Enhancing Integration of Emerging Technologies in Technical Vocational Education and Training (TVET) Programmes for Sustainable Development

by

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ABSTRACT

The study was carried out to ascertain how to enhance integration of emerging technologies in Technical Vocational Education and Training (TVET) programmes for sustainable development. The study adopted a case study survey design. The population for the study involved 217 respondents which comprises of 92 TVET lecturers and 125 TVET technical instructors in the Faculty of Vocational and Technical Education, University of Nigeria, Nsukka. No sampling was used for this study since the total population is of manageable size. The instrument for data collection was a structured 37-item questionnaire. Three experts validated the research instruments. Cronbach alpha method was used to establish the reliability of the instrument and a reliability coefficient (α) of 0.80 was obtained. Data collected were analyzed using Mean and T-tests of Statistical Package for Social Sciences (SPSS) version 23. The study revealed among others that some of the emerging technologies which should be integrated in TVET programmes include, the use of smartboards, chatbots, Web 2.0 technologies such as Blogs, Wikis, and Social Bookmarking tools. The study recommended among others that Funding to TVET institutions by stakeholders should be taken seriously and should not be diverted or misappropriated so that they can be effectively utilized for the acquisition and provision of emerging technologies for teaching and learning.

Keywords: Emerging Technologies, Technical Vocational Education and Training (TVET), TVET Institutions and Sustainable Development.

Introduction

Education is regarded as the principal foundation for any modern society that exists in the world today. The rapidly evolving landscape of education and the integration of emerging technologies into Technical Vocational Education and Training (TVET) could become a pivotal avenue for fostering sustainable development. Sustainable development according to Chitewere (2017) is the people's approach to social, economic development and environmental planning that attempts to balance the social and economic needs of present and future generations by preventing undue damage to the natural environment. Devine (2020) defined sustainable development as a global approach on social, economic and environmental policies that takes into account the needs of future generations with the imperative of preserving the natural environment. In essence, sustainable development is development that meets the need of the present without compromising the ability of future generations to meet their own needs. Lotz-Sisitka, Shumba, Lupele and Wilmot (2017) stated that sustainable development is far broader than just the environment as it also ensures a strong, healthy and just society. This means that sustainable development helps in meeting the diverse needs of all people in existing and future communities, promoting personal wellbeing, social cohesion and inclusion, and creating equal opportunity. Oviawe, Uwameiye, and Uddin, (2017) stated thatTechnical Vocational Education and

Training (TVET) can facilitate the transition of society to a sustainable economy.

Technical Vocational Education and Training (TVET) is the educational and training programs that focus on providing learners with practical skills and knowledge that are relevant to specific trades, occupations, or vocations (Renold, Bolli & Caves, 2016). Technical Vocational Education and Training (TVET)as noted bySchröder (2019) comprises of education, training and skills development relating to a wide range of occupational fields, production, services and livelihoods. TVET is a broad range of educational and training programs designed to equip students with the technical, practical, and professional skills required to enter and excel in the world of work. TVET programs include a mix of classroom instruction, hands-on training, and experiential learning opportunities, which may be offered at the secondary, post-secondary, or higher education level. These programs are designed to prepare students for careers in a wide range of fields, including manufacturing, construction, engineering, and healthcare, hospitality, and information technology. TVET programs are often seen as an important means of providing individuals with the skills and knowledge they need to enter the workforce and succeed in their chosen careers. According to Mao, Li, Pei and Xu (2018), TVET can facilitate sustainable development by inculcating sustainable environmental values, and the application of environmentally appropriate knowledge and skills. Also, Gbadegbe, Amewu, and Buami, (2023) stated that TVET programs can also contribute to sustainable development by helping to train individuals in trades and occupations that are in demand in the sustainable economy, such as renewable energy and sustainable agriculture. This can help to reduce reliance on fossil fuels and promote environmentally-sustainable practices. Sustainable development can also increase productivity, competitiveness, employment growth and living standards. However, the traditional paradigms of teaching and learning in TVET are being reshaped by technological advancements, necessitating a reevaluation of pedagogical approaches. As Johnson, and Smith, (2019) noted, that the adoption of emerging technologies is essential for preparing TVET educators and students to meet the demands of a digitally driven society.

Emerging technologies are tools, concepts, innovations, and advancements utilized in diverse educational settings to serve varied education-related purposes (Adenle, Oyeyemi, Shobowale, Olukayode & Ariba, Olusegun, 2019).Emerging technologies byKallio, and Hakkinen, (2020) is the new and innovative technologies that are being developed or have recently been introduced into the society for diverse purposes in education, sciences and other sectors.In essence, emerging technology are new technologies whose development and practical applications are still largely unrealized. Emerging technologies have the potential to significantly impact society, education and the economy and can be recognized by their common characteristics. These characteristics according to Jones, and Wang, (2020) include; high potential, rapidly evolving,disruptive, and interdisciplinary. Emerging technologies have a high potential for growth and development, which means they can create significant opportunities for individuals and organizations. These technologies are relatively new and not fully established, leading to uncertainty about their future prospects and the challenges that may arise. Emerging technologies are continuously evolving, and new advancements are being made at a fast pace. Emerging technologies often combine different disciplines, such as computer science, engineering, education and biology. This interdisciplinary nature makes them unique and presents exciting opportunities for innovation. Emerging

technologies also have the potential to disrupt traditional industries and ways of doing things. This can create significant opportunities but also presents challenges and risks (Smith, & Brown, 2019).

Emerging technologies have a wide range of applications, and they are being used in various industries including education. Some examples of emerging technologies and their applications are:Artificial Intelligence (AI) is being used in healthcare, finance, and transportation to improve decision-making and automate processes (Wang, 2019). Internet of Things (IoT) is being used in manufacturing, logistics, and agriculture to monitor and control processes and optimize resource usage (Kibet & Kibet, 2019). While Blockchain is being used in finance, supply chain management, and healthcare to provide secure and transparent transactions (Smith & Brown, 2019). Emerging technologies is also used in education and could also be applied in teaching and learning of Technical Vocational Education and Training (TVET) programmes.Video and online classes is becoming popular among educational institutions: with the growth of usage in Zoom, BlueJeans and additional web conferencing tools, due to the novel coronavirus, many TVET institutions could benefit by offering more coursework online and remote student learning. TVET institutions could use chatbots for easier enrolments while their teachers could use the machine learning capabilities to develop more personalized forms of learning by looking at the patterns from data collected and offering insights to their students to guide them in the right direction.The lecturers and technical instructors are the TVET teachers who teach and train students in TVET institutions.TVET teachers could use digital simulators to show technical processes while assessments may become easier with the help of technology. With the use of emerging technology trends, testing the level of the student's understanding could be done in real-time, allowing TVET teachers to use this information to help weaker learners understand the subject better. The class can then move-on to the next subject with ease, knowing that all learners are on the same page and have the same understanding.For TVET lecturers who teach in foreign languages, being able to connect with native language speakers can enhance and improve the skills of their students. New platforms have emerged, such as Glovico.org which allows students to set up language lessons with a native speaker, via video conferencing (Wang, 2019). TVET Lecturers could set up language exchanges in their classrooms, and expose their class to different cultures and perspectives by using these advanced emerging technology trends. With the use of a Smart Board, the video conferences can be interactive, bringing another element of learning into the class.

Similarly, Yusuf, and Soyemi, (2012) stated that emerging technologies have the potential to deliver complex messages that are in line with today's complex educational sector. These technologies have the capacity to deliver messages that are personalized and learner-centric. Emerging technologies could facilitate personalized learning, cultivate necessary digital skills, and open up new avenues for exploration and critical thinking among TVET educators and students. As more and more educational institutions embrace online instruction, the emerging technologies are becoming an important part of online instruction. Emerging technologies could also reduce the digital divide as groups with particular learning difficulties can be assisted through access to learning activities which suit their learning styles, preference and learning need. TVET institutions, could adopt these technologies so as to integrate, use, examine, and evaluate them regularly.

However, despite the massive benefits associated with the integration of emerging technologies in TVET programmes, it faces

numerous barriers and challenges. Although TVET teachers generally appreciate the benefits of emerging technologies, most of them often find smooth and effective integration of these technologies challenging. Most TVET teachers struggle to effectively integrate emerging technologies into their teaching due to the lack of competence and knowledge in technology-based applications (Gbadegbe, Amewu, & Buami, 2023).One of the main challenges facing TVET programs is a lack of adequate funding from stakeholders. Many TVET programs struggle to secure sufficient resources to cover the costs of instructional materials, equipment, and other expenses. From acquisition of new technology equipment to adaptation of curricula and teaching techniques to incorporate new educational tools, technology integration presents significant challenges to educators (Rosenberg, Ramsarup, Lotz-Sisitka, 2020).

TVET programs especially in Nigeria often have limited resources, including funding and staff, which can make it difficult to integrate sustainable development principles into their curricula and operations.Furthermore, Kanwar, Balasubramanian and Carr, (2019) noted that many stakeholders within the TVET sector, including students, teachers, and policymakers, may have limited awareness about the importance of sustainability and the role that TVET can play in promoting sustainable development. Also, some TVET programs may not be aligned with the needs of industries that are focused on sustainability, which can make it difficult for students to find employment in these sectors. Other challenges include inadequate facilities and materials for student training and a shortage of technical teachers and instructors for technology-related subjects/courses in TVET(Adenle, et al, 2019). In some cases, TVET programs do not have access to high-quality training materials or experienced instructors, which can make it difficult to provide students with the skills and knowledge needed to work in sustainable industries. The inability to incorporate some emerging technologies into TVET programmes hampers the creative output and socio-economic progress of the students. Therefore, there is need to find out how to enhance the integration of emerging technologies in technical vocational education and training (TVET) Programmes for sustainable development thus this study.

Statement of the Problem

Technical Vocational Education and Training (TVET) is a vital component of the educational system, which focuses on the development of skilled workers for the society. The integration of emerging technologies in TVET programmes is regarded as one of the primary keys to economic growth, unemployment reduction and sustainable development. However, despite the massive benefits associated with the integration of emerging technologies in TVET programmes, it faces numerous barriers and challenges. TVET teachers often find smooth and effective integration of these technologies challenging. Most TVET teachers struggle to effectively integrate emerging technologies into their teaching due to the lack of competence and knowledge in technology-based applications. Many TVET programs struggle to secure sufficient resources to cover the costs of instructional materials, equipment, and other expenses. TVET programs especially in Nigeria often have limited resources, including funding and staff, which can make it difficult to integrate sustainable development principles into their curricula and operations.

Report also shows that many stakeholders within the TVET sector, including students, teachers, and policymakers, may have limited awareness about the importance of sustainability and the role that TVET can play in promoting sustainable development. Inadequate facilities and materials for student training and a

shortage of technical teachers and instructors for technology-related subjects are other challenges facing smooth integration of emerging technologies in TVET. In some cases, TVET programs do not have access to high-quality training materials or experienced instructors, which can make it difficult to provide students with the skills and knowledge needed to work in sustainable industries. The inability to incorporate some emerging technologies into TVET hampers the creative output and socio-economic progress of the students. It is on the backdrop of these problems that this study seeks to find out how to enhance the integration of emerging technologies in Technical Vocational Education and Training (TVET) Programmes for sustainable development.

Purpose of the Study

The main purpose of the study was to find out how to enhance the integration of emerging technologies in technical vocational education and training (TVET) Programmes for sustainable development. Specifically, the study sought to ascertain:

1. The emerging technologies that could be integrated into TVET programmes.
2. How TVET institutions can enhance integration of emerging technologies for teaching and learning activities.
3. How TVET programmes can contribute to sustainable development in the society.

Research Questions

This research therefore seeks to provide answers to the following questions:

1. What are the emerging technologies that could be integrated into TVET programmes?
2. How can TVET institutions enhance the integration of emerging technologies for teaching and learning activities?
3. How canTVET programmes contribute to sustainable development in the society?

Hypotheses

The following null hypothesis was tested at 0.05 level of significance:

1. There is no significant difference in the mean responses of TVET lecturers and technical instructors on the emerging technologies that could be integrated into TVET programmes.
2. There is no significant difference in the mean responses of TVET lecturers and technical instructors on how TVET institutions can enhance the integration of emerging technologies for teaching and learning activities.
3. There is no significant difference in the mean responses of TVET lecturers and technical instructors on how TVET programmes will contribute to sustainable development in the society.

Methodology

The study adopted a case study survey design. The study was carried out in Enugu State Nigeria. The population for the study involved 217 respondents which comprises of 92 TVET lecturers and 125 TVET technical instructors in the Faculty of Vocational and Technical Education, University of Nigeria Nsukka. No sampling was used for this studysince the total population of 217 subjects is of manageable size.

The instrument for data collection was a structured 37-item questionnaire titled: Questionnaire on enhancing the integration of emerging technologies in TVET for sustainable development(QEIETTSD).The questionnaire was designed on the 5-point likert scale of Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD). Three experts from the Faculty of Vocational and Technical Education, University of Nigeria Nsukka validated the research instrument. The reliability of the instrument was established using 10TVETlecturers and 20TVET technical instructors from the Department of Technology and Vocational Education, Enugu State University of Technology who were not part of the population of the study. The

responses to the questionnaire were collated and analyzed using Cronbach alpha method and a reliability coefficient (α) of 0.801 was obtained. Data collected were analyzed using Mean and T-tests of Statistical Package for Social Sciences (SPSS) version 23. The mean was used to answer the research questions. Any item of the questionnaire with mean of 3.50 and above was considered to be agreed while any item of the questionnaire with mean value below 3.50 was considered to be disagreed. The null hypothesis was accepted when the p-value (t-calculated) is greater than 0.05 level (t-critical) but the null hypotheses was rejected when the p-value (t-calculated) is less than 0.05 level value of the t-critic.

Results

The results were presented in Tables 1 to 3.

Table 1: Mean and Standard Deviation of TVET lecturers and technical instructors on the emerging technologies that could be integrated into TVET programmes *N = 217*

S/N	Item Statements	X	SD	P-values	Remarks	SIG
1	Course/Content Management Systems such as Moodle, Canvas, Drupal.	3.61	0.71	0.14	Agree	NS
2	Web 2.0 Technologies such as Blogs, Wikis, Social Bookmarking tools, Virtual Worlds, Podcasts, and Various educational games.	3.57	0.70	0.18	Agree	NS
3	Synchronous instruction technologies such as flipped classrooms, Blackboard Collaborate, Skype, Smart Boards and Panopto.	3.63	0.75	0.10	Agree	NS
4	Social Networking Technologies such as Facebook, LinkedIn, Pinterest, Flickr, Twitter, Google+	3.72	0.60	0.15	Agree	NS
5	Productivity Technologies such as Prezi, GoogleDocs, Mindmap, IHMC Cmap, VoiceThread, Dropbox and Google classroom.	3.58	0.66	0.09	Agree	NS
6	AI-fueled chatbots and virtual assistants that help to address student and faculty queries, provide guidance, and steer group dialogues.	3.53	0.72	0.12	Agree	NS
7	TVET teachers can use the machine learning capabilities to develop more personalized forms of learning.	3.73	0.60	0.15	Agree	NS
8	TVET teachers can use digital simulators to show technical processes and assessments.	3.55	0.65	0.20	Agree	NS
9	TVET teachers can use Smart Boards for video conferences and promote interactive learning experience.	3.64	0.74	0.26	Agree	NS
10	E-readers such as the Amazon Kindle, Kobo Aura and other Electronic and interactive textbooks that include audio and video capabilities for enhanced reading for younger students and those with disabilities.	3.78	0.66	0.09	Agree	NS
11	Adaptive learning platforms such as employing AI, algorithms that tailor educational content to each student's level and requirements thereby creating personalized learning experiences.	3.72	0.60	0.15	Agree	NS
12	Automated essay scoring systems through AI's evaluation capacity can aid TVET teachers in reducing their grading workload.	3.58	0.66	0.09	Agree	NS
13	Predictive analytics through AI, helps to identify at-risk students for tailored interventions.	3.53	0.72	0.12	Agree	NS
14	Predictive analytics through AI enables predicting upcoming educational patterns.	3.73	0.60	0.15	Agree	NS
15	Administrative task automation through AI's support can enable smoother operations in admissions, enrollment, scheduling, financial aid, and other areas.	3.55	0.65	0.20	Agree	NS

Keys:X = Mean SD =Standard Deviation, NS=Not significant.

The data in table 1 revealed that the 15 items have their mean values all above the cut-off point of 3.50. This indicates that all the items were accepted by the respondents asthe emerging technologies that could be integrated into TVET programmes. The standard deviation of the 15 items in table 1 ranges from 0.71-0.60 which shows that the respondents were not far from each other in their responses. On the other hand, the hypothesis showed that all the 15 items in table 1 have their p-values greater than 0.05 level of significance. The null hypothesis that there is no significant difference in the mean responses of TVET lecturers and technical instructors on the emerging technologies that could be integrated into TVET programmes was therefore accepted.

Table 2: Mean and Standard Deviation of TVET lecturers and technical instructors on how TVET institutions will enhance the integration of emerging technologies for teaching and learning activities ***N = 217***

S/N	Items	X	SD	P-values	Remarks	SIG
16	Continuous curriculum updating: TVET institutions must regularly review and update their curricula to ensure that they remain relevant to the current and future needs of the labor market.	3.95	0.75	0.18	Agree	NS
17	TVET institutions must invest in modern infrastructure, equipment, and facilities to provide students with access to cutting-edge technologies and resources.	3.77	0.77	0.26	Agree	NS
18	Developing digital skills: TVET institutions must incorporate digital literacy and advanced digital skills into their programs, equipping staff and students with the necessary competencies to succeed in the digital age	3.80	0.76	0.08	Agree	NS
19	TVET institutions must develop innovative teaching methods and curricula that incorporate emerging technologies to prepare learners for the digital economy.	3.59	0.74	0.22	Agree	NS
20	TVET institutions must engage the lecturers, technical instructors and other TVET teachers in up-skilling, training and re-training programme to equip them with the requisite skill in the use of emerging technologies for teaching and learning.	3.56	0.75	0.18	Agree	NS
21	TVET institutions must provide alternative steady power supply to help the smooth adoption and integration emerging technologies for teaching and learning activities.	3.68	0.82	0.28	Agree	NS
22	TVET institutions must provide adequate security to protect the physical tools and infrastructure that supports the use of emerging technologies against theft and vandalism.	3.58	0.88	0.17	Agree	NS
23	TVET institutions must provide sustainable budgeting approaches that will aid regular and routine maintenance of emerging tools and technologies in the system.	3.82	0.73	0.13	Agree	NS

Keys: X = Mean SD =Standard Deviation, NS=Not significant.

The data presented in Table 2 revealed that the 8 items listed have their mean values all above the cut-off point of 3.50. This indicates that the respondents accepted the items as how TVET institutions will enhance the integration of emerging technologies for teaching and learning activities. The standard deviation of the 8 items in table 2 ranges from 0.73-0.88 which shows that the respondents were not far from each other in their responses. On the other hand, the hypothesis showed that all the 8 items in table 2 have their p-values greater than 0.05 level of significance. The null hypothesis that there is no significant difference in the mean responses of TVET lecturers and technical instructors on how TVET institutions can enhance the integration of emerging technologies for teaching and learning activities was not rejected.

Table 3: Mean and Standard Deviation of TVETlecturers and technical instructors on how TVET programmes will contribute to sustainable development in the society.

N = 217

S/N	Item Statements	X	SD	P-Value	Remarks	SIG
24	TVET programmes provide individuals with the practical skills and knowledge they need to enter the workforce and be productive members of society.	3.82	0.73	0.13	Agree	NS
25	TVET provide individuals with the practical skills and knowledge they need to enter the workforce and increase labour productivity and competitiveness.	3.69	0.71	0.08	Agree	NS
26	TVET address skills shortages and mismatches in the labour market, which can lead to increased employment and economic opportunities for individuals and communities.	3.95	0.75	0.18	Agree	NS
27	TVET can improve the sufficient supply of skilled workers, so that businesses can operate more efficiently and effectively, thus driving economic growth.	3.77	0.77	0.26	Agree	NS
28	TVET programmes can foster innovation and entrepreneurship by providing individuals with the skills and knowledge they need to start and grow their own businesses.	3.80	0.76	0.08	Agree	NS
29	TVET can improve social mobility and reduce poverty by providing disadvantaged individuals with the skills and knowledge they need to access better paying jobs and improve their economic prospects.	3.59	0.74	0.22	Agree	NS
30	TVET programmes can contribute to the development of a highly skilled labour force by providing ongoing professional development and training opportunities for existing workers.	3.56	0.75	0.18	Agree	NS
31	TVET can help to keep workers up-todate with the latest industry trends and technologies, which can improve their productivity and competitiveness	3.68	0.82	0.28	Agree	NS
32	TVET programmes emphasizes practical, hands-on training and close collaboration between schools and industry.	3.58	0.83	0.17	Agree	NS
33	TVET programmes can teach students about sustainable practices and technologies in fields such as renewable energy, eco-friendly construction, and sustainable agriculture.	3.82	0.73	0.13	Agree	NS
34	TVET programmes can help to create a workforce that is equipped with the skills and knowledge to contribute to the transition to a more sustainable economy.	3.77	0.77	0.26	Agree	NS
35	TVET programmes can also focus on teaching students about environmental conservation and the importance of preserving natural resources.	3.54	0.72	0.16	Agree	NS
36	TVET programmes can help to raise awareness about the importance of sustainability and encourage students to adopt environmentally-friendly practices in their personal and professional lives.	3.77	0.77	0.26	Agree	NS
37	By providing practical, hands-on training, TVET programmes help students to develop the skills and knowledge needed to work in green industries or to start their own environmentally-conscious businesses.	3.80	0.76	0.08	Agree	NS

Keys: X = Mean SD =Standard Deviation, NS=Not significant.

The data presented in Table 3 revealed that the 14 items listed have their mean values all above the cut-off point of 3.50. This indicates that the respondents accepted the items suggested a show TVET programmes will contribute to sustainable development in the society. The standard deviation of the 14 items in table 3 ranges from 0.72-0.83 which shows that the respondents were not far from each other in their responses. On the other

hand, the hypothesis showed that all the 14 items in table 3 have their p-values greater than 0.05 level of significance. The null hypothesis that there is no significant difference in the mean responses of TVET lecturers and technical instructors on how TVET programmes will contribute to sustainable development in the society was not rejected.

Discussion of Findings

The findings from Table 1 revealed the emerging technologies that could be integrated into TVET programmes. Some of these technologies include:Web 2.0 Technologies such as Blogs, Wikis, Social Bookmarking tools, Virtual Worlds, Podcasts, and Various educational games. Others includesynchronous instruction technologies such as flipped classrooms, Blackboard Collaborate, Skype, Smart Boards and Panopto. The findings are in line with the opinion ofKallio, and Hakkinen, (2020), who exemplified the effective use of online collaborative platforms in facilitating international collaboration among teachers. The project not only enhanced the cultural competence of educators but also fostered a global perspective in the learning experiences of their students. Smith, and Brown, (2019) also supported the findings of this study by highlighting the successful integration of Artificial Intelligence (AI) in teacher professional development programs. The study reveals how AI-driven personalized learning modules tailored to individual teacher needs resulted in improved instructional strategies and student achievement. Mobile devices like tablets are giving students access to the subject matter information they need; this is possible because students can access and learn the subject matter contents from their tablets at the comfort of their homes or classrooms. Assessment tools can also help teachers and administrators ensure that students are progressing in each grade level.

The findings from Table 2, revealed how TVET institutions will enhance the integration of emerging technologies for teaching and learning activities. Some of them include:TVET institutions must regularly review and update their curricula to ensure that they remain relevant to the current and future needs of the labor market and thatTVET institutions must invest in modern infrastructure, equipment, and facilities to provide students with access to cutting-edge technologies and resources. This is in line with the findings of Bergmann and Sams (2012) who stated that TVET institutions should establish processes for regularly reviewing and updating competency indicators to ensure that they remain relevant and responsive to changing industry needs. Charu and Saroj (2023) also supported the findings by stating that in order to embrace innovation for competency development, TVET institutions must embrace innovation and focus on developing the competencies that are in demand in the global workforce to remain relevant and effective in the twenty-first century. This requires a shift in teaching methods, curricula, and assessment practices to ensure that TVET programs are aligned with the needs of the labor market and the evolving expectations of learners.

The findings from Table 3,revealed how TVET programmes will contribute to sustainable development in the society. Some of them include: TVET programmes can teach students about sustainable practices and technologies in fields such as renewable energy, eco-friendly construction, and sustainable agriculture. By providing practical, hands-on training, TVET programmes help students to develop the skills and knowledge needed to work in green industries or to start their own environmentally-conscious businesses. Schröder (2019) gave a typical example of a successful TVET program that promotes both economic development and sustainable development program in Australia.

The program was developed by the Australian government in partnership with industry, education and training providers, and community organizations. The Green Skills programme aims to build the skills and knowledge of workers in the clean energy and sustainability sectors, with a focus on meeting the needs of small and medium-sized enterprises (SMEs). Such programme can be implemented in Nigeria to help TVET graduates who venture in SMEs. It could also help to provide training and education in areas such as renewable energy, energy efficiency, and waste management. Also,Gbadegbe et al, (2023) noted that in terms of sustainable development, TVET programmes has helped to promote the adoption of clean energy and sustainability practices in Small and Medium-Sized Enterprises (SMEs) in Ghana; Which has also contributed to the reduction of greenhouse gas emissions and the protection of the environment. In addition, the program has focused on building the capacity of SMEs to adopt these practices, which has helped to ensure that these businesses are able to continue to operate in a sustainable manner over the long term. The above-mentioned programmes could also be adopted and implemented to help Nigerian SMEs.

Conclusions

The study was carried out to ascertain how to enhance the integration of emerging technologies in technical vocational education and training (TVET) programmes for sustainable development. The study revealed that some of the emerging technologies which should be integrated in TVET programmes include, the use of smartboards, chatbots, Web 2.0 technologies such as Blogs, Wikis, Social Bookmarking tools, Virtual Worlds, Podcasts, and Various educational games. Others include; Synchronous instruction technologies such as flipped classrooms, Blackboard Collaborate, Skype, Smart Boards and Panop to. Based on the findings of the study, TVET programmes contribute to sustainable development in the society byto creating a workforce that is equipped with the skills and knowledge to contribute to the transition to a more sustainable economy, fostering innovation and entrepreneurship by providing individuals with the skills and knowledge they need to start and grow their own businesses.This study demonstrates that the future of technical vocational education and training (TVET) in Nigeria will be significantly influenced by two key factors: mastery of technological tools using technologically driven instructional approaches and teachers' technological knowledge and abilities.

Therefore, the effective integration of emerging technologies and teachers' proficiency in technological skills will play a pivotal role in shaping the trajectory of TVET. A technologically focused teaching strategy would outperform conventional teaching techniques in helping students develop their skills and better meet the expectations of the present generation of youngsters.

Recommendations

The following recommendations were made from the findings of the study:

1. The study calls on teachers to master and apply emerging technological tools in their lesson delivery. TVET teachers should be equipped with these technological factors to effectively incorporate technology into teaching TVET courses. This will enhance Technical and Vocational Education and Training (TVET) delivery and promote technology-inclusive TVET across all TVET disciplines.
2. Funding to TVET institutions by stakeholders should be taken seriously and should not be diverted or misappropriated so that they can be effectively utilized for the acquisition and provision of emerging technologies for teaching and learning.
3. TVET institutions must adapt their programs to prepare students for the emerging technologies and industries.

Therefore, TVET institutions must incorporate digital literacy and advanced digital skills into their programs, equipping students with the necessary competencies to succeed in the digital age.

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