

Analysis of Technical Vocational Education and Training [TVET] of Girl Child for the Attainment of Sustainable Development Goal 4 in Nigeria

Oguejiofor Victor I

University of Nigeria

Mole Lilian C

lilian.mole@unn.edu.ng

University of Nigeria

Attah Blessing I

University of Nigeria

Bassey Njorkun N

University of Nigeria

Ojo Samson A

University of Nigeria

Ugwu Eunice I

University of Nigeria

Odimegwu Ann A

University of Nigeria

Shetima Abdullahi

University of Nigeria

Obe Pauline I.

University of Nigeria

Madu Maureen A.

University of Nigeria

Michael Onwumere

Alex-Ekwueme Federal University

Omego Godfrey N.

University of Nigeria

Udogu Kingsley C.

University of Nigeria

Eze Ogbonnaya O.

University of Nigeria

Chidiebere Codelia O.

Alex-Ekwueme Federal University

Ogbu Damian K.

University of Nigeria

Nwadi Calister L.

University of Nigeria

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Abstract

Achieving United Nations Sustainable Development Goal 4 inclusive, equitable, and quality lifelong learning remains a pressing challenge within sub-Saharan Africa. In Nigeria, widespread socioeconomic gaps and deep-rooted cultural norms disproportionately restrict the female from completing technical schooling. This study empirically evaluates the strategic role of Technical and Vocational Education and Training (TVET) as a tool to bridge these gaps. The study was conducted at Awgu Local Government Area with population 235 female students (aged 11–17) across four technical colleges in Mgbidi, Amoli, Mgbowo and Mpu. Using Taro Yamane's formula, a sample size of 148 girls was drawn via stratified random sampling. A descriptive survey design was employed, utilizing the validated 15-item structured Questionnaire with a high reliability index of 0.85. Data were analyzed using mean and standard deviation for the research questions, while the null hypotheses were tested using ANOVA. The findings reveal that gender-smart infrastructure significantly enhances daily class attendance and enrollment. Furthermore, direct financial incentives and stipends is a critical safety net that significantly improves student retention and minimizes dropout rates among low-income households. Finally, the acquisition of modern digital and technical skills emerged as the most critical determinant for post-graduation entrepreneurship/economic self-reliance. This work provides localized, empirical evidence demonstrating that targeted investments in female technical literacy are an essential catalyst to dismantle structural gender disparities, build resilient local work forces, and realize the global 2030 educational agenda in rural West Africa. The study among others recommends that the government should allocate capital for gender-smart infrastructure to all technical colleges.

1. Introduction

The pursuit of Sustainable Development Goal 4 (SDG 4) highlights a global commitment to universal, high-quality, and inclusive lifelong learning [1, 2, 3, 9]. Yet, sub-Saharan Africa's educational realities reveal deep inequalities. Within Nigeria, systemic crises have left over 7.6 million girls out of school, driven by localized insecurity, poverty, and cultural traditions [10]. This massive learning gap leaves a vast portion of the young population without foundational literacy and market-ready skills [11, 4, 5]. To build a resilient economy, Nigeria must move beyond conventional general education paths and integrate dynamic, skill-based vocational models [6, 12].

Technical and Vocational Education and Training (TVET) offers a direct method to address this drop-out crisis [13]. Rather than focusing solely on academic degrees, TVET prioritizes immediate, hands-on capabilities [14]. This practical focus makes vocational training highly effective for vulnerable youth, especially adolescent girls facing restricted economic mobility [15]. When technical education frameworks cater explicitly to women, they disrupt poverty cycles, delay early marriage, and foster self-reliance [7, 8, 16]. This research work examines TVET's potential as a pillar for gender equity and social inclusion under SDG 4. By reviewing the structural barriers within Nigeria's training sector, the study proposes systemic solutions to unlock female-driven economic development. This study is guided with three research question and three null hypotheses'

1.1 Research Questions

The following three research questions guided the study:

1. What is the relationship between the availability of gender-smart infrastructure and the enrollment rates of the girl child in Nigerian technical colleges?
2. To what extent do direct financial incentives influence the retention and completion rates of female vocational students education?
3. How does the acquisition of modern digital and technical skills through updated TVET curricula affect the post-graduation employment/entrepreneurship success of the Nigerian girl child?

1.2 Null Hypotheses

The following three null hypotheses were formulated and tested at 0.05 level of significance.

Ho1: There is no significant relationship between the availability of gender-smart infrastructure and the enrollment rates of the girl child in Nigerian technical colleges.

- **Ho2:** Direct financial incentives do not significantly influence the retention and completion rates of female vocational students education in Nigeria.
- **Ho3:** The acquisition of modern digital and technical skills through updated TVET curricula has no significant effect on the post-graduation employment/ entrepreneurship success of the Nigerian girl child.

2. Literature Review

2.1. Conceptual Framework

The structural of this study is built upon three interlinked core variables. These concepts directly affect female participation in TVET as a tool to realize SDG 4 in local communities like Awgu LGA, Enugu State, Nigeria

2.1.1. Technical and Vocational Education and Training (TVET)

TVET involves those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences [17]. It emphasizes the acquisition of practical skills, attitudes, understanding, and knowledge relating to occupations in various sectors of economic and social life [18]. In Nigeria, TVET is institutionalized through formal technical colleges, polytechnics, and informal craft hubs [19]. For the girl child, TVET is not merely an alternative educational track but a mechanism for self-reliance, poverty reduction, and socioeconomic survival [20].

2.1.2. Sustainable Development Goal 4 (SDG 4)

SDG 4 aims to guarantee inclusive, equitable, and quality education while promoting lifelong learning opportunities for all by 2030 [21]. In developing countries like Nigeria, completing general literacy tracks does not always result in economic independence for young women due to poor labor-market alignment [22]. Consequently, targets 4.3, 4.4, and 4.5 of SDG 4 focus on ensuring equal access to vocational/technical skills [23]. This transforms technical education into a benchmark for measuring gender equality and developmental progress [24].

2.2. Theoretical Framework

2.2.1. Human Capital Theory

Human Capital Theory states that investments in education, training, and healthcare increase human productivity and drive economic growth [25, 26]. When applied to the girl child in Awgu LGA, this theory suggests that teaching young women specialized technical and vocational skills directly increases their market value. Instead of being restricted to unpaid domestic roles, educated girls become skilled workers who add value to local manufacturing, agriculture, and technical sectors, supporting the economic goals of SDG 4.

2.2.2. Liberal Feminist Theory

Liberal Feminist Theory argues that gender inequality stems from systemic social and legal blockages that keep women from accessing education and employment markets [27, 28]. This framework targets the structural barriers such as male-dominated school cultures and a lack of proper facilities that keep girls out of technical fields [29]. The theory shows that creating gender-smart infrastructure and giving girls direct financial aid can dismantle these limits, offering female students an equal starting line in technical fields.

2.3. Empirical Review

2.3.1. Gender-Smart Infrastructure and Girl Child Enrollment Rates

A school's physical environment directly influences student attendance, safety, and retention [30]. In Nigeria, many public technical colleges suffer from broken facilities, missing perimeter walls, unlit workshops, and a total lack of clean, separate female toilets [31]. Empirical assessments show that missing water, sanitation, and hygiene spaces frequently forces adolescent girls to stay home during their menstrual cycles [32]. Furthermore, studies in technical centers note that lacking private changing spaces prevents girls from enrolling in trades like mechanical fabrication or welding [33]. Building well-lit, secure, and girl-friendly infrastructure directly eases parents' safety fears, boosting female enrollment in technical colleges [34].

2.3.2. Direct Financial Incentives and Female Student Retention Rates

Poverty remains a primary driver of high female dropout rates across sub-Saharan Africa [35]. When families face tight budgets, they often choose to sponsor a son's education over a daughter's [36]. Additionally, technical education requires extra spending on hand tools, safety uniforms, and practical workshop materials [37]. Research on Nigeria's educational policies confirms that targeted financial help, such as the Federal Ministry of Education (FME) TVET Initiative's student stipends, directly helps low-income families cover these extra costs [38]. When governments remove tuition fees and offer direct material stipends, female student dropout rates plummet, helping more girls finish their programs and earn their certifications [39].

2.3.3. Modern Digital & Technical Skills and Post-Graduation Success

The modern job market values high-tech capabilities, automation, and digital communication [40]. However, many rural Nigerian technical colleges still rely on outdated textbooks and broken, old machinery [41]. This gap leaves students with obsolete skills that do not match what modern employers need [42]. Examining female employment choices show that training girls in digital tools, computer repair, and modern agro-processing significantly increases their chances of finding a job/starting a business [43]. Giving girls access to modern technical curricula allows female graduates to launch local enterprises immediately, protecting them from unemployment and helping fulfill the core goals of SDG 4 [44].

3. Materials and Methods

3.1. Research Design and Study Area

This study used a descriptive survey research design. The study was carried out in Awgu Local Government Area located in the southern part of Enugu State, Nigeria. Awgu is largely a rural area where most people work in farming, local trade, and crafts.

3.2. Population, Sample Size, and Sampling Technique

The population of the study was 235 female students aged 11 to 17 years who are currently enrolled in the four technical colleges in Awgu LGA, which are Technical College Mgbidi, Technical College Amoli, Technical College Mgbowo and Technical college Mpu. To get a fair and accurate sample from the 235 girls, the researchers used Taro Yamane's formula to get a sample of 148. Stratified random sampling was used to make sure each school was represented fairly based on its population size.

3.3. Instrument and Data Analysis

A 15-item Questionnaire instrument structured on a 4-point Likert Scale of Strongly Agree (SA – 4 points), Agree (A – 3 points), Disagree (D – 2 points), and Strongly Disagree (SD – 1 point) was used by the researchers to collect data. Cronbach’s Alpha returned a reliability score of 0.85. Data were analyzed using Mean and Standard Deviation (SD) for the three research questions. A mean score of 2.50 served as the benchmark for agreement and ANOVA was used to analyze the three null hypotheses using SPSS.

4. Results

4.1. Data Presentation and Analysis

Table 1

Mean and standard deviation scores of the respondents on the relationship between the availability of gender-smart infrastructure and the enrollment rates of the girl child in Nigerian technical colleges

S/N.	Item Statement	SA	A	D	SD	Mean	SD	Decision
1.	Separate and clean female toilets make girls feel comfortable attending school daily.	100	48	0	0	3.68	0.47	Agree
2.	Well-lit school compounds reduce girls fear of harassment during practical evening classes.	120	28	0	0	3.81	0.39	Agree
3.	The absence of private changing rooms stops girls from participating in heavy technical workshops.	130	18	0	0	3.88	0.33	Agree
4.	Secure school perimeter walls encourage my parents to let me stay late for technical projects.	125	23	0	0	3.84	0.36	Agree
5.	Having female instructors on campus makes it easier for me to report safety complaints.	131	17	0	0	3.89	0.32	Agree
Cluster Mean						3.82	0.37	Accept

Data in Table 1 show that all items exceeded the benchmark score of 2.50 and the cumulative cluster mean 3.82. This shows that gender-smart physical infrastructure is a critical factor influencing girl-child enrollment rates in technical colleges in Awgu LGA, Enugu State, Nigeria.

Table 2

Mean and standard deviation scores of the respondents on extent direct financial incentives influence the retention and completion rates of female vocational students technical education

S/N	Item Statement	SA	A	D	SD	Mean	SD	Decision
6.	Monthly stipends help my family cover the costs of my textbooks and uniform.	130	18	0	0	3.88	0.33	Agree
7.	I would likely drop out of school if my family had to pay for all workshop materials out of pocket.	140	8	0	0	3.95	0.23	Agree
8.	Free tuition programs give girls an equal chance to learn technical trades alongside boys.	142	6	0	0	3.96	0.20	Agree
9.	Financial allowances from the government motivate me to complete my vocational education.	145	3	0	0	3.98	0.14	Agree
10.	Transport allowances make it easier for me to attend remote training hubs.	138	10	0	0	3.93	0.25	Agree
Cluster Mean						3.94	0.23	Accept

As presented in Table 2, Item 9 achieved the highest individual mean score, The overall cluster mean of 3.94 demonstrates that direct financial interventions minimize out-of-pocket overheads, drastically improving female vocational student retention and graduation rates.

Table 3

Mean and standard deviation scores of the respondents on how the acquisition of modern digital and technical skills through updated TVET curricula affect the post-graduation employment /entrepreneurship success of the Nigerian girl child.

S/N	Item Statement	SA	A	D	SD	Mean	SD	Decision
11.	Learning digital tools and computer repair builds my confidence to compete in the job market.	140	8	0	0	3.95	0.23	Agree
12.	My school relies on old machines, which prevents me from learning modern marketplace skills.	132	16	0	0	3.89	0.31	Agree
13.	Training in modern fashion design and catering provides me with immediate income after school.	128	20	0	0	3.86	0.34	Agree
14.	Practical lessons in eco-farming and processing help me plan to launch my own business.	130	18	0	0	3.88	0.33	Agree
15.	Connecting our school workshops with private firms helps girls secure jobs right after graduation.	131	17	0	0	3.89	0.32	Agree
Cluster Mean						3.89	0.31	Accept

Table 3 indicates strong agreement across all sampled schools. Teaching updated digital tools alongside local trade crafts directly expands post-graduation career opportunities and supports independent female entrepreneurship.

Table 4

ANOVA for the test that there is no significant relationship between the availability of gender-smart infrastructure and the enrollment rates of the girl child in technical colleges.

Source of Variation	Sum of Squares	Degrees of Freedom (df)	Mean Square	F-Calculated	F-Critical	Decision
Between Groups	4.32	4	1.08	7.52	2.38	Reject Ho1
Within Groups	105.42	735	0.14			
Total	109.74	739				

Table 4 show that F-calculated of 7.52 significantly exceeded F-critical of 2.38. Therefore, was rejected hypothesis one. This shows that there is significant relationship between the availability of gender-smart infrastructure and the enrollment rates of the girl child in technical colleges

Table 5

ANOVA for the test that direct financial incentives do not significantly influence the retention and completion rates of female vocational students in Nigeria.

Source of Variation	Sum of Squares	Degrees of Freedom (df)	Mean Square	F-Calculated	F-Critical	Decision
Between Groups	0.86	4	0.22	3.84	2.38	Reject Ho2
Within Groups	41.40	735	0.06			
Total	42.26	739				

The results in Table 5 show that F-calculated which is 3.84, is above F-critical of 2.38. Consequently, hypothesis two was rejected, establishing that financial support variables have a statistically significant and distinct impact on female student retention.

Table 6

ANOVA for the test that acquisition of modern digital and technical skills through updated TVET curricula has no significant effect on the post-graduation employment/entrepreneurship success of the Nigerian girl child.

Source of Variation	Sum of Squares	Degrees of Freedom (df)	Mean Square	F-Calculated	F-Critical	Decision
Between Groups	0.57	4	0.14	1.50	2.38	Accept Ho3
Within Groups	69.99	735	0.10			
Total	70.56	739				

Table 6 show that F-calculated of 1.50 is below the threshold of F-critical of 2.38. Thus, the study accept hypothesis three. Therefore, the acquisition of modern digital and technical skills through updated TVET curricula has significant effect on the post-graduation employment/entrepreneurship success of the Nigerian girl child.

5. Discussion of Findings

The empirical data collected via research question one indicates that physical learning environments directly dictate enrollment rates for the female demographic. When technical institutions lack separate, functional female toilets and secure perimeter fencing, parental safety concerns escalate, leading to low enrollment. This finding directly mirrors the positions established in recent literature, where water, sanitation, and hygiene (WASH) deficits were shown to heavily restrict girls from participating in rigorous practical workshop settings [27, 28, 32]. Furthermore, by rejecting Null Hypothesis one this study

confirms that introducing well-lit environments and protective spaces directly offsets local safety fears [34]. This aligns with Liberal Feminist principles by removing structural environmental barriers to expand educational entry [29].

The statistical evaluation of research question two confirms that financial considerations heavily dictate whether a girl completes her technical certificate education or drops out early. Vocational training carries extra financial burdens due to the cost of equipment kits, personal protective apparel, and workshop materials. The study proves that direct financial aid such as the tuition reliefs and student stipends under the active FME TVET Initiative substantially handles family budget constraints [38]. These findings support earlier empirical observations, which noted that economic safety nets prevent rural households from prioritizing a son's education over a daughter's during financial hardships [20, 39]. The rejection of Null Hypothesis two underscores that targeted financial interventions are vital tool to achieve the equity benchmarks of SDG Target 4.5 [14].

The findings from research question three demonstrate that equipping the girl child with modern, market-aligned capabilities like ICT, computer repair, and modern agro-processing tools is the single most reliable predictor of economic independence after graduation [40]. Conversely, relying on obsolete machines lowers the market value of graduates [41]. This outcome validates Human Capital Theory, which views technical competency as a direct driver of individual productivity and regional economic growth [25, 26]. This finding aligns with vocational curriculum studies, which stated that embedding digital technologies into traditional vocational trades transforms female students from simple manual workers into competitive entrepreneurs [43]. Thus, updating the TVET curricula within Awgu LGA directly matches the exact human-empowerment requirements of SDG Target 4.4 [23].

6. Conclusions and Recommendations

6.1. Conclusions

This study demonstrates that providing Technical and Vocational Education and Training (TVET) to the girl child in Awgu LGA is an economic and social necessity for achieving SDG 4 in Nigeria. By evaluating the specific conditions at Technical Colleges in Mgbidi, Amoli, Mgbowo, and Mpu, the research proves that female educational progress relies heavily on a three-pronged framework: secure, gender-smart facilities; robust financial incentives; and modern, digitally focused skill sets. Tackling poor infrastructure and easing out-of-pocket expenses protects young girls from early dropouts and cultural marginalization. Ultimately, transforming TVET into an inclusive, highly modern environment ensures that young women in Enugu State, Nigeria become self-reliant economic contributors, shifting the country closer to its sustainable development targets by 2030.

6.2. Recommendations

Based on the findings of this study, the following recommendation were made:

1. Allocate targeted capital for gender-smart infrastructure: The Enugu State Science, Technical and Vocational Schools Management Board should direct capital funds to build separate, modern facilities, private changing rooms, and solar-powered campus lighting at technical colleges in Mgbidi, Amoli, Mgbowo, and Mpu.
2. Expand and streamline financial safety nets: The Federal Ministry of Education should maintain and widen its direct TVET monthly stipends. To secure long-term success, graduating female students should receive post-training "starter tool-packs" such as diagnostic machines, laptops, and industrial fashion kits to help them launch businesses immediately.
3. Modernize the technical college curriculum: The National Board for Technical Education should phase out obsolete machinery and fully integrate basic ICT, automated mechanics, and clean green energy technologies into the standard coursework for female vocational paths.
4. Deploy grassroots institutional advocacy campaigns: Local government administrations should partner with traditional leaders and community groups in Awgu LGA to challenge gender stereotypes, actively encouraging parents to enroll their daughters in advanced technical and engineering trades.

Declarations

Author Contributions:

Conceptualization: O V I, S A, O P I, U K C

Data curation: O V I, M L C, U E I, O P I, E O O

Formal analysis: O V I, B N N, S A, U K C

Funding acquisition: O V I, M L C, N C L, B N N, A B I, U E I, M O, O D K, O S A, O G N, S A, C C O, O P I, U K C, O A A, M M A, E O O

Investigation: O V I, N C L, U E I, O S A, O G N,

Methodology: O V I, M L C, O S A, O G N, S A, U K C, O A A, . M M A.

Project administration: O V I, B N N, E O O

Resources: O V I, A B I, U E I, O D K, C C O

Software: O S A, O V I, B N N, M O, O A A, M M A.

Supervision: A B I, O V I, M O, O D K, C C O, . M M A.

Validation: O V I, M L C, O A A, E O O

Visualization: N C L, O V I, A B I, O, C C O

Writing-original draft: O V I, O D K, N C L

Writing-review & editing: O V I, O G N, O P I, E O O, O S A

Data Availability Statement: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest : The authors have no conflicts of interest to disclose.

Funding: This research received no external funding.

Human Consent Deceleration : The use of students as respondents for this study received approval from Enugu State Ethics Committee of the post primary school management board and all the parents of the students.

Clinical Trial Number : Not applicable

Ethical approval: The use of students as respondents for this study received approval from the Departments of Ethics Committee of the post primary school management board and all the parents of the students. A letter with the references numbers RG/ITE/TVE/UNN/0121 and RG/ITE/TVE/UNN/0223 were written to post primary school management and parents respectively to ensure them that confidentiality and welfare of the students used for the study.

Ethical accordance: The study was conducted in accordance with ethical standard of the Department of Ethics Committee of the post primary school management board and the Deceleration of Helsinki.

Consent to Participate: Informed consent was obtained from parents of the students that participants in the study.

Parental consent: The consent of all the parents of the students used for the study was obtained.

Consent to Publish: Not applicable.

The study was approved by Enugu State post primary school management under the Chairmanship of Mr Davidson Onuh Chief Supervising Principal of post primary school management board and University of Nigeria, Nsukka Review Board.

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