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ASSESSING OPPORTUNITIES AND CHALLENGES OF THE INTEGRATION OF DIGITAL TECHNOLOGIES IN VOCATIONAL AND TECHNICAL EDUCATION

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ABSTRACT

This study examines the opportunities and challenges associated with integrating digital technologies into Vocational and Technical Education (VTE), with a particular focus on stakeholder perspectives in Nigeria. Adopting a survey research design, data were collected from 60 respondents comprising technical teachers and Ministry of Education staff in Adamawa State. Findings reveal that, digital technologies—such as virtual simulations, online learning platforms, and artificial intelligence—significantly enhance VTE by improving access to learning resources, enabling flexible and remote learning, supporting personalized instruction, and strengthening industry alignment. Both respondent groups strongly agreed on these benefits, with no statistically significant difference in their perceptions. Despite these advantages, the study identified major challenges hindering effective integration, including inadequate infrastructure, high implementation costs, limited digital literacy, and resistance to change. These barriers were similarly acknowledged by both teachers and policymakers. Teacher preparedness emerged as a critical factor influencing successful adoption, as it enhances confidence, reduces resistance, and improves instructional delivery and student outcomes. The study further highlights key strategies for optimizing digital integration, including investment in infrastructure, continuous teacher training, development of industry-relevant digital content, adoption of blended learning approaches, and strengthened institutional and policy support. The findings underscore the importance of collaborative efforts between educators and policymakers in achieving sustainable digital transformation in VTE.

Keywords: Digital technologies, Vocational and Technical Education, Teacher preparedness, Digital integration, Educational challenges

Introduction

Digital technologies in Vocational and Technical Education (VTE) refer to a range of modern tools, systems, and applications that facilitate teaching, learning, and skill development. These technologies include computer-based learning platforms, virtual simulations, artificial intelligence (AI), augmented reality (AR), virtual reality (VR), mobile learning applications, and internet-based educational resources (UNESCO, 2021). The integration of these technologies enables students to acquire hands-on technical skills in a digitalized, interactive, and industry-relevant manner**.**

In the 21st century, the rapid integration of digital technologies has transformed various sectors, including education. Vocational and Technical Education serves as a critical component in equipping students with practical skills and technical expertise essential for workforce readiness (UNESCO, 2020). Digital technologies such as virtual reality, online learning platforms, and simulation software have the potential to revolutionize VTE by enhancing accessibility, fostering creativity, and improving learning outcomes (Zhao et al., 2022). According to Kumar and Sharma (2022)**,** digital technologies in VTE help bridge the gap between theoretical knowledge and practical application by providing learners with real-world simulations and remote training opportunities**.** Similarly**,** McCarthy (2020) highlights that, digital tools in VTE enhance students' engagement and skill mastery, preparing them for the demands of modern industries. However, despite these promising advancements, the integration of digital technologies in VTE faces significant challenges, including limited resources, inadequate teacher preparedness, and infrastructural deficits, especially in developing countries (Adigun & Salawu, 2021).

Opportunities Presented by Digital Technologies in Enhancing VTE

The adoption of digital technologies in Vocational and Technical Education (VTE) presents several transformative opportunities for enhancing learning outcomes, improving accessibility, and aligning training with industry needs. These opportunities include:

Enhanced practical learning through simulation and virtual reality: Digital technologies such as Virtual Reality (VR), Augmented Reality (AR), and simulation software provide immersive, hands-on training experiences without the risks associated with real-world applications (Aguayo et al., 2020). For example, VR welding simulators allow students to practice welding techniques in a safe environment before handling real tools (Zhao et al., 2022).

It increased accessibility and flexibility: That is online learning platforms and mobile applications enables students to access vocational training regardless of their location, reducing geographical barriers (World Bank, 2022). Learners can also engage in self-paced and blended learning models, which accommodate diverse learning needs (Eze et al., 2020).

Industry Alignment and Workforce Readiness. That is digital tools ensure that VTE programs remain industry-relevant by incorporating automation, artificial intelligence (AI), and smart manufacturing processes into training curricula (Frey and Osborne, (2019). Frey and Osborne, (2019) found that industry partnerships with VTE institutions allow students to work with real-world digital tools used in various sectors.

Cost Efficiency in Training Delivery: The use of e-learning and cloud-based platforms reduces the need for expensive physical infrastructure, making VTE more affordable (Okoye & Eze, 2021). Digital simulations minimize material wastage, lowering operational costs for training institutions (Pinto et al., 2022).

Challenges Hindering the Effective Integration of Digital Technologies in VTE

The followings are some of the challenges that hinder the successful integration of digital technologies in VTE:

Infrastructure and Connectivity Issues. Many VTE institutions, especially in developing countries, lack adequate digital infrastructure, such as stable internet, modern computers, and smart classrooms (UNESCO, 2021). Electricity shortages and high costs of ICT equipment further limit digital adoption in vocational education (Okoye & Eze, 2021).

High Costs of Implementation and Maintenance: Acquiring and maintaining VR/AR tools, IoT-enabled devices, and AI-powered learning platforms is expensive (World Bank, 2022). Many institutions struggle to secure funding for digital transformation, especially in low-income regions (McCarthy, 2020). Digital Literacy Gaps among Teachers and Students: Many VTE instructors lack adequate training in digital tools, leading to resistance or ineffective technology use in teaching (Adigun & Salawu, 2021). Students from underprivileged backgrounds may also lack basic digital literacy skills**,** limiting their ability to engage with e-learning platforms (Eze et al., 2020).

Resistance to Change and Cultural Barriers: Some educators and institutions prefer traditional teaching methods over digital approaches due to fear of change or lack of familiarity (Aguayo et al., 2020). In some cultures, vocational training is still perceived as a "hands-on" discipline, making it difficult to accept fully digital-based training models (Hamari et al., 2019).

How Teacher Preparedness Influences the Adoption of Digital Tools in VTE

The level of teacher preparedness significantly affects the successful adoption of digital technologies in VTE.

Role of Teachers as Digital Facilitators: Teachers are the primary drivers of digital integration; their ability to use and implement digital tools effectively determines how well students engage with these technologies (Goodyear, 2022). Professional

development programs focused on digital literacy help instructors confidently integrate technology into their teaching (UNESCO, 2022).

Impact of Training and Professional Development: Regular ICT training for VTE teachers is essential for ensuring they can utilize e-learning platforms, VR tools, and AI-powered assessments (Kumar & Sharma, 2022). Studies show that institutions that invest in teacher digital training experience higher student engagement and learning outcomes (Dumford & Miller, 2020).

Teacher Attitudes Toward Technology Adoption: Teachers with a positive mind-set toward digital transformation are more likely to explore innovative teaching methods using technology (Pinto et al., 2022). Resistance to adopting digital tools is often due to lack of confidence or fear of job displacement, requiring institutional support and continuous training (Okoye & Eze, 2021).

Institutional Support for Teachers: Schools that provide adequate resources, incentives, and mentorship programs for teachers improve the adoption of digital tools (Frey & Osbon, 2019). Encouraging teachers to co-develop digital curricula fosters ownership and motivation to integrate new technologies (Hamari et al., 2019).

Strategies to Optimize the Use of Digital Technologies in VTE

To maximize the benefits of digital technologies in vocational and technical education, institutions must implement structured strategies for effective adoption.

Investment in Digital Infrastructure: Governments and educational institutions must prioritize affordable internet access, smart classrooms, and modern ICT equipment (UNESCO, 2021). Public-private partnerships can help fund digital transformation initiatives in VTE institutions (World Bank, 2022).

Continuous Teacher Training and Capacity Building: Regular digital literacy workshops should be conducted to equip VTE instructors with the necessary skills (McCarthy, 2020). Certification programs in educational technology can incentivize teachers to engage with digital tools (Frey & Osborne, 2019).

Development of Locally Relevant Digital Content: Digital learning materials should be customized to reflect local industry demands and cultural contexts (Okoye & Eze, 2021). Institutions should therefore collaborate with local businesses and industry experts to develop skill-based digital content.

Adoption of Blended Learning Models: A hybrid approach combining digital and hands-on learning ensures that students gain both technical knowledge and practical skills (Eze et al., 2020). Using gamification elements, simulations, and AI-driven adaptive learning enhances student engagement (Hamari et al., 2019). Strengthening Policy Frameworks and Funding: Governments should create policies that support digital VTE expansion, including incentives for institutions adopting technology (UNESCO, 2022). Increased funding for digital education initiatives ensures that VTE institutions have the necessary resources (World Bank, 2022). It is against this background that the researcher sought to examine the opportunities and challenges associated with integrating digital technologies in Vocational and Technical Education and suggest the strategies to optimize its use.

Statement of the Problem

The rapid advancement of digital technologies has significantly transformed educational systems worldwide, with Vocational and Technical Education (VTE) expected to play a pivotal role in preparing a technologically competent workforce. Digital tools such as virtual simulations, artificial intelligence, and online learning platforms have demonstrated strong potential to enhance skill acquisition, improve instructional delivery, and align training with industry demands. Despite these advantages, the integration of digital technologies into VTE, particularly in developing contexts like Nigeria remains uneven and limited.

Existing studies have extensively documented the general benefits of digital technologies in education as well as broad challenges such as inadequate infrastructure, limited funding, and low digital literacy among educators. However, there is a notable gap in empirical evidence comparing the perspectives of key stakeholders, specifically technical teachers and ministry of education personnel, on the opportunities, challenges, and practical strategies for digital integration in VTE. Most prior research tends to focus on either educators or policymakers in isolation, thereby overlooking the importance of aligning their views for effective implementation.

Furthermore, while teacher preparedness has been widely acknowledged as a critical factor, there is insufficient localized evidence examining how both teachers and policymakers jointly perceive its influence on digital adoption within VTE systems. This lack of comparative insight limits the development of coordinated policies and interventions that are responsive to both classroom realities and administrative expectations.

Therefore, this study seeks to fill this gap by providing a comparative analysis of the perceptions of technical teachers and ministry of education staff regarding the opportunities, challenges, teacher preparedness, and strategies for integrating digital

technologies in VTE. By doing so, the study aims to generate evidence that supports more collaborative, context-specific, and effective approaches to digital transformation in vocational and technical education

Objectives of the Study

The main objective of this study is to examine the opportunities and challenges associated with the integration of digital technologies in Vocational and Technical Education (VTE).

The specific objectives are to:

1. Examine the opportunities presented by digital technologies in enhancing VTE.
2. Identify the challenges that hinder the effective integration of digital technologies in VTE.
3. Assess how teacher preparedness influences the adoption of digital tools in VTE.
4. Determine the strategies that can be implemented to optimize the use of digital technologies in VTE.

Research Questions

1. What are the opportunities presented by digital technologies in enhancing VTE?
2. What challenges hinder the effective integration of digital technologies in VTE?
3. How does teacher preparedness influence the adoption of digital tools in VTE?
4. What strategies can be implemented to optimize the use of digital technologies in VTE?

Hypotheses

1. There is no significance difference between the opinion of technical teachers and ministry of education staff on the opportunities presented by digital technologies in enhancing VTE?
2. There is no significance difference between the opinion of technical teachers and ministry of education staff on the challenges that hinder the effective integration of digital technologies in VTE?
3. There is no significance difference between the opinion of technical teachers and ministry of education staff on how teacher preparedness influences the adoption of digital tools in VTE
4. There is no significance difference between the opinion of technical teachers and ministry of education staff on the strategies that can be implemented to optimize the use of digital technologies in VTE

Methodology

This study adopted a survey research design. Data was collected through self-designed questionnaire named "Assessing Opportunities and Challenges of Integration of Digital Technologies in Vocational and Technical Education (AOCIDTVTE)". The total population of the study was 71 which comprises of 37 technical college teacher who are holders of bachelor of technology education (B. Tech. Ed) and 34 Ministry of education staff with the same qualifications. Taro Yamane's formula was used to determine the sample size at 0.05 level of precision and 30 teachers were randomly sampled from the three Government Science and Technical Colleges of Adamawa state and 30 staff of Adamawa state ministry of education making total of 60 respondents. The questionnaires were distributed to the with the permission of the school principals and the permanent secretary ministry of education to the respondents. Quantitative data was analysed using statistical tools such as SPSS, while hypotheses were tested using t-test statistics. Any item with mean/percentage of less than 2(50%) was rejected, while those with mean/percentage of equal to or greater than 2(50%) were accepted.

Presentation of Results

RQ1: What are the opportunities presented by digital technologies in enhancing VTE?

Table 1: Responses of Technical Teachers on the opportunities presented by digital technologies in enhancing VTE

SN	Items	SA	A	DA	SD	UD	X	%	Remark
1	Improved Access to Learning Resources	8	15	6	1	0	3.0	75	Accepted
2	Enhanced Skill Development Through Simulation and VR	15	12	3	0	0	3.4	85	Accepted
3	Flexible and Remote Learning	18	12	0	0	0	3.6	90	Accepted
4	Industry Collaboration and Real-Time Updates	10	18	1	0	1	3.2	80	Accepted
5	Automated Assessment and Personalized Learning	12	18	0	0	0	3.4	85	Accepted
	Grand mean						3.3	83	Accepted

The result on table 1showed that the highest-rated opportunity was flexible and remote learning (90%), showing strong support for digital technologies enabling learning flexibility. Enhanced skill development through simulation and VR (85%) and automated assessment and personalized learning (85%) were also highly rated, suggesting that teachers recognize the role of technology in skill development and personalized learning. Improved access to learning resources (75%) and industry collaboration (80%**)** were also seen as benefits. The grand mean (83%) indicates overall agreement on the benefits of digital technologies

Table 2: Responses of ministry of education staff on the opportunities presented by digital technologies in enhancing VTE

SN	Items	SA	A	DA	SD	UD	X	%	Remark
1	Improved Access to Learning Resources	18	10	1	0	1	3.5	87	Accepted

2	Enhanced Skill Development Through Simulation and VR	6	20	4	0	0	3.1	77	Accepted
3	Flexible and Remote Learning	8	21	1	0	0	3.2	81	Accepted
4	Industry Collaboration and Real-Time Updates	5	24	0	0	1	3.0	77	Accepted
5	Automated Assessment and Personalized Learning	7	21	0	0	2	3.0	76	Accepted
	Grand mean						3.2	81	Accepted

The results presented on table 2 revealed that improved Access to learning resources (87%) was rated highly, with flexible and remote learning (81%) and enhanced skill development (77%) also receiving strong support. However, scores for Automated Assessment (76%) and industry collaboration (77%) were slightly lower, though all the listed opportunities were accepted. The grand mean of 3.2(81%) reflects a positive perception but slightly lower than that of the technical teachers.

RQ2: What challenges hinder the effective integration of digital technologies in VTE?

Table 3: Responses of technical teachers on the challenges hinder the effective integration of digital technologies in VTE

SN	Questionnaire Item	SA	A	DA	SD	UD	X	%	Remark
1	Inadequate Infrastructure and Internet Connectivity	2	27	0	0	1	2.8	71	Accepted
2	Limited Digital Skills Among Teachers and Students	20	8	2	0	0	3.6	90	Accepted
3	High Cost of Digital Technologies	8	20	1	1	0	3.2	79	Accepted
4	Resistance to Change and	10	20	0	0	0	3.3	83	Accepted

	Traditional Teaching Methods								
5	Lack of Relevant Digital Content for VTE	13	14	1	1	1	3.2	81	Accepted
	Grand mean						3.2	81	Accepted

The result displayed on table 3 revealed that the most significant challenge was limited digital skills among teachers and students (90%), followed by resistance to change (83%) and lack of relevant digital content (81%). High cost of digital technologies (79%) and inadequate infrastructure (71%) were also seen as barriers. The grand mean (81%) indicates strong agreement that these factors hinder integration.

Table 4: Responses of ministry of education staff on the challenges hinder the effective integration of digital technologies in VTE

SN	Questionnaire Item	SA	A	DA	SD	UD	X	%	Remark
1	Inadequate Infrastructure and Internet Connectivity	15	13	1	0	1	3.4	85	Accepted
2	Limited Digital Skills Among Teachers and Students	14	16	0	0	0	3.5	87	Accepted
3	High Cost of Digital Technologies	12	17	0	0	1	3.3	83	Accepted
4	Resistance to Change and Traditional Teaching Methods	10	19	1	0	1	3.3	83	Accepted

5	Lack of Relevant Digital Content for VTE	18	10	1	1	0	3.5	88	Accepted
	Grand mean						3.4	85	Accepted

The result on table 4 indicated that lack of relevant digital content (88%), limited digital skills (87%), and inadequate infrastructure (85%) were the highest-rated challenges. High cost of digital technologies (83%) and resistance to change (83%) were also significant. The grand mean (85%) suggests that ministry officials perceive more challenges compared to teachers. Both groups accepted all the items as challenges that hinders the effective integration of digital technologies in VTE

RQ3: How does teacher preparedness influence the adoption of digital tools in VTE?

Table 5: Responses of technical teachers on how teacher preparedness influences the adoption of digital tools in VTE

SN	Questionnaire Item	SA	A	DA	SD	UD	X	%	Remark
1	Enhances Effective Integration of Digital Tools	18	10	1	0	1	3.5	87	Accepted
2	Boosts Teachers' Confidence and Willingness to Use Technology	11	18	1	0	0	3.3	83	Accepted
3	Improves Student Engagement and Learning Outcomes	9	20	0	1	0	3.2	81	Accepted
4	Facilitates Continuous Professional Development	17	13	0	0	0	3.6	89	Accepted
5	Reduces Resistance to Change	15	14	1	0	0	3.5	87	Accepted
	Grand mean						3.4	85	Accepted

Table 5 revealed that the highest-rated factor was facilitating continuous professional development (89%), followed by enhancing effective integration of digital tools (87%) and reducing resistance to change (87%). The grand mean (85%) reflects strong agreement that teacher preparedness is crucial for digital adoption.

Table 6: Responses of ministry of education staff on how teacher preparedness influences the adoption of digital tools in VTE

SN	Questionnaire Item	SA	A	DA	SD	UD	X	%	Remark
1	Enhances Effective Integration of Digital Tools	17	12	1	0	0	3.5	88	Accepted
2	Boosts Teachers' Confidence and Willingness to Use Technology	19	9	0	0	1	3.5	88	Accepted
3	Improves Student Engagement and Learning Outcomes	11	19	0	1	0	3.4	84	Accepted
4	Facilitates Continuous Professional Development	8	20	1	1	1	3.2	79	Accepted
5	Reduces Resistance to Change	13	16	0	0	1	3.3	83	Accepted
	Grand mean						3.4	85	Accepted

The result on table 6 showed that the highest-rated items were enhancing effective integration of digital tools (88%) and boosting teachers' confidence (88%), while continuous professional development (79%) was rated slightly lower. The grand mean (85%) was similar to that of the teachers, showing agreement on the importance of teacher preparedness. Both groups agreed that teacher preparedness plays a crucial role in digital adoption, primarily by boosting confidence, reducing resistance, and facilitating professional development.

RQ4: What strategies can be implemented to optimize the use of digital technologies in VTE?

Table 7: Responses of technical teachers on the strategies that can be implemented to optimize the use of digital technologies in VTE

SN	Questionnaire Item	SA	A	DA	SD	UD	X	%	Remark
1	Providing Regular Training and Capacity Building for Teachers	10	20	0	0	0	3.3	83	Accepted
2	Investing in Digital Infrastructure and Resources	12	16	1	1	0	3.3	83	Accepted
3	Developing Industry-Relevant Digital Content	18	12	0	0	0	3.6	90	Accepted
4	Encouraging Blended Learning Approaches	11	18	0	0	1	3.3	82	Accepted

5	Strengthening Partnerships with Industry and Tech Companies	15	14	1	0	0	3.5	87	Accepted
	Grand mean						3.4	85	Accepted

The result on Table 7 revealed that the most highly rated strategy was developing industry-Relevant digital content (90%), followed by strengthening partnerships with industry (87%). training and capacity building (83%), investing in digital infrastructure (83%), and blended learning approaches (82%) were also seen as key strategies. The grand mean (85%) suggests strong agreement on these strategies.

Table 8: Responses of ministry of education staff on the strategies that can be implemented to optimize the use of digital technologies in VTE.

N	Questionnaire Item	SA	A	DA	SD	UD	X	%	Remark
1	Providing Regular Training and Capacity Building for Teachers	11	18	1	0	0	3.3	81	Accepted
2	Investing in Digital Infrastructure and Resources	20	10	0	0	0	3.7	92	Accepted
3	Developing Industry-Relevant Digital Content	15	13	1	1	0	3.3	83	Accepted
4	Encouraging Blended Learning Approaches	14	16	0	0	0	3.5	87	Accepted
5	Strengthening Partnerships with Industry and Tech Companies	12	17	0	0	1	3.3	83	Accepted
	Grand mean						3.4	85	Accepted

The results presented on table 8 proved that investing in digital infrastructure (92%) was the highest-rated strategy, followed by encouraging blended learning (87%) and developing industry-relevant digital content (83%). The grand mean (85%) was consistent with the teachers' responses, indicating agreement on effective strategies.

HO1: There is no significance difference between the opinion of technical teachers and ministry of education staff on the opportunities presented by digital technologies in enhancing VTE

Table 9
Independent Samples t-Test Results

Variable	Test Condition	F	p	t	df	p (2-tailed)	Mean Difference	SE Difference	95% CI [LL, UL]
Categorical	Equal variances assumed	0.76	.39	1.72	58	.09	3.83	2.22	[-0.62, 8.29]
	Equal variances not assumed	—	—	1,72	56.93	.09	3.83	2.22	[-0.62, 8.29]

Note. SE = Standard error; CI = confidence interval; LL = lower limit; UL = upper limit. Levene's test for equality of variance was not significant, E(1,58) = 0.76, P = .388, indicating that the assumption of equal variance was met. The independent samples *t*-test on table 9 showed that there was no statistically significant difference between the opinions of technical teachers and ministry of education staff regarding the opportunities presented by digital technologies in VTE, t (58) = 1.72, p = .09. Since p > .05, the null hypothesis was retained. This indicates that both groups share similar perceptions of the benefits of digital technologies, including improved access, flexibility, and enhanced skill acquisition.

HO2: There is no significance difference between the opinion of technical teachers and ministry of education staff on the challenges that hinder the effective integration of digital technologies in VTE?

Table 10
Independent Samples t-Test Results

Variable	Test Condition	F	p	t	df	p (2-tailed)	Mean Difference	SE Difference	95% CI [LL, UL]
Categorical	Equal variances assumed	0.56	.46	-0.58	58	.57	-1.37	2.37	[-6.11, 3.38]
	Equal variances not assumed	—	—	-0.58	56.29	.57	-1.37	2.37	[-6.11, 3.38]

The results showed on table 10 revealed no significant difference between the opinions of both groups on the challenges hindering digital technology integration, t (58) = -0.58, p = .57. The null hypothesis was therefore accepted. This suggests a

strong consensus that issues such as inadequate infrastructure, high costs, limited digital skills, and resistance to change are common barriers in VTE.

HO3: There is no significance difference between the opinion of technical teachers and ministry of education staff on how teacher preparedness influences the adoption of digital tools in VTE

Table 11
Independent Samples t-Test Results

Variable	Test Condition	F	p	t	Df	p (2-tailed)	Mean Difference	SE Difference	95% CI [LL, UL]
Categorical	Equal variances assumed	0.22	.64	-0.04	58	.97	-0.10	2.31	[-4.72, 4.52]
	Equal variances not assumed	—	—	-0.04	57.18	.97	-0.10	2.31	[-4.72, 4.52]

The analysis on table 11 indicated no significant difference between technical teachers and ministry staff regarding the influence of teacher preparedness on digital adoption, $t(58) = -0.04$, $p = .97$. Thus, the null hypothesis was retained. This implies that both groups equally recognize that teacher competence, confidence, and training are critical factors in successful digital integration.

HO4: There is no significance difference between the opinion of technical teachers and ministry of education staff on the strategies that can be implemented to optimize the use of digital technologies in VTE

Table **12**
Independent Samples t-Test Results

Variable	Test Condition	F	p	t	df	p (2-tailed)	Mean Difference	SE Difference	95% CI [LL, UL]
Categorical	Equal variances assumed	0.74	.39	1.28	58	.21	2.67	2.09	[-1.51, 6.84]
	Equal variances not assumed	—	—	1.28	57.50	.21	2.67	2.09	[-1.51, 6.84]

The findings on table 12 showed no statistically significant difference between the two groups regarding strategies for optimizing digital technologies in VTE, t (58) = 1.28, p = .21. Therefore, the null hypothesis was accepted. This demonstrates agreement on key strategies such as investment in infrastructure, teacher training, industry collaboration, and blended learning approaches.

Discussion of Findings

The findings of this study provide strong evidence that stakeholders in VTE—technical teachers and ministry staff—hold largely consistent views on the integration of digital technologies.

The high ratings for flexible learning, simulation-based skill development, and personalized learning confirm that digital technologies significantly enhance VTE delivery. This aligns with UNESCO (2021) and Zhao et al. (2022), who emphasized that technologies such as VR, AI, and simulations improve hands-on training and learning outcomes.

Similarly, the findings support Kumar and Sharma (2022), w”ho argued that digital tools bridge the gap between theory and practice. The strong agreement across both respondent groups suggests that digital technologies are widely perceived as transformative tools for modernizing VTE.

Despite the recognized benefits, the study identified major barriers such as limited digital skills, infrastructural deficits, and high implementation costs. These findings are consistent with Adigun and Salawu (2021) and UNESCO (2021), who identified similar constraints in developing countries.

The prominence of digital literacy gaps supports Eze et al. (2020), highlighting the need for foundational ICT skills among both teachers and students. Additionally, resistance to change reflects the arguments of Aguayo et al. (2020) and Hamari et al. (2019), who noted that cultural and institutional inertia often slows technological adoption.

The study underscores teacher preparedness as a central determinant of successful digital integration. This aligns with Goodyear (2022), who described teachers as key facilitators of digital learning environments.

The importance of continuous professional development supports findings by Dumford and Miller (2020) and Kumar and Sharma (2022), who found that teacher training improves both instructional quality and student engagement.

Furthermore, the role of teacher attitudes confirms the work of Pinto et al. (2022), indicating that positive perceptions toward technology enhance adoption rates.

Conclusion

This study concludes that digital technologies have the potential to significantly enhance Vocational and Technical Education by improving accessibility, skill acquisition, and alignment with industry demands. However, their effective integration is constrained by infrastructural deficiencies, high costs, and inadequate digital competencies.

Teacher preparedness emerged as a critical success factor, emphasizing the need for continuous training and institutional support. The absence of significant differences between technical teachers and ministry staff indicates a unified perspective, which provides a strong foundation for collaborative policy development and implementation.

Recommendations:

1. Governments and institutions should prioritize the development of adequate digital infrastructure, including high-speed internet, digital labs, and e-learning platforms, to support the integration of digital technologies in VTE.
2. Continuous professional development programs should be implemented to enhance teachers' digital skills, confidence, and ability to integrate emerging technologies such as VR, AI, and AR into teaching.
3. Policymakers should allocate more financial resources to support the acquisition, maintenance, and sustainability of digital tools in VTE institutions, addressing the financial constraints identified in the study.
4. Collaboration between curriculum developers and industry stakeholders should be encouraged to create relevant digital learning materials that align with workforce demands, improving the practical applicability of VTE programs.

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