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Integrating Emerging Standards in Teaching Technical Education:

Advancing Sustainable Development Goals (SDGs) in Kano State, Nigeria

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Abstract

This research explores the integration standards in Technical & Vocational Education & Training (TVET) within Kano State, Nigeria, and its alignment with the sustainable Development Goals (SDGs). TVET primary purpose is to prepare individuals for employment in skilled based occupations. The study examines current pedagogical practices, the adoption of new technologies, and green skills to enhance quality education (SDG 4), economic growth (SDG 8) and climate action (SDG 13). The research employs a quantitative data surveys approach. Survey of TVET students, educators, and industry stakeholders in Kano State was employed using a semi structural questionnaire. The findings highlight a mixed landscape for TVET in Kano State: Alignment with SDGs: While some progress has been made in addressing SDGs, particularly SDG 8 and SDG 13, significant gaps remain in achieving SDG 4 due to outdated curricula, insufficient teacher training, and inadequate infrastructure. The study recommends curriculum modernization to update TVET curricula to align with industry requirement, incorporating green skills and emerging technologies to optimize TVET's role in achieving sustainable development.

Keywords: Emerging standards, teaching technical education, Sustainable Development Goals (SDGs)



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Introduction

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Kano State, as a major economic and industrial hub in Nigeria, has a growing demand for a skilled workforce to meet the challenges of globalization and sustainability. Technical and Vocational Education and Training (TVET) plays a critical role in equipping individuals with the skills necessary for economic growth, social inclusion, and environmental sustainability (UNESCO, 2022). In Kano State, Nigeria, TVET institutions have the potential to address high youth unemployment rates and the growing demand for skilled labour (Muhammad, et al. 2023). However, the integration of emerging standards, such as digital literacy, green skills, and Industry 4.0 competencies, remains a challenge (Muhammad et al., 2020). This study aims to assess the current state of TVET in Kano State, identify gaps in alignment with global standards, and explore strategies for advancing the Sustainable Development Goals (SDGs) through technical education. Despite the importance of TVET in fostering sustainable development, institutions in Kano State face significant challenges, including outdated curricula, inadequate funding, and a lack of alignment with global standards (Muhammad et al., 2020). The limited integration of emerging technologies and green skills further hinders TVET's potential to contribute meaningfully to SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), and SDG 13 (Climate Action). Without addressing these gaps, Kano risks falling behind in preparing its workforce for the demands of a rapidly changing global economy (Hamza et al., 2023).

This study is significant for several reasons:

1. Policy Development: It provides insights for policymakers to design equitable and sustainable TVET systems in Kano State.

2. Curriculum Modernization: The research offers recommendations for integrating emerging standards into TVET curricula.

3. Economic Impact: By aligning TVET with SDGs, the study aims to enhance employment opportunities and economic growth in Kano State.

4. Sustainability Goals: It emphasizes the importance of green skills and environmental sustainability in technical education, contributing to global climate action efforts.

5. Capacity Building: The study highlights the need for educator training to effectively implement emerging teaching standards.

Objectives:

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- 1. To assess the current state of TVET in Kano State and its alignment with SDGs.
- 2. To analyses the adoption of emerging standards in teaching methodologies and curricula.
- 3. To identify challenges and opportunities in integrating SDG-aligned TVET.

Research Questions:

1. How do you assess the current state of TVET in Kano State and its alignment with SDGs?

2. What are the emerging standards in teaching methodologies and curricula need for integration into TVET?

3. What are challenges and opportunities in integrating SDGs that aligned TVET with SDGs?

Literature Review

The literature review explores global and local perspectives on TVET and its role in achieving SDGs. It includes:

Conceptual Framework:

The study is guided by the intersection of TVET and SDGs, focusing on how emerging standards can transform education to support sustainable development. Key concepts include:

- Emerging Standards: AI, Industry 4.0 tools, and green skills (Hamza et al., 2017).

- SDGs Focus: Quality Education (SDG 4), Decent Work (SDG 8), and Climate Action (SDG 13) (UN- DESA, 2019).

- Challenges and Enablers: Funding, infrastructure, and educator preparedness as mediators for success (Muhammad et al., 2024).

Theoretical Framework:

The research draws on the 'Human Capital Theory', emphasizing the role of education and training in enhancing individual productivity and societal progress (Becker, 1994). It also incorporates elements of 'Sustainable Development Theory', focusing on balancing economic, social, and environmental objectives (Nwosu & Micah, 2017).

Global Emerging Standards in TVET

Education 4.0

Education 4.0 is a response to Industry 4.0, emphasizing education tailored to the digital and technological era. It integrates emerging technologies like artificial intelligence, virtual reality, and robotics into teaching and learning processes, aiming to foster critical thinking, creativity, problem-solving, and adaptability (OECD, 2019). Additionally, it focuses on learner-centred

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@2025 International Council for Education Research and Training 2025, Vol. 03, Issue 02, 88-98 ISSN: 2960-0006 DOI: https://doi.org/10.59231/edumania/9118 approaches, and digital literacy. Likewise, it encourages collaboration, personalized learning, and lifelong skill development to meet the dynamic needs of modern industries (Saud et al., 2018). Therefore, Education 4.0 is relevant for aligning TVET with Industry 4.0 demands.

Industry 4.0 Technologies

Industry 4.0 encompasses advanced technologies that drive automation, data exchange, and smart manufacturing systems. Key technologies include: Artificial Intelligence (AI), Internet of Things (IoT), Big Data and Analytics, Robotics, Blockchain and 3D printing. These technologies enhance efficiency, reduce costs, and enable real-time decision making in various sectors (Saud et al., 2018).

Green Skills

Inclining green skills to technology, it is enough to describe green skills as technical skills, knowledge, values and attitude needed in the technology graduates industries to develop and support sustainable social, economic and environmental outcomes in the technology graduates industry (Hamza et al., 2023). Consequently, green skills includes competencies for promoting environmental sustainability, such as energy conservation and waste management (Isa et al., 2024).

Challenges in Kano State

Infrastructure Deficits

Many TVET institutions lack the resources to implement modern technologies or green initiatives in Nigeria with particular reference to Kano state. According Muhammad et al. 2019) one of the vital challenges of integrating entrepreneurial competencies into technical college programs in Nigeria was the infrastructures shortages in the colleges. Likewise, (Haruna et al., 2024) argued that most of TVET institutions in northern Nigeria lack the assets for implementation new technologies in their domain.

Curriculum Gaps

Obsolete curricula fail to incorporate emerging standards or address the specific needs of local industries. In this regard (Muhammad et al., 2024) emphasized the need for integrating emerging standards in the curriculum to address the specific needs of the local industries.

Educator Capacity



@2025 International Council for Education Research and Training2025, Vol. 03, Issue 02, 88-98ISSN: 2960-0006DOI: https: https://doi.org/10.59231/edumania/9118Educator capacity refers to the skills, knowledge, and competencies educators need to deliver

effective teaching in modern, dynamic contexts. For Education 4.0, this includes:

- Proficiency in digital tools and technologies.

- Pedagogical strategies for blended and personalized learning.

- Continuous professional development to stay updated with new teaching methodologies and industry trends (Isa, M. U., Abubakar, B. S., Jogana, M. A., Shuaibu, H. & Muhammad, 2024).

Policy Implementation

Policy implications involve aligning educational systems with emerging trends to address skills gaps and technological advancements. Key considerations include:

- Curriculum reform: Incorporating digital literacy and green skills into education.

- Infrastructure development: Investing in technology-enabled classrooms.

- Funding mechanisms: Supporting teacher training and resource acquisition.

- Industry collaboration: Partnering with industries to bridge the skills gap and create job-ready graduates (Duru and Anyanwu, 2019).

Alignment with SDGs

SDG 4: Quality Education. Focused on inclusivity and equitable quality education. Emerging standards can enhance teaching effectiveness and student engagement. Achieving SDG 4 on quality education for all requires significant additional financing. Annual total spending for SDG 4 on quality education would need to more than triple to achieve the first two—and costliest—education targets, namely universal pre-primary, primary and secondary education in low-income countries alone (UN- DESA, 2019).

There are three primary sources of funding to fill the gap: Governments, donors and households. Other private sector actors also play a role in the financing and delivery of education in many countries, often when there are quality concerns with the public option. But the cost of even non-profit private education can be prohibitive for many, raising concerns on equity and risking leaving many behind (UN- DESA, 2019).

SDG 8: Decent Work and Economic Growth. Aligning TVET with market demands can reduce unemployment and foster economic growth. Therefore, it promotes strong, inclusive and sustainable economic growth and decent work for all. It also calls for the integration of small-scale firms, in particular from developing countries, into global value chains (Nwosu & Micah, 2017).



@2025 International Council for Education Research and Training 2025, Vol. 03, Issue 02, 88-98 ISSN: 2960-0006 DOI: https://doi.org/10.59231/edumania/9118 Consequently, decent work and economic growth promotes higher levels of productivity and technological innovation, entrepreneurship and decent job creation, access to financial services and protection of labour rights (UN- DESA, 2019).

SDG 13: Climate Action. Introducing green skills in TVET curricula can support Nigeria's climate goals. SDG 13 commits the international community to take urgent action on climate change mitigation and adaptation, noting the need for awareness-raising, capacity-building and financing. Climate change is proceeding faster than humanity is tackling the problem. There is no country that is not experiencing the drastic effects first-hand (UN- DESA, 2019).

Methodology

The research employs a quantitative data surveys approach. Survey of TVET students, educators, and industry stakeholders in Kano State was employed using a semi structural questionnaire. The participant were selected through stratified and simple random sampling (Creswell, 2014). The data analysis was done using Statistical Package Social Science (SPSS 24).

Results

RQ 1: How do you assess the current state of TVET in Kano State and its alignment with SDGs?

eed
eed
reed
reed
agree
reed
reed



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Limited student interest	2	2.25	1.07	Disagree

RQ 2: What are the emerging standards in teaching methodologies and curricula need for integration into TVET?

S/N	ITEMS	Ā	SD	REMARK
4	Are emerging technologies (e.g., AI, digital tools)	2.46	1.11	Disagree
	integrated into teaching practices in your institution?			
5	How familiar are educators and students with green skills	2.15	1.08	Disagree
	and environmental sustainability?			
6	What type of training do you think educators need to			
	integrate emerging standards?			
	Digital literacy	3.05	0.81	Needed
	Industry 4.0 tools	3.45	0.71	Needed
	Green skills	3.54	0.73	Needed
	Pedagogical strategies	3.07	0.01	Needed

RQ 3: What are challenges and opportunities in integrating SDGs that aligned TVET with SDGs?

S/N	ITEMS	Ā	SD	REMARK
7	How well do you think TVET in Kano aligns with	2.69	0.95	Partially
	SDG 4 (Quality Education)?			aligned
8	Do TVET programs in Kano contribute to SDG 8	2.78	1.00	Agreed
	(Decent Work and Economic Growth)?			
9	Are TVET programs addressing SDG 13 (Climate	3.05	0.81	Agreed
	Action)?			

NOTE: $\bar{\mathbf{X}}$ = MEAN; \mathbf{SD} = Standard Deviation

Findings

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@2025 International Council for Education Research and Training2025, Vol. 03, Issue 02, 88-98ISSN: 2960-0006DOI: https: https://doi.org/10.59231/edumania/9118RQ 1: How do you assess the current state of TVET in Kano State and its alignment with SDGs?

- The quality of TVET facilities is rated "Good" (Mean = 3.13, SD = 0.96).

- TVET curricula are somewhat aligned with industry-required skills (Mean = 2.98, SD = 0.99).

- Challenges include a lack of funding (Mean = 3.05), outdated curricula (Mean = 2.15), insufficient teacher training (Mean = 2.69), and poor infrastructure (Mean = 2.67). However, limited student interest is not considered a major issue (Mean = 2.25).

RQ 2: What are the emerging standards in teaching methodologies and curricula need for integration into TVET?

- Integration of emerging technologies like AI and digital tools is limited (Mean = 2.46, SD = 1.11).

- Familiarity with green skills and environmental sustainability is also low (Mean = 2.15, SD = 1.08).

- Key training needs for educators include digital literacy (Mean = 3.05), Industry 4.0 tools (Mean = 3.45), green skills (Mean = 3.54), and pedagogical strategies (Mean = 3.07).

RQ 3: What are challenges and opportunities in integrating SDGs that aligned TVET with SDGs?

- Alignment with SDG 4 (Quality Education) is partial (Mean = 2.69, SD = 0.95).

- TVET programs contribute to SDG 8 (Decent Work and Economic Growth) (Mean = 2.78).

- Contributions to SDG 13 (Climate Action) are recognized (Mean = 3.05).

Discussion

The findings highlight a mixed landscape for TVET in Kano State:

Alignment with SDGs: While some progress has been made in addressing SDGs, particularly SDG 8 and SDG 13, significant gaps remain in achieving SDG 4 due to outdated curricula, insufficient teacher training, and inadequate infrastructure. This finding was in line with (Nwosu & Micah, 2017) who identified the failures of the TVET as an instrument required for national sustainability development, and the challenges encountered in Nigeria.

Emerging Standards: Limited integration of technologies and green skills suggests a need for systemic changes in teaching methodologies to meet modern standards and sustainability goals. The finding concurred with (Hamza et al., 2023) findings who suggested the need for include emerging standards in the Nigeria technical colleges to achieve environmental sustainability.



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Challenges and Opportunities: Challenges like funding shortages and insufficient resources hinder progress, but opportunities exist through targeted interventions, such as educator training in digital literacy and green skills. The outcome was agreed by (Muhammad et al. 2019) who ascertained that poor funding, lack of qualified teachers, inappropriate curriculum and negative attitude toward on entrepreneurship education are the main challenges hindering the integration of entrepreneurial competencies into technical college programs in Nigeria.

Recommendations

1. Curriculum Modernization: Update TVET curricula to align with industry requirements, incorporating green skills and emerging technologies.

2. Educator Training: Provide professional development in digital literacy, Industry 4.0 tools, and pedagogical strategies to enhance teaching effectiveness.

3. Infrastructure Improvement: Invest in upgrading TVET facilities and resources to improve learning environments.

4. Policy Support: Strengthen government and private sector partnerships to address funding gaps and promote sustainability initiatives in TVET.

5. Awareness Campaigns: Increase awareness of TVET's potential for sustainable development among students and educators.

Conclusion

Aligning TVET with emerging standards and SDGs in Kano State is crucial for sustainable development. This study provides a roadmap for enhancing TVET's relevance and impact in achieving equitable education, economic growth, and environmental sustainability.

References:

- Becker, G. (1994). Human capital revisited. *Journal of Chemical Information and Modeling*, 53(9), 1689–1699. <u>https://doi.org/10.1017/CBO9781107415324.004</u>
- 2. Creswell, J. W. (2014). Research Design: Qualitative, quantitative, and mixed methods approaches (VK & J. Young (Eds.) (4th ed.). Sage Publications.
- 3. Duru, I. U., & Anyanwu, S. O. (2019). Entrepreneurship in small and medium enterprises: A catalyst for capacity building and sustainable youths employment generation in the Federal



@2025 International Council for Education Research and Training
ISSN: 2960-0006
Capital Territory, Abuja, Nigeria. International Journal of Social and Administrative Sciences,
4(2), 277–296. https://doi.org/10.18488/journal.136.2019.42.277.296

 Hamza, S., Jamal, A. H. B. M., & Kamin, Y. B. (2017). A preliminary study of the awareness and applications of green skills: Students' perceptions. *Man in India*, 97(12), 31. https://www.scopus.com/inward/record.url?eid=2-s2.0-85025120862&partnerID=40&md5=627626684aaf7d21afca1fce1b9c72b6

 Hamza, S., Muhammad, A. I., Jogana, M. A., & Haruna, R. (2023). Analysis of transversal Green Skills Model for Graduates of Technical Colleges in Nigeria. *Journal of Science Technology and Education*, 11(4), 181–192. http://www.atbuftejoste.net

- Haruna, R., Isa, M. U., Muhammad, A. I., & Salihu, Y. I. (2024). A systematic Review of Concept of Digitalization and Automation in the Fourth Industrial Revolution for Technical and Vocational Education and Training. In R. E. Israel-Regha, M., S. A. Mfutau, M. Pulife, B. A. Idris, m. Dare, S. O., A. Baman, & Eziokwu (Eds.), *Topics in humanities, vocational & technical education, science and general education for NCE and undergraduate students, VI* (Issue 1, pp. 147–152). Harmony Publishers.
- Isa, M. U., Abubakar, B. S., Jogana, M. A., Shuaibu, H., & Muhammad, A. I. (2024). Application of project-based learning in enhancing entrepreneurship skills of construction technology education students at Colleges of Education. *Bayero Journal of African Entrepreneurship Studies*, 6(1), 19–28. http://buk.edu.ng/dbs/journals
- Muhammad, A. I., Hamza, S., Jogana, M. A., & Haruna, R. (2024). Measuring Competencies and Analysis of Factors Affecting the implementation of Entrepreneurship Education at Technical Colleges in North-West, Nigeria. *Vunoklang Multidisciplinary Journal of Science and Technology Education*, *12*(2), 65–75. https://doi.org/https://doi.org/10.5281/zenodo.10940307
- Muhammad, A. I., Jogana, M. A., & Hamza, S. (2020). Small and medium enterprises participation in funding and financing the integration of entrepreneurship education into technical colleges in Nigeria. *Journal of Vocational and Technical Educators (JOVTED)*, 5(5), 166–177.



Edumania-An International Multidisciplinary Journal

@2025 International Council for Education Research and Training 2025, Vol. 03, Issue 02, 88-98 DOI: https://doi.org/10.59231/edumania/9118
10. Muhammad, A. I., & Kamin, Y. B. (2019). Challenge of integrating entrepreneurial competencies into technical college programs. *International Journal of Engineering and Advanced Technology*, 8(5C), 379–383. https://doi.org/10.35940/ijeat.E1054.0585C19

- Muhammad, A. I., Zahradeeen, M. M., Usman, A. G., Jogana, M. A., Haruna, R., & Kamin, Y. B. (2023). Confirmatory Factor Analysis (CFA) of Managerial Entrepreneurial Competencies Model Required by Technical College Students for self-employment. *Edumania-An International Multidisciplinary Journal*, 01(02), 138–153. https://doi.org/https://doi.org/10.59231/edumania/8979
- 12. Organization for Economic Co-operation and Development. (2019). *Trends shaping* education.
- Saud, M. S., Rameli, M. R. M., Kosnin, A. M., Yahaya, N., Kamin, Y., Zakaria, M. A. Z. M., Mokhtar, M., Abdullah, A. H., Suhairom, N., Kamis, A., Rahman, F. A., Minghat, A. D., Daris, Z. M., Alhassora, N. S. A., & Omar, M. (2018). Readiness in implementing teacher training programmes based on Industrial Revolution 4.0: Evidence from Malaysian public universities. *Journal of Engineering Science and Technology*, *13*, 42–48 (Special Issue on ICITE. 2018).
- 14. United Nations. (2019). Sustainable Development Report. DESA. Department of Economic and Social Affairs, United Nations. http://developmentfinance.un.org/fsdr2019
- 15. United Nations Educational, Scientific and Cultural Organization. (2022). Digital skills development in TVET teacher training, 1 (pp. 7–56). International Centre for Technical and Vocational Education and Training. https://unevoc.unesco.org/pub/trends_mapping_study_digital_skills_development_in_tvet_t eacher_training.pdf

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