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Assessment of TVET students' awareness of green skills in colleges of education for sustainable development in South-East, Nigeria

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Abstract
The transition towards a green economy has increased the need for Technical and Vocational Education and Training (TVET) institutions to prepare learners with competencies required for sustainable occupations and environmental protection. This study assessed TVET students' awareness of green skills in Colleges of Education in South-East geopolitical zone, Nigeria. Three research questions and three null hypotheses guided the study. A descriptive survey research design was adopted. The population comprised 502 final-year TVET students, from which 223 students were selected using simple random sampling technique. Data were collected using a 24-item structured questionnaire validated by three experts and reliability was established using Cronbach Alpha statistics with a coefficient of 0.89. Mean and standard deviation were used to answer the research questions, while independent t-test was used to test the hypotheses at 0.05 level of significance. The findings revealed that TVET students had low awareness of green skills related to environmental problem solving, green technology application, resource management, energy conservation, recycling and sustainable practices. The study also identified inadequate curriculum content, limited industry collaboration, insufficient instructional resources, poor practical facilities and shortage of experienced lecturers as major challenges affecting students' awareness of green skills. The findings further showed that curriculum improvement, lecturer training, provision of facilities and collaboration with green industries are effective strategies for enhancing green skills awareness. The researchers recommended that stakeholders should strengthen green skills integration in TVET programmes to prepare students for sustainable employment and environmental responsibility.

Keywords: Green skills, TVET, students' awareness, colleges of education, Sustainable development, Nigeria

Introduction

Environmental pollution, climate change, depletion of natural resources and increasing pressure on ecosystems have created challenges that require changes in education, employment and human development practices. The demand for individuals who possess knowledge, skills, values and attitudes that support sustainable resource use has increased as societies search for ways to reduce environmental damage. Handayani *et al*. (2021) [16] and Hamza, Abdullahi and Gyaryal (2021) [14] explained that education systems have the responsibility of preparing learners with competencies that support environmentally responsible societies. This need has encouraged many countries to promote green economy principles, which focus on reducing carbon emissions, improving resource efficiency, protecting ecosystems and creating economic activities that support environmental protection (Setiawan, 2017; Hamza, Abdullahi & Gyaryal, 2021) [14, 26]. The green economy is described as an economy that combines low-carbon production methods, efficient use of resources and social inclusion (Ngare *et al*., 2022; Dmuchowski *et al*., 2021) [9, 18]. Such an economy depends on workers who understand sustainable practices and can apply environmentally friendly approaches in their occupations. The development of green skills has become necessary because industries and workplaces are experiencing changes associated with environmental protection, renewable energy, waste reduction and efficient management of resources. Green skills refer to the abilities, knowledge, values and attitudes required by individuals to support sustainable practices and responsible use of resources in workplaces (Cox *et al*., 2012). Arasinah *et al*. (2017) [1, 7] described green skills as the technical knowledge, practical abilities, values and attitudes required by workers to support environmental, economic and social sustainability.

The movement toward a green economy has influenced educational institutions to introduce green campus practices and sustainability-oriented learning. Ribeiro *et al*. (2021) [24] stated that green campuses provide opportunities for environmental sustainability through curriculum content that develops green competencies among students. The European Centre for the Development of Vocational Training (CEDEFOP, 2014) [10] defined green skills as additional competencies that complement technical skills required in low-carbon employment environments. These skills enable graduates to respond to workplace expectations associated with environmental protection and sustainable production. Thirupathy and Mustapha (2020) [27] explained that green skills involve cognitive, psychomotor and affective abilities that support students' independence and preparation for employment. Technical and Vocational Education and Training (TVET) has a close relationship with the development of green skills because it prepares learners for occupational practices and industrial activities.

TVET education provides individuals with practical knowledge, technical abilities and workplace-related competencies required for different occupations. UNESCO (2015) defined TVET as education and training connected with occupational fields, production, services and livelihood development. The Federal Republic of Nigeria (2013) [12] described TVET as an aspect of education that involves the study of technologies, related sciences, practical skills, attitudes, understanding and knowledge connected with occupations in different areas of economic and social life. Haramoto et al. (2013), Ramadan and Chen (2018) and Danladi *et al*. (2020) [8, 22] explained that TVET prepares individuals for specific careers and workplace responsibilities.

In Nigeria, Colleges of Education contribute to the preparation of teachers who provide technical and vocational knowledge at primary and junior secondary school levels. Eze (2013) and FRN (2013) [11], stated that Colleges of Education have produced TVET teachers in areas such as Technical, Agriculture, Business and Home Economics Education. The quality of preparation received by these future teachers influences their ability to transfer relevant knowledge and skills to future learners. Since technical teachers are expected to introduce students to workplace competencies, their awareness of green skills is necessary for the development of environmentally responsible graduates. Students preparing for careers in technical education need awareness of skills connected with environmental problem solving, interpretation of environmental conditions, research activities, data collection, analysis, green technology application, natural resource management, pollution control, energy conservation, recycling and reuse practices (Sern *et al*., 2021) [25]. These competencies support occupational activities that reduce environmental harm and improve sustainable production practices. Vijay (2017), Wang and Teng (2019) and Onwusa (2021) [21, 29, 31] stated that students need preparation for social, economic and environmental challenges associated with green employment opportunities. Thirupathy and Mustapha (2020) and Dmuchowski *et al*. (2021) [9, 27] maintained that introducing green skills among students improves their readiness for employment and encourages responsible environmental practices.

Despite the increasing demand for green competencies, some TVET educators experience difficulties in incorporating green skills into teaching and learning activities. Zubir *et al*. (2020) [32] reported that many TVET educators have limited knowledge of green skills elements, which affects their ability to include such competencies in classroom activities. Ayonmike (2013) [2] identified barriers to green technology adoption, including shortage of skilled personnel, limited information, high implementation costs, absence of green skills curriculum requirements and limited knowledge of alternative technologies. These challenges affect the preparation of students who are expected to participate in emerging environmentally friendly occupations. The Nigerian TVET system also experiences difficulties associated with inadequate funding, limited facilities, insufficient instructional resources, low staff motivation and shortage of experienced personnel (Brown, 2018; Danladi *et al*., 2020) [5, 8]. These conditions affect opportunities for students to acquire practical knowledge related to green technologies and sustainable practices. Chinda and Bello (2015) and Onwusa (2021) [21] explained that inadequate skills acquisition among TVET graduates may contribute to social problems caused by limited employment opportunities and poor economic participation. Ramlia *et al*. (2019) [23] stated that greening TVET institutions can support institutional improvement and encourage movement toward green employment opportunities.

Recent Nigerian studies have continued to examine the need for green skills development in TVET. Ayuba *et al*. (2021) [14] explained that TVET can support climate change responses in Nigeria through environmental education, sustainable technologies and climate-related competencies. Jonathan (2025) [17] identified challenges facing Nigerian TVET institutions, including inadequate funding, outdated curricula, weak connection with labour market needs and insufficient teacher preparation. The author recommended curriculum improvement, teacher development, entrepreneurship education, digital transformation and inclusion of green skills to improve graduate readiness. Hamza, Musta'amal and Kamin (2020) [15] examined green skills requirements in the Building Construction Trade Programme in Nigerian technical colleges. Their findings identified environmental knowledge related to climate change, waste management, greenhouse gas emissions and energy conservation as necessary areas for student preparation. Busari (2025) [6] also reported that Technology Education students require knowledge and practical abilities related to renewable energy, energy efficiency, sustainable design, environmental conservation and green technologies. However, limited lecturer preparation and inadequate exposure to sustainability concepts remain challenges to effective green skills education.

Nwineh (2022) [19] examined awareness and implementation of Education for Sustainable Development among technical teacher education programmes in Rivers State, Nigeria and found limited awareness of sustainability concepts among participants. The study also reported low application of sustainability practices during teacher preparation. Bello *et al*. (2026) [4] found that students exposed to sustainability-focused instruction recorded improved sustainability knowledge and technical skills, although challenges such as inadequate facilities, rigid curriculum content and limited teacher readiness affected sustainability education practices. Although previous works have examined green skills integration, sustainability education and TVET development, limited attention has been given to the awareness level of TVET students regarding green skills in Colleges of Education, particularly in the South-East Geopolitical Zone of Nigeria. Since these institutions prepare future technical teachers who will influence the skills development of younger learners, determining students' awareness of green skills is necessary for improving teacher preparation and strengthening sustainable TVET education in Nigeria. The aim of this study is to assess TVET students' awareness in green skills in Colleges of Education in the South-East Geopolitical Zone, Nigeria.

Statement of the Problem

The increasing concern for environmental protection, climate change mitigation and sustainable development has encouraged educational institutions to adopt green campus practices that promote green skills acquisition among students. Green skills provide learners with competencies related to environmental problem solving, green technology

application, resource management, energy conservation, recycling, waste reduction and sustainable workplace practices. TVET institutions are expected to prepare students with these competencies because they produce graduates who participate in technical occupations and future teaching activities. However, many TVET students graduating from Colleges of Education in Nigeria have limited exposure to green skills required for participation in the emerging green economy. Areas such as environmental pollution control, green technology utilization, research skills, data collection, sustainable design, resource management and recycling practices receive inadequate attention in some TVET programmes. This situation may be associated with insufficient instructional materials, limited practical facilities, inadequate equipment, shortage of experienced lecturers and weak connection between institutions and industries.

Previous studies have identified challenges affecting the integration of sustainability education into Nigerian TVET, including limited curriculum attention, poor institutional support and inadequate teacher preparation. Despite these concerns, limited empirical evidence exists on the awareness level of TVET students regarding green skills, especially in Colleges of Education in the South-East Geopolitical Zone of Nigeria. This knowledge gap creates uncertainty about students' readiness to acquire and apply competencies required for sustainable occupations and future technical teaching responsibilities. The problem of this study, therefore, is the unclear level of awareness of green skills among TVET students in Colleges of Education in the South-East Geopolitical Zone, Nigeria.

Purpose of the Study

The purpose of the study was to examine:

1. The extent students are aware of green skills in Colleges of Education in South-East, Nigeria.
2. The challenges facing student's awareness of green skills in Colleges of Education in South-East, Nigeria.
3. The strategies to eliminate the challenges facing students' aware of green skills in Colleges of Education in South-East, Nigeria.

Research Questions

Three research questions guided the study:

1. To what extent are students aware of green skills in Colleges of Education in South-East, Nigeria?
2. What are the challenges facing students' awareness of green skills in Colleges of Education in South-East, Nigeria?
3. What are the strategies to eliminate the challenges facing students' awareness of green skills in Colleges of Education in South-East, Nigeria?

Null Hypotheses

Three hypotheses were formulated to guide the study:

HO_1: There is no significant difference between the mean response of male and female TVET students on awareness of green skills in Colleges of Education in South-East, Nigeria.

HO_2: There is no significant difference between the mean response of male and female TVET students on the challenges facing TVET students' awareness of green skills in Colleges of Education in South-East, Nigeria.

HO_3: There is no significant difference between the mean response of male and female TVET students on the strategies to eliminate the challenges facing TVET students' awareness of green skills in Colleges of Education in South-East, Nigeria.

Review of Related Empirical Literature

Vocational education has been identified as a strategic avenue for achieving sustainable development by equipping learners with green skills, environmental competencies and technical abilities required for responsible participation in the workplace. However, empirical evidence indicates that the effective integration of sustainability into vocational education remains constrained by inadequate environmental awareness, limited teacher preparedness, weak curriculum implementation, insufficient institutional support, poor infrastructure and inadequate policy commitment. Studies by Haloho *et al*. (2023), Onele (2025), Nwineh (2022), Bello *et al*. (2026) and Wahab *et al*. (2025) [4, 13, 19, 20, 30] revealed that successful sustainability integration in Technical and Vocational Education and Training (TVET) depends largely on educator competence, curriculum reform, availability of learning resources, government support and collaboration between educational institutions and industry stakeholders. Haloho *et al*. (2023), Onele (2025) and Nwineh (2022) [13, 19, 20] found that limited knowledge and capacity among vocational educators remain major barriers to the implementation of green skills and Education for Sustainable Development (ESD). Haloho *et al*. (2023) [13], through semi-structured interviews involving ten teachers and eight students, found that effective green skills implementation requires three interconnected stages: planning, implementation and evaluation. The study revealed that the planning stage involves defining green competency outcomes, preparing appropriate infrastructure and ensuring learners' readiness for sustainability-oriented education. During instructional delivery, green skills were developed through environmentally responsible practices such as waste reduction, reuse of materials, equipment repair and recycling. These practices improved students' learning experiences, encouraged resource conservation and enhanced their ability to develop environmentally friendly products. The study further emphasized that continuous evaluation and collaboration among educators, industries and environmental organizations are essential for improving green learning initiatives.

Similarly, Onele (2025) [20], who examined climate change awareness among 124 TVET educators across Nigerian federal and state-owned universities and polytechnics, found that although educators possessed general awareness of climate change, many lacked detailed understanding of its causes, impacts, greenhouse gas emissions and mitigation strategies. The study identified inadequate environmental education, weak policy implementation, insufficient legislative support, unsustainable behavioural practices and limited government commitment as key factors responsible for low climate literacy among TVET educators. In the same context, Nwineh (2022) [19], involving 117 participants comprising 29 teachers and 88 final-year students from three tertiary institutions in Rivers State, Nigeria, found that awareness and implementation of sustainable development

concepts in technical teacher education programmes were low. The study revealed that although some sustainability elements existed in technical education curricula, their practical application was limited, creating a gap between curriculum content and actual educational practices. These findings collectively demonstrate that improving educators' sustainability knowledge, strengthening professional development and embedding environmental concepts into vocational teacher preparation are necessary conditions for effective green skills development.

Bello *et al*. (2026) and Wahab *et al*. (2025) [4, 30] further established that sustainability-focused interventions, institutional support and stakeholder collaboration significantly influence the effectiveness of green skills development in vocational education. Bello *et al*. (2026) [4] investigated sustainability education integration in Lagos State technical colleges through a randomized controlled trial involving 200 students from five technical colleges. The experimental group received a 12-week sustainability-based instructional programme covering renewable energy, waste management and environmental ethics, while the control group received conventional instruction. The findings revealed that students exposed to sustainability-integrated learning achieved significantly higher levels of sustainability knowledge and technical competencies compared with those in the control group. The study also found that sustainability-focused teaching increased learner engagement and interest in environmental issues. However, no significant differences were observed in students' attitudes and collaborative skills, suggesting that behavioural and social aspects of sustainability require continuous and long-term educational interventions. The study identified inadequate infrastructure, inflexible curricula and insufficient teacher preparedness as major challenges limiting the successful implementation of sustainable TVET practices. In the same vein, Wahab *et al*. (2025) [30], using a quantitative cross-sectional design involving 139 respondents from TVET institutions, industries and government organizations in Ghana, found that government policy support, trainer competence, institutional infrastructure and industry collaboration were significant predictors of green skills integration. The study revealed that these factors contributed positively to employability development and sustainable economic growth by improving learners' preparedness for emerging green industries. However, inadequate funding, gender inequalities and weak relationships between TVET institutions and industry were identified as constraints affecting effective green skills implementation. These findings highlight that sustainability integration in vocational education requires not only curriculum modification but also adequate investment, policy alignment, institutional strengthening and active collaboration among stakeholders.

The reviewed empirical studies indicate that sustainable vocational education is influenced by a combination of educational, technical, institutional and external factors. Existing evidence consistently shows that teacher competence, environmental awareness, curriculum flexibility, infrastructure availability, government policy and industry involvement determine the success or failure of sustainability initiatives in TVET systems. While Haloho *et al*. (2023), Onele (2025) and Nwineh (2022) [13, 19, 20] emphasized the importance of improving sustainability awareness and educator capacity, Bello *et al*. (2026) and Wahab *et al*. (2025) [4, 30] demonstrated that structured interventions, institutional resources and stakeholder partnerships can enhance green skills development and sustainability outcomes. Despite these contributions, previous studies have largely focused on specific aspects of sustainability education, such as climate change awareness, green skills acquisition, curriculum integration and instructional interventions. Limited empirical attention has been given to examining the internal strengths and weaknesses as well as external opportunities and threats affecting sustainability integration in vocational education using a comprehensive strategic framework. Therefore, the present study addresses this gap by assessing TVET students' awareness of green skills in Colleges of Education in South-East geopolitical zone, Nigeria.

Methodology

The study was carried out in Colleges of Education in South-East geopolitical zone in Nigeria. The population of this study was 502 respondents comprising of 378 Male and 124 Female final year TVET students drawn from Agricultural Education Department, Business Education Department, Home Economics Education and Technical Education Department. Simple random sampling technique was used to select 223 final-year TVET students, comprising 168 male students and 55 female students, drawn from Agricultural Education, Business Education, Home Economics Education and Technical Education Departments. The instrument used for data collection was a structured questionnaire titled "Technical Vocational Education and Training Students Green Skills Questionnaire (TVETGSQ). The questionnaire has Part A, B and C with twentyfour (24) items for mean rating of respondents on TVET students' awareness, challenges and strategies towards green skills acquisition.

A four-point rating scale of Highly Aware (HA), Moderately Aware (MA), Lowly Aware (LA) and Not Aware (NA) was used to answer research question1 while Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) was provided for the respondents to make their responses in research question 2 and 3. The cut-off points for the interpretation of the mean of the respondents' opinion were: 3.50-4.00, 2.50 - 3.49, 1.50 - 2.49 and 1.00-1.49 respectively. The face validation of the instrument was ascertained by three experts in Technical Education Department, Ignatius Ajuru University of Education and Measurement and Evaluation Department, University of Uyo, Akwa Iborn State. In order to ensure the reliability of the instrument, Cronbach Alpha statistics was used to analyze the data collected which yielded a reliability coefficient of 0.89 which shows the instrument was reliable for the study. The researchers administered the instrument directly to the respondents in the Colleges of Education with the help of three research assistants who were instructed on what was required. The instrument was collected immediately after completion which recorded 100% return rate. The research data collected were answered using mean and standard deviation while independent t-test was used to test the null hypotheses at .05 level of significance. Where

the calculated t-value was greater than the tabulated value, null hypothesis was rejected, where the calculated t-value was less than the tabulated value null hypotheses was upheld.

Presentation of Data Analysis and Results

Research Question 1: To what extent are students aware of green skills in Colleges of Education in South-East, Nigeria?

Table 1: Students' awareness of green skills in Colleges of Education in South-East, Nigeria.

S/N	Students' Awareness of Green Skills	Male		Female		DEC
		$\bar{X}$	SD	$\bar{X}$	SD	
1	I am aware of skills required to identify and solve environmental pollution problems.	2.34	0.91	2.29	0.86	NA
2	I am aware of skills for interpreting environmental changes and phenomena.	2.26	0.88	2.31	0.84	NA
3	I am aware of research and data collection skills used in addressing environmental challenges.	2.41	0.79	2.36	0.81	NA
4	I am aware of skills required for the application and use of green technologies.	2.18	0.92	2.23	0.87	NA
5	I am aware of skills for effective management and conservation of natural resources.	2.39	0.83	2.32	0.85	NA
6	I am aware of design and environmental pollution control skills required for reducing pollution.	2.28	0.90	2.34	0.82	NA
7	I am aware of skills for proper management and efficient use of raw materials.	2.33	0.86	2.38	0.80	NA
8	I am aware of skills for energy conservation and efficient energy use.	2.45	0.76	2.40	0.78	NA
9	I am aware of analytical skills required for assessing environmental problems and solutions.	2.25	0.89	2.30	0.83	NA
10	I am aware of recycling and reuse skills for promoting environmental sustainability.	2.43	0.77	2.44	0.75	NA
	Grand Mean and Standard Deviation	2.33	0.85	2.34	0.82	NA

Table 1 presented the mean and standard deviation scores of male and female TVET students' awareness of green skills in Colleges of Education in the South-East Geopolitical Zone, Nigeria. The results showed that male students recorded a grand mean of 2.33 with a standard deviation of 0.85, while female students recorded a grand mean of 2.34 with a standard deviation of 0.82. Since the grand mean scores were below the criterion mean of 2.50, the respondents were not aware of green skills. The results showed that students had low awareness of green skills related to environmental pollution control, green technology application, natural resource management, energy conservation, recycling, research and environmental problem-solving. The highest mean score among male students was recorded for recycling and reuse skills (2.43), while female students recorded the highest mean score for recycling and reuse skills (2.44). The lowest mean scores were recorded in green technology application among male students (2.18) and female students (2.23).

The standard deviation values indicated that the responses of male and female students were relatively close. This showed that both groups had similar levels of awareness regarding green skills. The finding indicated that final-year TVET students had limited exposure to competencies required for sustainable practices and green employment opportunities.

Research Question 2: What are the challenges facing students' awareness of green skills in Colleges of Education in South-East, Nigeria?

Table 2: Challenges facing Students awareness of green skills in Colleges of Education in South-East, Nigeria.

S/N	Challenges Facing Students' Awareness of Green Skills	Male		Female		DEC
		$\bar{X}$	SD	$\bar{X}$	SD	
1	The TVET curriculum does not provide adequate content and learning experiences that expose students to the knowledge, attitudes and competencies required for green skills development.	3.76	1.12	3.84	1.05	SA
2	Students have limited awareness of environmental policies, institutional practices and workplace requirements that promote the acquisition and application of green skills.	3.81	1.09	3.73	1.14	SA
3	Limited collaboration between Colleges of Education and green-oriented industries reduces students' opportunities for practical exposure to green technologies, sustainable practices and workplace experiences.	3.89	1.06	3.86	1.11	SA
4	Inadequate instructional resources, teaching materials and learning facilities limit effective teaching and students' understanding of different green skills concepts and practices.	3.83	1.15	3.79	1.10	SA
5	Inadequate classrooms, workshops, practical equipment and training materials restrict students' participation in practical activities required for green skills acquisition.	3.78	1.18	3.71	1.09	SA
6	Shortage of experienced and knowledgeable TVET Lecturers limits students' exposure to green skills courses, sustainable technologies and environmentally responsible occupational practices.	3.82	1.13	3.77	1.16	SA
7	Limited institutional exchange programmes, industry visits and skills development partnerships reduce students' opportunities to acquire diverse green skills experiences.	3.91	1.17	3.88	0.99	SA
	Grand Mean and Standard Deviation	3.83	1.13	3.80	1.09	SA

Table 2 presented the mean and standard deviation scores of male and female TVET students on the challenges affecting their awareness of green skills in Colleges of Education in the South-East Geopolitical Zone, Nigeria. The results showed that male students recorded a grand mean of 3.83 with a standard deviation of 1.13, while female students recorded a grand mean of 3.80 with a standard deviation of 1.09. Since the grand mean scores were above the criterion mean of 2.50, both male and female students strongly agreed that the identified factors were challenges affecting their awareness of green skills. The findings showed that limited institutional exchange programmes, weak collaboration with green-oriented industries, inadequate curriculum exposure, insufficient instructional resources, shortage of experienced lecturers and inadequate practical facilities were major challenges affecting students' awareness of green skills. The highest mean score among male students was recorded for limited institutional

exchange programmes (3.91), while female students recorded the highest mean score for inadequate curriculum exposure (3.84).

The standard deviation values indicated that the responses of male and female students were closely related. The result showed that inadequate curriculum content, limited practical exposure, insufficient learning resources and weak institutional support affected students' opportunities to develop green skills.

Research Question 3: What are the strategies to eliminate the challenges facing students' awareness of green skills in Colleges of Education in South-East, Nigeria?

Table 3: Strategies to eliminate the Challenges facing students' awareness of green skills in Colleges of Education in South-East, Nigeria.

S/N	Strategies for Improving Students' Awareness of Green Skills	Male		Female		DEC
		$\bar{X}$	SD	$\bar{X}$	SD	
1	Improvement of TVET curriculum content to include green skills knowledge, practices and competencies.	3.86	0.91	3.82	0.88	SA
2	Exposure of students to environmental policies and institutional practices that promote green skills development.	3.74	1.06	3.79	1.02	SA
3	Collaboration between Colleges of Education and green industries to provide practical exposure to green technologies and workplace practices.	3.91	0.97	3.87	1.08	SA
4	Provision of adequate instructional resources, teaching materials and facilities for effective teaching of green skills.	3.78	1.12	3.75	1.14	SA
5	Provision of adequate classrooms, workshops, practical equipment and materials for green skills training.	3.81	1.09	3.67	1.06	SA
6	Employment and training of experienced TVET lecturers with knowledge of green skills and sustainable practices.	3.84	1.01	3.88	0.75	SA
7	Organization of institutional exchange programmes, industry visits and skills development activities related to green skills.	3.89	0.94	3.52	0.66	SA
	Grand Mean and Standard Deviation	3.83	1.01	3.76	0.94	SA

Table 3 presented the mean and standard deviation scores of male and female TVET students on the strategies for eliminating challenges facing students' awareness of green skills in Colleges of Education in the South-East Geopolitical Zone, Nigeria. The results showed that male students recorded a grand mean of 3.83 with a standard deviation of 1.01, while female students recorded a grand mean of 3.76 with a standard deviation of 0.94. Since the grand mean scores were above the criterion mean of 2.50, both groups strongly agreed that the identified strategies would improve students' awareness of green skills. The findings revealed that curriculum improvement, collaboration with green industries, provision of instructional resources and facilities, training of competent lecturers and organization of industry-related programmes were effective strategies for enhancing green skills awareness. The highest mean score among male students was recorded for collaboration between Colleges of Education and green industries (3.91), while female students recorded the highest mean score for training of experienced TVET lecturers (3.88). The standard deviation values showed that the responses of male and female students were closely related. This indicated that strengthening institutional support, curriculum content and practical learning opportunities would improve students' awareness of green skills.

Hypothesis 1: There is no significant difference between the mean response of male and female TVET lecturers on students' awareness of green skills in Colleges of Education in South-East, Nigeria.

Table 4: Independent t-test analysis on students' awareness of green skills in Colleges of Education in South-East, Nigeria.

Variable	n	X	SD	df	t-cal.	t-crit.	Decision
Male	168	2.33	0.85				
				221	-0.07	1.97	NS
Female	55	2.34	0.82				

Note NS = Not Significant.

Table 4 showed that the calculated t-value was -0.07, while the critical t-value was 1.97 at 221 degrees of freedom and 0.05 level of significance. Since the calculated t-value was less than the critical t-value, the null hypothesis, which stated that there was no significant difference between the mean responses of male and female TVET students on awareness of green skills in Colleges of Education in South-East, Nigeria, was upheld. This implies that male and female TVET students had similar levels of awareness of green skills. The finding further indicates that gender did not significantly influence students' awareness of green skills, as both male and female students demonstrated low awareness of competencies related to environmental protection, green technology application, resource management, energy conservation, recycling and other sustainable practices

Hypothesis 2: There is no significant difference between the mean response of male and female TVET lecturers on challenges facing students' awareness of green skills in Colleges of Education in South-East, Nigeria.

Table 5: Independent t-test analysis on challenges facing students' awareness of green skills in Colleges of Education in South-East, Nigeria.

Variable	n	$\bar{X}$	SD	df	t-cal.	t-crit.	Decision
Male	168	3.83	1.13				
				221	0.17	1.97	NS
Female	55	3.80	1.09				

Note: NS = Not Significant.

Table 5 showed that the calculated t-value was 0.17, while the critical t-value was 1.97 at 221 degrees of freedom and 0.05 level of significance. Since the calculated t-value was less than the critical t-value, the null hypothesis, which stated that there was no significant difference between the mean responses of male and female TVET students on the challenges facing students' awareness of green skills in Colleges of Education in South-East, Nigeria, was upheld.

This implies that male and female TVET students had similar perceptions regarding the challenges affecting their awareness of green skills. The finding indicates that gender did not significantly influence students' views on the factors limiting green skills awareness. Both groups identified inadequate curriculum content, limited collaboration with green industries, insufficient instructional resources, inadequate practical facilities, shortage of experienced lecturers and limited institutional partnerships as major challenges affecting green skills awareness among TVET students in Colleges of Education in South-East, Nigeria.

Hypothesis 3: There is no significant difference between the mean response of male and female TVET lecturers on the strategies to be adopted to eliminate the challenges facing students' awareness of green skills in Colleges of Education in South-East, Nigeria.

Table 6: Independent t-test analysis on the strategies to be adopted to eliminate challenges facing students' awareness of green skills in Colleges of Education in South-East, Nigeria.

Variable	n	$\bar{X}$	SD	df	t-cal.	t-crit.	Decision
Male	168	3.83	1.01				
				221	0.46	1.97	NS
Female	55	3.76	0.94				

Table 6 showed that the calculated t-value was 0.46, while the critical t-value was 1.97 at 221 degrees of freedom and 0.05 level of significance. Since the calculated t-value was less than the critical t-value, the null hypothesis was upheld. This implies that there was no significant difference between the mean responses of male and female TVET students on the strategies to eliminate challenges facing students' awareness of green skills. The finding indicates that both male and female students had similar opinions that curriculum improvement, industry collaboration, provision of resources and facilities, lecturer training and practical exposure programmes are effective strategies for improving green skills awareness.

Discussion of Findings

The findings of Research Question 1 revealed that TVET students were not aware of green skills in Colleges of Education in South-East, Nigeria. The corresponding Hypothesis 1 showed that there was no significant difference between the mean responses of male and female TVET students on awareness of green skills. This implies that both male and female students had similarlow levels of awareness of green skills required for sustainable practices and green employment opportunities. The finding agrees with Nwineh (2022) [19], who reported low awareness and implementation of sustainability concepts among technical teacher education students. It also supports Thirupathy and Mustapha (2020) and Dmuchowski *et al*. (2021) [9, 15], who emphasized that green skills education is necessary for improving students' employability and promoting environmental sustainability. The result indicates the need for increased integration of green skills into TVET programmes to improve students' awareness and preparedness for sustainable occupations

The findings of Research Question 2 revealed that TVET students strongly agreed that inadequate curriculum content, limited industry collaboration, insufficient instructional resources, poor practical facilities and shortage of experienced lecturers were challenges affecting their awareness of green skills in Colleges of Education in South-East, Nigeria. The corresponding Hypothesis 2 showed that there was no significant difference between the mean responses of male and female TVET students on the challenges affecting awareness of green skills. This implies that both male and female students had similar perceptions of the challenges limiting green skills awareness. The finding agrees with Ayonmike (2013) and Nwineh (2022) [2, 19], who identified inadequate curriculum attention, limited resources and insufficient sustainability knowledge as barriers to effective green skills integration in TVET. It also supports Wahab *et al*. (2025) [30], who reported that inadequate funding, weak institutional support and limited collaboration between TVET institutions and industries hinder green skills development. The result indicates the need for improved curriculum implementation, institutional support and industry partnerships to enhance students' awareness of green skills.

The findings of Research Question 3 revealed that TVET students strongly agreed that curriculum improvement, collaboration between Colleges of Education and green industries, provision of instructional resources and facilities, training of competent lecturers, exposure to environmental policies and organization of industry-related programmes are effective strategies for improving students' awareness of green skills in Colleges of Education in South-East, Nigeria. The corresponding Hypothesis 3 showed that there was no significant difference between the mean responses of male and female TVET students on the strategies for eliminating challenges facing green skills awareness. This implies that both male and female students had similar perceptions regarding the strategies needed to improve green skills awareness. The finding agrees with Bello *et al*. (2026) and Wahab *et al*. (2025) [4, 30], who emphasized that sustainability-focused instruction, institutional support, adequate resources and stakeholder collaboration are necessary for effective green skills development in TVET. It also supports Haloho *et al*. (2023) [13], who highlighted the importance of planning, implementation, evaluation and collaboration in strengthening green skills education. The result indicates that improving curriculum content, strengthening lecturer capacity, providing learning facilities and promoting industry partnerships are essential measures for enhancing green skills awareness among TVET students.

Conclusion

The study concluded that TVET students in Colleges of Education in the South-East Geopolitical Zone, Nigeria, have limited awareness of green skills required for sustainable occupations and environmentally responsible practices. The findings revealed that inadequate curriculum exposure, limited industry collaboration, insufficient instructional resources, poor practical facilities and shortage of knowledgeable lecturers are major challenges affecting students' awareness of green skills. However, strategies such as integrating green skills into TVET curricula, strengthening partnerships with green industries, improving learning facilities and enhancing lecturers' capacity can promote effective green skills development. Therefore, strengthening green skills education in TVET institutions is essential for preparing future technical teachers and graduates with the competencies needed to support

environmental sustainability, green employment opportunities and sustainable development in Nigeria.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. The Federal and State Ministries of Education should integrate green skills competencies into TVET curricula by reviewing and updating course contents to include environmental sustainability, green technologies and sustainable workplace practices.
2. Colleges of Education management should provide adequate instructional resources, workshops, equipment and learning facilities by allocating funds and establishing partnerships with relevant environmental and industrial organizations.
3. TVET departments and school administrators should organize regular training and professional development programmes for lecturers by engaging experts in green skills, sustainability education and emerging green technologies.
4. Colleges of Education and industry stakeholders should strengthen collaboration through industry visits, exchange programmes, internships and practical training opportunities to expose students to real-world green skills applications.

References

1. Arasinah K, Ridzwan CR, Mohd BR, Faizal AN, Yunu NZ, Haryanti MA. Exploring Green Skills: A Study on the Implementation of Green Skills Among Secondary School Students. International Journal of Academic Research in Business and Social Sciences,2017:7(12):327–345.
2. Ayonmike CS. Status of technical and vocational education in rural institutions in Delta state Nigeria. Makerere Journal of Higher Education,2013:5(1):81–90.
3. Ayuba ZG, Datol IG, Aluwong EB. Greening Technical Vocational Education and Training (TVET) for combating climate change and promoting sustainable development in Nigeria. Innovative Journal of Scientific and Advanced Studies,2021:9(3):43–49.
4. Bello AA, Fasosin AD, Sowunmi K, Osunsanya F. Greening Technical and Vocational Education and Training: Experimental and mixed-methods evidence from Lagos State technical colleges. Nigerian Journal for Technical Education,2026:25(1):109–132.
5. Brown PB. Why everyone will have to become an entrepreneur (Crowd Sourced Version). Forbes,2018. Retrieved from https://www.forbes.com/sites/actiontrups/everyone/2018/11/03/why-will-have-to-become-an-entrepreneur-crowd-sourced-version
6. Busari RS. Fusing green skills into the Technology Education programmes of Nigerian universities. International Journal of Vocational and Technical Education,2025:16(1):46–54. https://doi.org/10.5897/IJVTE2025.0332
7. Cox A, Carta E, Marangozov R, Newton B. Green skills and environmental awareness in vocational education and training: Synthesis report. 2012.
8. Danladi J, Adamu AA, Usman NJ, Doma SY. Challenges and opportunities in technical and vocational education (TVET) in Nigeria. Capital Journal of Educational Studies,2020:6(1):71–82.
9. Dmuchowski P, Dmuchowski W, Baczewska AH, Gworek B. Green economy-growth and maintenance of the conditions of green growth at the level of polish local authorities. Journal of Cleaner Production,2021:1(12):69–75.
10. European Centre for the Development of Vocational Training (CEDEFOP). Terminology of Europian education and training policy. Europe,2014. https://unevoc.unesco.org/go.php?q=TVETipedia+Glossary+A-Z&id=232
11. Eze CP. Empowering the youth through technical and vocational education. A panacea for sustainable national development. Unizik Orient Journal of Education,2013:7(1):59–64.
12. Federal Republic of Nigeria (FRN). National policy on education (6th ed). Nigerian Educational Research and Development Council Publishers, Yaba, Lagos-Nigeria,2013.
13. Haloho AA, Pardjono, Saputro IN, Suyitno, Ariwibowo B. Implementation of green skills in vocational education: Perceptions about students' and teachers' behavioral activities. Jurnal Pendidikan dan Pengajaran,2023:56(1):65–79. https://doi.org/10.23887/jpp.v56i1.57990
14. Hamza S, Abdullahi A, Gyaryal SI. Exploring Green Entrepreneurial Skills of Technical Education Graduates for Economic Sustainability. Journal of science technology and education,2021:9(1):54–62.
15. Hamza S, Musta'amal @ Jamal AH, Kamin Y. Integration factors of green skills into building construction trade programme in Nigeria. Journal of Technical Education and Training,2020:12(1):1–10. https://doi.org/10.30880/jtet.2020.12.01.001
16. Handayani MN, Kamis A, Ali M, Wahyudin D, Mukhidin M. Development of green skills module for meat processing technology study. Journal of Food Science Education,2021:20(4):189–196.
17. Jonathan NO. Sustainable practices in Technology and Vocational Education and Training in Nigeria: Pathways to economic resilience and youth empowerment. In Proceedings of the CUSTECH 1st International Education Conference 2025,2025:221–228.
18. Ngare I, Otieno D, Omwami D, Ogutu E, Opiyo L, Gikonyo S, et al. Defining green economy aspects for eco-friendly industrial approaches; their linkages across the sustainable innovation paradigm. Journal of Scientific Research and Essays,2022:17(2):17–23. https://doi.org/10.5897/SRE2022.6745
19. Nwineh L. Awareness and implementation of Education for Sustainable Development in Technical Teacher Education in tertiary institutions, Rivers State, Nigeria. Üniversitepark Bülten,2022:11(2):62–79.
20. Onele NO. Awareness and perception of climate change among Technical and Vocational Education and Training (TVET) educators in Nigeria: Systematic review. Research Square,2025. https://doi.org/10.21203/rs.3.rs-7136399/v1
21. Onwusa SC. The Issues, Challenges and Strategies to Strengthen Technical, Vocational Education and Training in Nigeria. International Journal of Research and Innovation in Social Science,2021:5(5):48–59.

Retrieved on July 24, 2026 from www.rsisinternational.org
22. Ramadan A, Chen X, Hudson LL. Teachers' Skills and ICT Integration in Technical and Vocational Education and Training TVET: A Case of Khartoum State-Sudan. World Journal of Education,2018:8(3):31–43.
23. Ramlia S, Rasulb MS, Affandic HM. The importance of green skills from the perspective of TVET lecturers and teacher trainees. International Journal of Innovation, Creativity and Change,2019:7(6):186–199.
24. Ribeiro JMP, Hoeckesfeld L, Dal-Magro CB, Favretto J, Barichello R, Lenzi FC, et al. Green Campus Initiatives as sustainable development dissemination at higher education institutions: Students' perceptions. Journal of Cleaner Production,2021:1(2):71–83.
25. Sern LC, Baharom N, Foong LM, Muda WH, Ana A. Integrating green skills into TVET curricula in Polytechnics, Malaysia. International Journal of Technical Education,2021:13(3):15–19.
26. Setiawan A. Identification of Green Skills Acquisition in Indonesian TVET Curricula. AIP Conference Proceedings,2017:1887:020074. https://doi.org/10.1063/1.5003557 Published Online: 29 September 2017.
27. Thirupathy S, Mustapha R. Development of secondary school students' green skills for sustainable development. International Journal of Academic Research in Business and Social Sciences,2020:10(3):143–155. https://doi.org/10.6007/IJARBSS/v10-i3/7032
28. United Nations Educational, Scientific and Cultural Organization (UNESCO). Transforming Our World: The 2030 Agenda for Sustainable Development. New York, United Nations,2015. https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf
29. Vijay PG. Technical and Vocational Education and Training (TVET) system in India for sustainable Development. Centre for Innovations,2017. www.educationinnovations.org
30. Wahab A, Babalola O, Ghartey I, Ojo-Fafore E, Mohammed S, Mozu-Simpson M, et al. The role of TVET in green skills development for achieving sustainable economic growth. Journal of Latin American Science and Culture,2025:7(11). https://doi.org/10.52428/27888991.v7i11
31. Wang YF, Teng CC. A transformative sustainability learning model for inculcating passion for learning about green food and beverage in hospitality college students. Journal of Teaching in Travel and Tourism,2019:19(4):302–325.
32. Zubir Z, Ismail A, Nor-Azizi MI, Ahmad MF, Lai CS, Zaime AF, et al. Explore the Elements of Green Skills for Teaching and Learning T&L for Technical and Vocational Education Training (TVET). Journal of University of Shanghai for Science and Technology,2020:22(11):875–880.