally, professional development participation also rated low (Mean = 2.93). Interviews with Heads of Department revealed that many trainers have limited exposure to industry settings and rarely participate in structured professional development. These findings confirm the claims stated by Mirieri (2018) on TVET institutions having underfunded upskilling programs. This disconnect affects their ability to deliver competency-based training that mirrors real-world scenarios.

### Objective 3: Digital Technology Integration

This objective explored the extent to which digital tools are used in teaching and their perceived impact on learning outcomes and workforce readiness.

**Table 4: Digital Technology Integration**

Statement	Mean	Agreement %
Use of Digital Tools in Teaching	3.15	37.5%
Trainer Utilisation of E-learning Platforms	3.05	36.2%
Adequacy of Digital Resources	2.95	34.3%
Internet Connectivity	2.87	33.0%
Enhancement of Student Engagement	3.28	46.3%
Improvement in Workforce Readiness	3.38	49.5%

The results indicate moderate integration of digital technology, which aligns with systemic challenges consistent with the literature. Student engagement and workforce readiness received relatively positive ratings. However, infrastructure-related items such as internet connectivity and adequacy of digital resources scored below 3.0, which reflects on the report from the Ministry of Education (2023) and KICD (2022) stating that rural institutions face significant barriers to technological adoption, which corresponds to respondents' reports on frustrations with unstable internet and limited access to digital tools.

The findings also underscore the value of digital tools to enhance the learning process, as seen with the positive ratings on student engagement (Mean = 3.28) and workforce readiness (3.38). This aligns with Hashim and Hamidon (2022), who found that blended learning improves retention and performance. However, it also reveals a critical point of contrast where global initiatives such as SkillsFuture in Singapore demonstrate advanced levels of digital technology integration, yet TVET institutions in Kenya remain constrained with limited and outdated infrastructure and capacity limitations among trainers.

Qualitative responses highlighted frequent disruptions, particularly among students in rural areas, due to unstable internet connectivity and limited access to digital tools. Students expressed frustration with inconsistent access to online modules, while trainers cited a lack of training in digital platforms as a barrier to adoption. These findings support Shaouf's (2018) and NGEC's (2021) findings on digital exclusion and reinforce the need for inclusive strategies to ensure equitable access to digital technologies in TVET.

## Discussion

This study explored the extent to which digital technologies influence workforce readiness at Nyandarua National Polytechnic, focusing on three key dimensions: the relevance of training resources, trainer qualifications, and the level of digital technology integration.

The findings reveal a moderate level of digital adoption, with notable gaps in infrastructure, trainer preparedness, and industry engagement. These results are consistent with broader literature on TVET transformation in developing contexts (Waihura et al., 2019; Kipchirchir & Ng'eno, 2024) and underscore the urgent need for strategic interventions.

## Training Resources and Workforce Alignment

The study found that training resources were generally perceived as relevant to workplace demands (Mean = 3.62), yet the adequacy of modern equipment and digital materials was rated significantly lower. This reflects a common challenge in Kenya, where TVET institutions often focus on including relevant content in their curricula with little regard to the provision of modern equipment (Waihura et al., 2019). As opposed to our counterparts in developed countries such as Germany and Finland, Kenyan TVET institutions are yet to fully embrace digital technologies in teaching and learning since such innovations rely on sustained investment.

The lack of modern equipment and simulation tools limits students' ability to develop hands-on competencies, which are essential for employability, often arising from a mismatch between curriculum relevance and training resources. This mirrors the report from the Federation of Kenya Employers (2023) stating that graduates lack job-ready skills. It also reinforces that Musyimi (2021) emphasises that the provision of modern teaching and learning equipment is a key driver of industrial growth in Kenya. Without access to contemporary tools, students risk graduating with theoretical knowledge that does not translate into workplace readiness.

Moreover, the limited opportunities for industry interaction (Mean = 3.20) further exacerbate the disconnect between training and employment. Industry collaboration is vital for contextualising learning, offering real-world exposure, and ensuring that graduates possess the skills required by employers. Mirieri (2018) advocates for stronger linkages between TVET institutions and industry to bridge this gap and enhance curriculum relevance.

## Trainer Qualifications and Digital Pedagogy

Trainer competence emerged as a mixed area, with academic qualifications rated positively (Mean= 3.41), but practical experience and digital integration skills receiving lower scores. This reflects a common challenge in many African TVET systems, where trainers are academically qualified but lack exposure to industry practices and digital teaching methodologies (Kipchirchir & Ng'eno, 2024).

The low score for professional development participation (Mean = 2.93) suggests that trainers are not regularly engaged in upskilling activities. This is problematic in a rapidly evolving digital landscape, where continuous learning is essential. Waihura et al. (2019) highlight that limited administrative support and resistance to change hinder the adoption of modern teaching practices in Kenyan TVET institutions.

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The TPACK framework (Mishra & Koehler, 2006) provides a useful lens for interpreting these findings. Effective digital teaching requires the integration of technological, pedagogical, and content knowledge. In this study, trainers demonstrated strength in content knowledge but lacked the technological and pedagogical components necessary for delivering digitally enhanced instruction. This imbalance undermines the potential of digital tools to improve learning outcomes and workforce readiness.

Furthermore, the low score for professional development (Mean = 2.93) highlights another challenge where TVET trainers in Kenya often have limited opportunities for professional development since such programs are sporadic and underfunded. This finding supports Mirieri's (2018) observation stating that the lack of support in upskilling trainers' competencies undermines TVET's skill-based training.

## **Digital Technology Integration and Infrastructure Constraints**

Digital technology integration was rated moderately (Mean = 3.15), with student engagement and perceived impact on workforce readiness receiving relatively higher scores (Means = 3.28 and 3.38, respectively). These findings suggest that digital tools have the potential to enhance learning and critical thinking (Schmidt & Ralph, 2016; Hashim & Hamidon, 2022).

However, internet connectivity (Mean = 2.87) and adequacy of digital resources (Mean = 2.95) were among the lowest-rated items, reflecting systemic barriers to digital transformation, which is consistent with the reports from UNESCO (2023) and KICD (2022) on institutions, particularly those in rural areas, facing persistent issues in connectivity and resource mobilisation. Without reliable internet and access to digital platforms, students and trainers cannot fully participate in technology-enhanced education.

The disparity in digital adoption across departments, particularly between engineering and hospitality, further illustrates the uneven nature of digital integration. Engineering and ICT departments benefit from simulation tools and virtual labs, while hospitality and tourism lag behind due to the service-oriented nature of their training. Yet, as Yen Lee et al. (2023) point out, digital tools such as smart hotel management systems and virtual reality simulations are increasingly relevant in the hospitality industry. This calls for sector-specific digital strategies that reflect the unique needs of each discipline.

## **Gender Dynamics and Inclusive Digital Education**

The study also highlighted a narrowing gender gap in digital engagement, with female students increasingly participating in technology-enhanced learning. However, disparities remain in terms of confidence, proficiency, and access to advanced digital tools. Shaouf (2018) argues that gender differences influence digital adoption, often due to cultural norms, limited digital exposure, and unequal access to resources.

Inclusive digital education requires targeted interventions such as mentorship programmes, gender-sensitive digital literacy training, and policy safeguards. Ensuring that all students, regardless of gender, have equal opportunities to engage with digital tools is essential for fostering equity and enhancing workforce readiness. This aligns with the African Union's Continental Strategy for TVET (2021), which emphasises inclusive access to digital learning across the continent.

Similarly, NGEC (2021) noted that students with disabilities remain excluded mostly due to the lack of assistive technologies in most TVET institutions. Income disparities are also another factor that affects the

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affordability of digital devices and data affordability (Ministry of Education, 2023). Addressing these barriers would, therefore, require subsidised cost of devices, and impactful mentorship, yet few studies have researched their scalability in the long-term.

This highlights a significant research gap in assessing equity-centred digital adoption strategies in TVET institutions within low-resource areas.

## **Leadership, Policy, and Industry Collaboration**

The limited involvement of industry stakeholders in shaping digital curricula (6.1% representation in the study) reflects a broader challenge in aligning TVET with market demands. This agrees with Vera Technical's (2023) critique that a mismatch between curriculum and industry undermines graduate employability. As Mirieri (2018) also notes, industry engagement is critical for curriculum relevance, practical training, and job placement.

Institutional leadership plays a pivotal role in driving digital transformation. Visionary leadership can mobilise resources, foster innovation, and create a culture of continuous improvement. The adoption of digital pedagogies, investment in infrastructure, and promotion of professional development must be championed by institutional leaders who understand the strategic importance of technology in education.

At the policy level, frameworks such as Kenya's Vision 2030, the National Education Sector Plan (NESP) and Competency-Based Education and Training (CBET) provide a foundation for digital integration. However, implementation requires coordinated efforts across government agencies, educational institutions, and industry partners. Funding, capacity building, and monitoring mechanisms must be strengthened to ensure that digital transformation translates into improved learning outcomes and workforce readiness.

## **5.0 CONCLUSION AND RECOMMENDATIONS**

**Conclusion:** This study set out to examine the influence of digital technology on workforce readiness at Nyandarua National Polytechnic, focusing on the relevance of training resources, trainer qualifications, and the extent of digital integration in teaching and learning. The findings reveal a mixed landscape: while there is moderate alignment between training programmes and workplace demands, significant gaps persist in infrastructure, trainer preparedness, and industry collaboration.

Training resources were generally perceived as relevant, yet the adequacy of modern equipment and digital materials remains insufficient. This limits students' ability to acquire practical, hands-on experience that mirrors real-world scenarios. Without access to up-to-date tools and simulation technologies, learners risk graduating with theoretical knowledge that does not translate into employable skills.

Trainer qualifications were found to be academically sound, but lacking in practical industry exposure and digital teaching competencies. The low participation in professional development programmes and the limited use of digital pedagogies suggest that trainers are not fully equipped to deliver technology-enhanced instruction. This undermines the effectiveness of TVET in preparing students for a digitally driven workforce.

Digital technology integration, while recognised for its potential to enhance engagement and learning outcomes, is hindered by poor internet connectivity, outdated infrastructure, and inconsistent access to

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digital platforms. These challenges are compounded by departmental disparities and gender-related barriers, which affect the inclusivity and reach of digital learning.

The study concludes that digital transformation in TVET is not merely a technological upgrade but a strategic imperative. To prepare learners for the demands of the 21<sup>st</sup> century workforce, institutions must invest in infrastructure, empower trainers, and forge stronger ties with industry stakeholders. Nyandarua National Polytechnic, like many TVET institutions in Kenya, stands at a crossroads: with the right interventions, it can become a model for technology-driven vocational education that fosters employability, innovation, and economic growth.

Recommendations: To enhance digital integration and workforce readiness in TVET institutions, a multi-level strategy is required, one that addresses infrastructure, pedagogy, policy, and partnerships. The following recommendations are organised into four thematic areas:

## **Institutional Infrastructure and Resource Development**

To strengthen digital adoption in TVET, institutions should invest in high-speed internet connectivity, smart classrooms, and modern training equipment to support blended learning and simulation-based instruction. This includes ensuring reliable access to e-learning platforms and digital content repositories across all departments. In addition, it is important to adopt sector-specific digital tools by equipping departments such as hospitality and tourism with industry-relevant digital technologies (e.g., virtual reality for service training, smart hotel management systems) to ensure equitable digital adoption across disciplines. Finally, institutions should create digital resource centres as dedicated spaces where students and trainers can access digital tools, receive technical support, and engage in self-paced learning.

## **Trainer Capacity Building and Pedagogical Innovation**

Institutions should implement mandatory digital pedagogy training through structured professional development programmes focused on digital teaching strategies, including the use of learning management systems, virtual labs, and flipped classroom models. They should also promote continuous professional development (CPD) by encouraging trainers to participate in regular upskilling initiatives, including industry attachments, certification courses, and peer-led workshops. CPD should be embedded into institutional performance frameworks and supported by leadership. In addition, it is important to recognise and reward trainers who adopt innovative digital practices through awards, research grants, and career advancement opportunities. This fosters a culture of experimentation and continuous improvement.

## **Curriculum Reform and Student Empowerment**

TVET institutions should integrate digital literacy into all programs by embedding digital competencies such as data handling, online collaboration, and digital ethics into every TVET curriculum to ensure students are prepared for technology-driven workplaces. They should also promote blended and flexible learning models by expanding the use of blended learning to offer students greater flexibility, allowing them to engage with content both in-person and online. This supports diverse learning styles and improves retention. In addition, institutions should support inclusive digital access by implementing gender-sensitive digital literacy programmes and providing targeted support for students from marginalised backgrounds to ensure equitable participation in digital learning.

## Policy, Leadership, and Industry Collaboration

To advance digital technology integration in TVET, institutions should establish strong industry partnerships by establishing formal frameworks for collaboration with industry stakeholders, including co-development of digital curricula, joint training programmes, and internship placements that integrate digital skills. Institutions should also mobilise government and donor support by advocating for increased public investment in TVET digitalisation through national education budgets and donor-funded initiatives. Funding should prioritise infrastructure, content development, and capacity building. Additionally, they should promote leadership for digital transformation by empowering institutional leaders to champion digital integration by providing strategic training in change management, digital strategy, and stakeholder engagement. Leadership must be proactive in setting a vision for technology-enhanced education. Lastly, institutions should establish monitoring and evaluation mechanisms by developing tools to assess the effectiveness of digital integration efforts, including student outcomes, trainer performance, and infrastructure utilisation. Data-driven decision-making will ensure continuous improvement and accountability.

By implementing these recommendations, TVET institutions can accelerate their digital transformation journey, improve the quality and relevance of vocational training, and better prepare graduates for the demands of a dynamic, technology-driven labour market. These actions will also contribute to national development goals and position TVET as a strategic pillar in Kenya's economic growth agenda.

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