ELECTROPRENUERSHIP: A PRECURSOR FOR DEVELOPING BUSINESS ACUMEN IN ELECTRICAL AND ELECTRONICS ENGINEERING EDUCATION STUDENT IN NIGERIAN UNIVERSITY

JIMRITU DUNAMA MEDUGU[1], JOSEPH ZAMBWA[2], ISAAC JOHN IBANGA[3*]

[1,2,3]DEPARTMENT OF ELECTRICAL TECHNOLOGY EDUCATION, MODIBBO ADAMA UNIVERSITY, YOLA, ADAMAWA STATE, NIGERIA

**Corresponding Author: isaacjohn@mau.edu.ng*

To cite this article (APA): Medugu, J. D., Zambwa, J., & Ibanga, I. J. (2025). Electroprenuership: a precursor for developing business acumen in electrical and electronics engineering education student in Nigerian university. *AAU Journal of Business Educators, 5* (1), 265-277.

Abstract

This study empirically examined how electropreneurship can serve as a precursor for developing business acumen in electrical and electronics engineering education students in Nigerian universities. The study was guided by four specific objectives, four research questions, and four null hypotheses. A descriptive survey research design was adopted to achieve the specific aims, address the research questions raised, and test the null hypotheses formulated for the study. The sample size of the participants were 360 lecturers, practicing electrical engineering, and electrical and electronics engineering education students across selected Nigerian universities, which was drawn using stratified and purposive sampling techniques to ensure adequate representation. A structured questionnaire, titled: Electropreneurship and Business Acumen Questionnaire, was used for data collection. Data were analyzed using descriptive statistics of mean, standard deviation and inferential statistic of analysis of variance (ANOVA). The findings revealed that the current level of entrepreneurial awareness among students was moderate, with foundational knowledge being higher than practical application. The findings also revealed that students possessed limited business acumen in areas such as financial literacy, market analysis, and business modeling. Electropreneurship education had a low moderate impact on students' preparedness for self-employment. It also had a high impact on their ability to become self-reliant. The ANOVA showed statistically significant difference in the mean responses of the three groups on all variables measured. Based on the findings on the study, the authors recommended, among others, that electropreneurship should be integrated into the electrical and electronics engineering education curriculum as this would guide students toward business-oriented thinking and self-reliant in future.

Keywords: *Business Acumen, Electropreneurship, Entrepreneurship Education, Electrical Engineering Education, Electronics Engineering Education, Nigerian Universities, Self-Reliance.*

Introduction

In recent years, higher education institutions, especially in developing nations, have been faced with the increasing pressure to produce graduates who are not only technically proficient, but also equipped with entrepreneurial skills and knowledge. This shift stems from the evolving nature of global labor markets, where self-reliance and innovation are essential for entrepreneurial success (Awojobi, 2022). The concept of "electropreneurship" has emerged as an interdisciplinary approach that combines the principles of integrating electrical and electronics engineering education into entrepreneurship education, which aimed to foster business acumen among students in the field of vocational and technology-oriented discipline.

Electropreneurship encourages electrical and electronics engineering education students to move beyond theoretical learning to learning-by-engaging in practice as well as business-oriented projects. This shift aligns with the idea that universities need to emphasize skills that prepare students for economic self-sufficiency, rather than reliance on traditional job markets, which are becoming increasingly saturated (Okafor, 2021). By fostering entrepreneurial mindsets, students can innovate, create value, and potentially generate employment opportunities, thus contributing positively to local and national economies (Nwankwo & Umaru, 2023).

Incorporating business skills into technical and vocational education and training (TVET) programmes

can be challenging and can be crucial in today's job environment. Studies have shown that graduates with a blend of TVET and entrepreneurial skills/knowledge have a higher likelihood of success in self-employment and small enterprise development (Aliyu, 2023; Edokpolor & Abusomwan, 2019; Edokpolor, Imeokparia & Osifo, 2023). However, traditional curricula in electrical and electronics engineering education programmes often lack business-oriented modules, which limits students' ability to experience transition seamlessly from academia to the entrepreneurial world (Yusuf & Ibrahim, 2022). Thus, integrating electropreneurship into electrical and electronics engineering education could offer students a competitive edge, which eventually enabling them to apply engineering solutions in commercially viable ways (Olawale & Dada, 2020).

In line with Activity Theory, which underscores the importance of collaborative and goal-oriented learning, incorporating electropreneurial initiatives within electrical and electronics engineering programmes can cultivate essential skills such as problem-solving, critical thinking, and resource management (Adeleke, 2019). This approach not only enhances TVET or entrepreneurial knowledge and skills but also prepares students to navigate the complexities of launching and managing their business ventures. Ultimately, integrating electropreneurship into electrical and electronics engineering education provides a pathway for students to become self-reliance individuals. By developing the necessary skills and knowledge for entrepreneurship, students can become active contributors to technological and economic advancements within their communities, underscoring the need for curricular innovation in electrical and electronics engineering education (Eze & Ogundele, 2023).

Statement of the Problem

In Nigeria, the growing rate of youth unemployment has become a critical socio-economic issue, with university graduates struggling to secure employment in their respective fields. Despite the high TVET or entrepreneurial skills and knowledge gained in fields like electrical and electronics engineering education, graduates often lack entrepreneurial skills and knowledge, which are crucial for self-reliance in an increasingly competitive job market economy (Eze & Ogundele, 2023). Electrical and electronics engineering education curricula traditionally emphasize TVET competencies over business acumen, leaving graduates with limited ability to apply their knowledge in commercially viable ways or launch their own business ventures (Aliyu, 2023).

The mismatch between academic training and the practical needs of the labor market results in a high dependency on formal employment opportunities, which are often scarce. This issue is compounded by the lack of integration between TVET and entrepreneurial training within the university programmes (Nwankwo & Umaru, 2023). Consequently, electrical and electronics engineering education graduates are unable to leverage the TVET skills acquired to create self-employed opportunities, contributing to the high rates of underemployment and job dissatisfaction among them (Olawale & Dada, 2020). Therefore, this study seeks to address the problem of inadequate TVET and entrepreneurial training within electrical and electronics engineering education programmes, thus investigating how integrating "electropreneurship" in the TVET curriculum can equip students with the business skills needed for economic self-reliance. This integration aims to empower graduates with both TVET and entrepreneurial competencies, thus fostering self-employment and enhancing their contributions to local economic development.

Purpose of the Study

The purpose of the study was to assess the Electroprenuership: developing business acumen in electrical/electronic engineering education student in university for self-reliance. This study sought to examine:

1. the current level of entrepreneurial awareness among electrical and electronics engineering education students in Nigerian universities.
2. the level of business acumen possessed by electrical and electronics engineering education students in Nigerian universities.
3. the place of electropreneurship education and students' preparedness for self-employment in Nigerian universities.
4. the place of electropreneurship education and students' ability to become self-reliant.

Research Questions

The study sought to answer the following research questions:

Research Question 1: What is the current level of entrepreneurial awareness among electrical and electronics

engineering education students in Nigerian universities?
Research Question 2: What is the level of business acumen possessed by electrical and electronics engineering education students in Nigerian universities?
Research Question 3: What is the place of electropreneurship education and students' preparedness for self-employment in Nigerian universities?
Research Question 4: What is the place of electropreneurship education and students' ability to become self-reliant?

Research Hypotheses

The following hypotheses guided the study:
Research Hypothesis 1: There is no significant difference in the mean responses of respondents on the current level of entrepreneurial awareness among electrical and electronics engineering education students in Nigerian universities.
Research Hypothesis 2: There is no significant difference in the mean responses of respondents the level of business acumen possessed by electrical and electronics engineering education students in Nigerian universities.
Research Hypothesis 3: There is no significant difference in the mean responses of respondents the place of electropreneurship education and students' preparedness for self-employment in Nigerian universities.
Research Hypothesis 4: There is no significant difference in the mean responses of respondents the place of electropreneurship education and students' ability to become self-reliant.

Theoretical Framework

The Activity Theory was postulated by Vygotsky (1978). The theory emphasizes collaborative, goal-oriented learning, and provides a valuable framework for understanding electropreneurship. Activity Theory posits that learning occurs through meaningful interactions and practical engagement with real-world tasks (Adeleke, 2019). In the context of electropreneurship, students learn not only by studying theoretical knowledge but also by applying this knowledge in projects that mimic entrepreneurial ventures. The Activity Theory supports the integration of entrepreneurship into engineering programs as a means of engaging students in learning experiences that prepare them for self-employment.

Conceptual Framework

Electropreneurship

Electropreneurship is an emerging interdisciplinary approach that integrates entrepreneurial skills into the study of electrical and electronics engineering education, which aims to prepare students for self-employment career and economic independence. This concept is based on the understanding that TVET expertise alone is insufficient in today's competitive job market; in that graduates must also possess entrepreneurial skills such as business acumen and problem-solving skills to succeed as entrepreneurs (Aliyu, 2023). Scholars emphasize that by blending entrepreneurship with of electrical and electronics engineering education, students can learn to apply their TVET and entrepreneurial skills in ways that meet market demands, and enhanced both employability and self-reliance (Olawale & Dada, 2020). Studies have shown that electropreneurship can empower electrical and electronics engineering students to create innovative products and services that address real-world problems, giving them an advantage in business creation and development (Eze & Ogundele, 2023). Therefore, electropreneurship aligns with the broader educational goals of producing graduates who are not solely job seekers but also job creators (Awojobi, 2022).

Entrepreneurial Skills in Electrical and Electronics Engineering Education

Entrepreneurial skills such as critical thinking, decision-making, and innovation are increasingly valuable in TVET disciplines such as electrical and electronics engineering education. According to Yusuf and Ibrahim (2022), incorporating entrepreneurial skills into electrical and electronics engineering education curricula, which prepares students to approach problems from both TVET and business perspectives, fostering an entrepreneurial mindset. This skill set is essential for graduates in developing countries, where traditional employment opportunities are limited, and self-employment is often a viable pathway to economic stability (Nwankwo & Umaru, 2023). A study by Okafor (2021) reveals that graduates with entrepreneurial skills can identify business opportunities, understand market dynamics, and navigate the complexities of establishing and managing their enterprises. As a result, universities are encouraged to incorporate these skills into their

programmes to enhance students' economic potential and adaptability to the job market.

Challenges of Integrating Entrepreneurship into Electrical and Electronics Engineering Education Curricula

The benefits of combining electrical and electronics engineering and entrepreneurship are widely acknowledged, while there are significant challenges to implementing it into university programmes. A study by Adeleke (2019) highlights several barriers, including limited institutional resources, inadequate faculty training, and a lack of supportive infrastructure for entrepreneurship education. Furthermore, traditional engineering education curricula often focus heavily on TVET content, leaving little room for business-related modules, which limits students' exposure to entrepreneurship (Aliyu, 2023). In addition to these structural barriers, students may face challenges in adapting to an interdisciplinary approach that combines TVET and entrepreneurial learning. Olawale and Dada (2020) suggest that engineering students might lack the motivation to pursue entrepreneurship due to a perceived lack of relevance or a lack of confidence in their business skills. Overcoming these challenges require comprehensive curriculum reform, including faculty development programmes and investments in entrepreneurship resources within electrical and electronics engineering education departments.

Electropreneurship, Self-Reliance and Economic Independence

Electropreneurship has shown salient promises in promoting self-reliance and economic independence among engineering students. Eze and Ogundele (2023) found that students who participated in entrepreneurial-focused engineering programs exhibited greater confidence in their ability to create and manage businesses. This approach equips students with the practical business skills and enhances their understanding of how to leverage their technical expertise in ways that meet market demands. Moreover, entrepreneurial education and training fosters a problem-solving orientation, encouraging students to seek opportunities and address challenges independently. According to Awojobi (2022), graduates with entrepreneurial knowledge and skills are better equipped to handle the uncertainties and demands of launching and managing a new business, thus increasing their chances of sustained economic independence. Additionally, these entrepreneurial knowledge and skills prepare students to contribute positively to economic development within their communities, supporting local innovation and job creation (Nwankwo & Umaru, 2023).

Strategies for Enhancing Electropreneurship in Engineering Education

To successfully integrate electropreneurship into electrical and electronics engineering education programmes, researchers have proposed several strategies, including curriculum reforms, faculty training, and collaboration with industry partners. Okafor (2021) suggests that universities should endeavor to develop interdisciplinary modules that combine engineering and entrepreneurship education, thereby emphasizing practical applications and real-world problem-solving. In addition, partnerships with industry can provide students with hands-on experience and exposure to market dynamics, thereby enhancing their understanding of business principles.

Faculty development is also essential, as instructors need adequate training and resources to deliver entrepreneurship education effectively (Yusuf & Ibrahim, 2022). Universities can organize workshops, professional development programmes, and incentives to motivate faculty to incorporate entrepreneurship into their teaching practices. Finally, establishing entrepreneurial incubators and support systems within engineering departments can provide students with access to resources, mentorship, and networking opportunities to cultivate their entrepreneurial potential (Awojobi, 2022). The integration of electropreneurship into electrical and electronics engineering education offers promising pathways for addressing the challenges and issues of unemployment and underemployment among young graduates in Nigeria. By equipping students with both TVET and entrepreneurial skills, universities can foster self-reliance and contribute to local economic development. However, achieving this goal requires overcoming significant barriers within educational systems and implementing strategic reforms to support electropreneurial learning. This literature review highlights the need for continued research and policy support to fully realize the benefits of electropreneurship in preparing students for a dynamic and competitive job market.

Method

Research Design

The study adopted a descriptive survey research design. A descriptive survey research design was deemed appropriate for the study as it allowed for the collection of data from a defined population to describe and interpret the current status of electropreneurship education and its effect on business acumen, self-employment preparedness, and self-reliance among electrical and electronics engineering education students in Nigerian universities.

Research Participants

The study participants were 1710, comprising 1,250 final-year electrical and electronics engineering education students, 210 lecturers who teach electrical and business-related courses, and 150 practicing electrical and electronics engineers who are actively involved in entrepreneurial ventures performance across the six geo-political zones of Nigeria. The selection of these groups was informed by their direct involvement and relevance to the study focus on electropreneurship.

Sample and Sampling Procedure

A purposive sampling technique was employed to select the participants from five Federal universities across Nigeria, with one university representing each geo-political zone. The sample were 360 respondents, comprising 250 final-year electrical and electronics engineering education students (50 students from each university), 60 lecturers (12 from each university), and 50 practicing electrical and electronics engineers (10 from each zone). The practicing electrical and electronics engineers were selected based on their active involvement in electropreneurial business ventures or their experience in mentoring electrical and electronics engineering education students. The stratified purposive sampling approach ensured that participants who were most relevant and knowledgeable in the subject area were included in the study.

Data Collection Instrument

A structured questionnaire, titled "electropreneurship and business acumen questionnaire" was used for data collection. The questionnaire was designed and divided into three sections to measure the variables of the study. Section A measured entrepreneurial awareness scale and was administered to students and practicing electrical and electronics engineers. Section B measured business acumen and preparedness for self-employment, and was applicable to students, lecturers, and practicing electrical and electronics engineers. Section C measured respondents' perceptions on electropreneurship education and self-reliance. The instrument comprised a series of structured five-point rating scales, such as Very High Level (5) to Very Low Level (1) for entrepreneurial awareness; Highly Possess (5) to Not Possess (1) for business acumen and preparedness for self-employment; and Very High Impact (5) to Very Low Impact (1) for respondents' perceptions on electropreneurship education and self-reliance. The questionnaire was designed to generate quantitative data for effective analysis and interpretation.

Validation of the Instrument

The instrument was validated by three experts two in entrepreneurship education and one in electrical and electronics engineering education from Nnamdi Azikiwe University, Awka, Anambra State and University of Nigeria, Nsukka, Enugu State. The suggestions from the validators were used to refine the questionnaire items for the purpose of clarity and relevance.

Reliability of the Instrument

A pilot study was conducted using 30 final-year electrical and electronics engineering education students and 10 lecturers from a university, which was not included in the main study. The reliability coefficient of the instrument was determined using the Cronbach's alpha, which yielded a coefficient value of 0.84, thus indicating a high level of internal consistency measure.

Data Collection Procedure

The authors, with the assistance of trained research assistants, administered the questionnaire on the respondents, using Google Forms to facilitate wider reach and ease of response. The Google Forms link was

shared with respondents through institutional mailing lists, WhatsApp groups, and during scheduled academic sessions and professional meetings. In the selected universities, the cooperation of heads of departments and faculty coordinators was sought to ensure students and lecturers received and responded to the questionnaire. Similarly, industry coordinators and professional associations helped distribute the form to practicing electrical and electronics engineers. Respondents were given two to three days to complete the questionnaire, and regular reminders were sent by the research assistants to ensure a high response rate and timely submission.

Data Analysis

Data collected from the respondents were analyzed using the descriptive and inferential statistics. Mean and standard deviation were used to answer the research questions. Analysis of Variance (ANOVA) was employed to test the hypotheses, at a 0.05 level of significance, using the Statistical Package for the Social Sciences (SPSS) version 26.0.

Results

Answering Research Questions

Research Question 1: What is the current level of entrepreneurial awareness among electrical and electronics engineering education students in Nigerian universities?

Table 1: Mean and Standard Deviation of Entrepreneurial Awareness among Electrical and Electronics Engineering Students.

Cluster	S/N	Questionnaire Statement	$\bar{x}_L$	$\bar{x}_E$	$\bar{x}_S$	$\bar{x}_G$	SD	Remark
Foundational Knowledge	1	Students understand core entrepreneurship concepts	3.8	3.6	3.4	3.6	0.7	LL
	2	Students can define "electropreneurship"	3.6	3.4	3.1	3.4	0.8	LL
	3	Students recognize entrepreneurship as a viable career	3.7	3.5	3.3	3.5	0.6	HL
	4	Students understand innovation's role in entrepreneurship	3.9	3.7	3.5	3.7	0.7	HL
	5	Students know government entrepreneurship policies	3.1	2.9	2.7	2.9	0.9	LL
Opportunity Identification	6	Students identify market gaps in energy solutions	3.3	3.2	2.9	3.1	0.8	LL
	7	Students spot opportunities in renewable energy	3.5	3.4	3.2	3.4	0.7	LL
	8	Students recognize demand for smart grid technologies	3.0	2.8	2.6	2.8	0.9	LL
	9	Students see business potential in electrical maintenance	3.8	3.7	3.5	3.7	0.6	HL
	10	Students identify IoT applications for Nigerian markets	3.2	3.0	2.8	3.0	1.0	LL
Resource Awareness	11	Students know startup funding sources	3.1	2.9	2.6	2.9	1.1	LL
	12	Students are aware of incubators for tech startups	3.4	3.2	2.9	3.2	0.8	LL
	13	Students understand patenting processes	2.9	2.7	2.5	2.7	1.2	LL
	14	Students know industry mentorship programs	3.0	2.8	2.6	2.8	1.0	LL
	15	Students utilize entrepreneurial support networks	3.3	3.1	2.8	3.1	0.9	LL
Mindset & Motivation	16	Students express desire to start businesses	3.6	3.4	3.1	3.4	0.8	LL
	17	Students believe in self-employment success	3.5	3.3	3.0	3.3	0.7	LL
	18	Students view failure as learning opportunity	3.8	3.6	3.4	3.6	0.6	HL
	19	Students proactively seek entrepreneurial knowledge	3.2	3.0	2.8	3.0	0.9	LL
	20	Students balance risk-taking with caution	3.7	3.5	3.3	3.5	0.7	HL
Industry Engagement	21	Students attend entrepreneurship workshops	3.1	2.9	2.7	2.9	1.0	LL
	22	Students network with industry entrepreneurs	3.0	2.8	2.5	2.8	1.1	LL
	23	Students participate in business plan competitions	3.4	3.2	2.9	3.2	0.8	LL
	24	Students analyze successful electropreneur case studies	3.5	3.3	3.0	3.3	0.7	LL
	25	Students intern with electronics startups	3.2	3.0	2.7	3.0	0.9	LL
		Cumulative Mean				3.2	0.8	LL

Key: *$\bar{x}_L$ = Mean Response of Lecturers, $\bar{x}_E$ = Mean Response of Engineers, $\bar{x}_S$ = Mean Response of Students, $\bar{x}_G$ =Grand Mean, SD = Standard Deviation, HL = High Level, LL = Low Level*

Table 1 shows that the current level of entrepreneurial awareness among electrical and electronics engineering education students in Nigerian universities is generally low, with a cumulative grand mean of 3.2 and a standard deviation of 0.8. Within the Foundational Knowledge cluster, students showed moderate awareness of core entrepreneurship concepts and innovation but struggled with defining "electropreneurship" and understanding policy. Opportunity Identification and Resource Awareness clusters recorded predominantly low mean scores, reflecting weak ability to spot market gaps and limited knowledge of funding, incubators, and mentorship. In the Mindset and Motivation cluster, students demonstrated a fair attitude toward entrepreneurship, especially in learning from failure and risk-taking. However, Industry Engagement scored lowest overall, suggesting minimal practical involvement in entrepreneurial activities. This highlights the need for stronger

curriculum emphasis on experiential and opportunity-driven learning.

Research Question 2: What is the level of business acumen possessed by electrical and electronics engineering education students in Nigerian universities?

Table 2: Mean and Standard of Business Acumen among Electrical and Electronics Engineering Students.

Cluster	S/N	Questionnaire Statement	$\bar{x}_L$	$\bar{x}_E$	$\bar{x}_S$	$\bar{x}_G$	SD	Remark
Financial Literacy	1	Students prepare financial projections	3.2	3.0	2.8	3.0	0.9	NP
	2	Students interpret balance sheets	2.9	2.7	2.5	2.7	1.1	NP
	3	Students calculate startup costs	3.4	3.2	3.0	3.2	0.8	NP
	4	Students manage cash flow	3.1	2.9	2.6	2.9	1.0	NP
	5	Students understand pricing strategies	3.5	3.3	3.1	3.3	0.7	NP
Market Analysis	6	Students conduct competitor analysis	3.3	3.1	2.9	3.1	0.8	NP
	7	Students identify target customers	3.6	3.4	3.2	3.4	0.7	NP
	8	Students perform SWOT analysis	3.2	3.0	2.7	3.0	0.9	NP
	9	Students assess market size	3.0	2.8	2.6	2.8	1.0	NP
	10	Students evaluate market entry barriers	2.9	2.7	2.4	2.7	1.1	NP
Business Modeling	11	Students develop viable business models	3.1	2.9	2.7	2.9	0.9	NP
	12	Students design revenue streams	3.3	3.1	2.8	3.1	0.8	NP
	13	Students validate product-market fit	3.0	2.8	2.5	2.8	1.0	NP
	14	Students create value propositions	3.4	3.2	3.0	3.2	0.7	NP
	15	Students adapt models to industry trends	3.2	3.0	2.7	3.0	0.9	NP
Operational Planning	16	Students plan supply chain logistics	2.8	2.6	2.4	2.6	1.1	NP
	17	Students manage inventory	3.1	2.9	2.6	2.9	1.0	NP
	18	Students develop quality control processes	3.7	3.5	3.3	3.5	0.6	P
	19	Students implement project timelines	3.8	3.6	3.4	3.6	0.5	P
	20	Students calculate production costs	3.0	2.8	2.5	2.8	1.0	NP
Legal & Compliance	21	Students understand business registration	3.1	2.9	2.6	2.9	1.0	NP
	22	Students comply with electrical safety regulations	4.0	3.9	3.7	3.9	0.4	P
	23	Students handle contract negotiations	2.9	2.7	2.4	2.7	1.1	NP
	24	Students manage intellectual property	3.0	2.8	2.5	2.8	1.0	NP
	25	Students adhere to tax obligations	2.8	2.6	2.3	2.6	1.2	NP
		Cumulative Mean				**3.0**	**0.9**	**NP**

Key: *$\bar{x}_L$ = Mean Response of Lecturers, $\bar{x}_E$ = Mean Response of Engineers, $\bar{x}_S$ = Mean Response of Students, $\bar{x}_G$ =Grand Mean, SD = Standard Deviation, P = Possess, NP = Not Possess*

Table 2 shows the level of business acumen possessed by electrical and electronics engineering education students in Nigerian universities, grouped across five core clusters. The cumulative grand mean of 3.0 and standard deviation of 0.9 indicate that students generally do not possess strong business acumen. In the Financial Literacy cluster, students showed limited proficiency in essential financial with most items rated "Not Possess." For Market Analysis, students performed slightly better in identifying target customers, but still fell below proficiency in tasks like conducting SWOT analysis and assessing market size. The Business Modeling cluster revealed similar patterns, with students scoring low in developing viable models ($\bar{x}$ = 2.9) and validating product-market fit ($\bar{x}$ = 2.8). In the Operational Planning cluster, only two items—developing quality control processes ($\bar{x}$ = 3.5) and implementing project timelines ($\bar{x}$ = 3.6)—were rated "Possess," indicating minimal strength in planning and execution. Finally, in Legal & Compliance, students performed well only in electrical safety compliance ($\bar{x}$ = 3.9), but lacked adequate knowledge of tax obligations ($\bar{x}$ = 2.6), intellectual property, and business registration. Overall, the findings suggest that while students may have some isolated competencies, their general business readiness for entrepreneurship remains poor and requires targeted intervention in financial, legal, and strategic business training.

Research Question 3: What is the place of electropreneurship education and students' preparedness for self-employment in Nigerian universities?

Table 3: Mean and Standard Deviation on the Place of Electropreneurship Education and Students' Preparedness for Self-Employment in Nigerian Universities.

Cluster	S/N	Questionnaire Statement	$\bar{x}_L$	$\bar{x}_E$	$\bar{x}_S$	$\bar{x}_G$	SD	Remark
Skill Development	1	Courses improve technical prototyping skills	4.0	3.8	3.6	3.8	0.5	HI
	2	Training enhances product development	3.9	3.7	3.5	3.7	0.6	HI
	3	Programs build business planning skills	3.3	3.1	2.9	3.1	0.9	LI
	4	Workshops develop market research skills	3.2	3.0	2.8	3.0	1.0	LI
	5	Curriculum teaches funding proposal writing	3.0	2.8	2.6	2.8	1.1	LI
Confidence Building	6	Education increases startup confidence	3.6	3.4	3.2	3.4	0.7	LI
	7	Training reduces fear of business failure	3.5	3.3	3.1	3.3	0.8	LI
	8	Programs enhance risk assessment ability	3.8	3.6	3.4	3.6	0.6	HI
	9	Courses improve decision-making skills	4.1	3.9	3.7	3.9	0.5	HI
	10	Workshops boost pitching competence	3.4	3.2	3.0	3.2	0.9	LI
Practical Exposure	11	Internships provide real-world experience	4.2	4.0	3.8	4.0	0.4	HI
	12	Industry projects enhance problem-solving	4.1	3.9	3.7	3.9	0.5	HI
	13	Case studies improve strategic thinking	3.7	3.5	3.3	3.5	0.6	HI
	14	Simulated startups teach operational skills	3.3	3.1	2.9	3.1	0.8	LI
	15	Mentorship bridges theory-practice gaps	3.9	3.7	3.5	3.7	0.6	HI
Resource Access	16	Programs connect students with investors	3.1	2.9	2.7	2.9	1.0	LI
	17	Courses provide incubation access	3.2	3.0	2.8	3.0	0.9	LI
	18	Training offers networking opportunities	4.0	3.8	3.6	3.8	0.5	HI
	19	Curriculum includes legal advisory services	2.9	2.7	2.5	2.7	1.1	LI
	20	Workshops facilitate tool/equipment access	3.8	3.6	3.4	3.6	0.7	HI
Mindset Shift	21	Education fosters entrepreneurial identity	3.5	3.3	3.1	3.3	0.8	LI
	22	Training cultivates opportunity recognition	4.0	3.8	3.6	3.8	0.5	HI
	23	Programs promote adaptability	3.9	3.7	3.5	3.7	0.6	HI
	24	Courses encourage innovation	4.1	3.9	3.7	3.9	0.4	HI
	25	Workshops develop resilience	3.6	3.4	3.2	3.4	0.7	LI
		Cumulative Mean				**3.4**	**0.7**	**LI**

Key: *$\bar{x}_L$= Mean Response of Lecturers, $\bar{x}_E$ = Mean Response of Engineers, $\bar{x}_S$ = Mean Response of Students, $\bar{x}_G$ =Grand Mean, SD = Standard Deviation, HL = High Impact, LL = Low Impact.*

Table 3 shows the place of electropreneurship education and students' preparedness for self-employment in Nigerian universities. The cumulative grand mean of 3.4 and a standard deviation of 0.7 indicate a generally Low Impact rating. Specifically, students demonstrated High Impact in clusters related to Skill Development ($\bar{x}$ = 3.7–3.8 for prototyping and product development), Confidence Building ($\bar{x}$ = 3.6–3.9 for risk assessment and decision-making), and Practical Exposure ($\bar{x}$ = 3.5–4.0 across internships, industry projects, and mentorship). However, Resource Access showed weaker outcomes ($\bar{x}$ = 2.7–3.0), especially regarding investor connections and legal advisory services. Similarly, aspects of Mindset Shift, such as fostering entrepreneurial identity and resilience, were mostly rated low ($\bar{x}$ = 3.3–3.4). Overall, while students benefit in hands-on and technical preparedness, deficiencies remain in business planning, funding access, and psychological readiness for self-employment.

Research Question 4: What is the place of electropreneurship education and students' ability to become self-reliant?

Table 4: Mean and Standard Deviation on the Place of Electropreneurship Education Students' Ability to Become Self-Reliant.

Cluster	S/N	Questionnaire Statement	$\bar{x}_L$	$\bar{x}_E$	$\bar{x}_S$	$\bar{x}_G$	SD	Remark
Financial Independence	1	Training enables income generation during studies	3.3	3.1	2.9	3.1	0.9	LI
	2	Programs reduce graduate unemployment	4.0	3.8	3.6	3.8	0.5	HI
	3	Education decreases financial dependency	3.7	3.5	3.3	3.5	0.6	HI
	4	Workshops teach personal finance management	3.2	3.0	2.8	3.0	1.0	LI
	5	Curriculum supports asset acquisition	3.0	2.8	2.6	2.8	1.1	LI
Problem-Solving Autonomy	6	Education enhances troubleshooting without supervision	4.2	4.0	3.8	4.0	0.4	HI
	7	Training develops client negotiation skills	3.5	3.3	3.1	3.3	0.8	LI
	8	Programs improve independent decision-making	4.1	3.9	3.7	3.9	0.5	HI
	9	Courses teach conflict resolution	3.4	3.2	3.0	3.2	0.9	LI
	10	Workshops foster creative solution development	4.0	3.8	3.6	3.8	0.6	HI

Technical Self-Sufficiency	11	Education enables independent product design	3.9	3.7	3.5	3.7	0.6	HI
	12	Training allows servicing equipment without assistance	4.1	3.9	3.7	3.9	0.5	HI
	13	Programs teach DIY prototyping	3.8	3.6	3.4	3.6	0.7	HI
	14	Curriculum covers independent quality testing	4.0	3.8	3.6	3.8	0.5	HI
	15	Workshops enable technical documentation	3.3	3.1	2.9	3.1	0.8	LI
Adaptive Capacity	16	Education teaches pivoting business models	3.2	3.0	2.8	3.0	0.9	LI
	17	Training responds to market changes	3.4	3.2	3.0	3.2	0.8	LI
	18	Programs adapt to technological disruptions	3.9	3.7	3.5	3.7	0.6	HI
	19	Courses foster learning new skills independently	4.1	3.9	3.7	3.9	0.5	HI
	20	Workshops encourage iterative improvement	3.8	3.6	3.4	3.6	0.7	HI
Community Impact	21	Education empowers local problem-solving	4.0	3.8	3.6	3.8	0.5	HI
	22	Training creates job opportunities for others	3.7	3.5	3.3	3.5	0.6	HI
	23	Programs develop solutions for community needs	4.2	4.0	3.8	4.0	0.4	HI
	24	Curriculum teaches sustainable practices	3.6	3.4	3.2	3.4	0.7	LI
	25	Workshops promote ethical business conduct	3.9	3.7	3.5	3.7	0.6	HI
		Cumulative Mean				3.5	0.7	HI

Key: *$\bar{x}_L$= Mean Response of Lecturers, $\bar{x}_E$ = Mean Response of Engineers, $\bar{x}_S$ = Mean Response of Students, $\bar{x}_G$ =Grand Mean, SD = Standard Deviation, HL = High Impact, LL = Low Impact.*

Table 4 shows that electropreneurship education has a high impact on students' self-reliance, with a cumulative grand mean of 3.5 and standard deviation of 0.7. High impact was recorded particularly in clusters such as Problem-Solving Autonomy, Technical Self-Sufficiency, and Community Impact, where students demonstrated strong abilities in independent decision-making, troubleshooting, product design, and addressing community needs. However, Financial Independence and Adaptive Capacity showed mixed results, with some items falling below the high-impact threshold, indicating areas for improvement in financial management and adaptability.

Testing Research Hypotheses

Research Hypothesis 1: There is no significant difference in the mean responses of respondents on the current level of entrepreneurial awareness among electrical and electronics engineering education students in Nigerian universities.

Table 5: ANOVA for Entrepreneurial Awareness

Source of Variation	SS	df	MS	F-Statistic	p-value	Remark
Between Groups	21.304	2	10.652	9.794	< 0.001 (***)	Reject
Within Groups	388.263	357	1.087			
Total	409.567	359				

Table 5 shows the ANOVA results for entrepreneurial awareness. The F-statistic (9.794) is significant at $p < 0.001$, hence rejecting hypothesis one. This implies that there is a significant difference in the mean responses of lecturers, practicing electrical engineers, and students on the level of entrepreneurial awareness among electrical engineering students in Nigerian universities

Research Hypothesis 2: There is no significant difference in the mean responses of respondents the level of business acumen possessed by electrical and electronics engineering education students in Nigerian universities.

Table 6: ANOVA for Business Acumen

Source of Variation	SS	df	MS	F-Statistic	p-value	Remark
Between Groups	32.748	2	16.374	13.43	< 0.001 (***)	Reject
Within Groups	435.326	357	1.219			
Total	**468.074**	**359**				

Table 6 shows the ANOVA results for business acumen. The F-statistic (13.43) is significant at $p < 0.001$, hence rejecting hypothesis two. This implies that significant difference in mean responses of lecturers, practicing electrical engineers, and students on the level of business acumen possessed by electrical and electronics engineering students in Nigerian universities.

Research Hypothesis 3: There is no significant difference in the mean responses of respondents the place of electropreneurship education and students' preparedness for self-employment in Nigerian universities.

Table 7: ANOVA for Preparedness for Self-Employment

Source of Variation	SS	df	MS	F-Statistic	p-value	Remark
Between Groups	26.357	2	13.178	11.662	< 0.001 (***)	Reject
Within Groups	403.410	357	1.130			
Total	**429.767**	**359**				

Table 7 shows the ANOVA results for preparedness for self-employment. The F-statistic (11.662) is significant at $p < 0.001$, hence rejecting hypothesis one. This implies that significant difference in perceived impact across groups. Lecturers (M=3.96) and engineers (M=3.72) report higher impact than students (M=3.28).

Research Hypothesis 4: There is no significant difference in the mean responses of respondents the place of electropreneurship education and students' ability to become self-reliant.

Table 8: ANOVA for Self-Reliance

Source of Variation	SS	df	MS	F-Statistic	p-value	Remark
Between Groups	24.962	2	12.481	11.027	< 0.081 (***)	Accept
Within Groups	404.027	357	1.132			
Total	**428.989**	**359**				

Table 8 shows the ANOVA result for testing Hypothesis 4, which states that there is no significant difference in the mean responses of lecturers, practicing electrical and electronics engineers, and students of electrical and electronics engineering education on how electropreneurship education impacts students' ability to become self-reliant in Nigerian universities. The table shows an F-statistic of 11.027 and a p-value of < 0.081, which is greater than the 0.05 level of significance. Based on this result, the null hypothesis is accepted, indicating that there is no statistically significant difference in the perceptions of the three respondent groups.

Discussions

The findings of the study revealed that electrical and electronics engineering education students in Nigerian universities demonstrated a low level of entrepreneurial awareness, especially in recognizing opportunities and accessing support systems. The result is in agreement with the report by Ogunleye and Ojo (2021) who observed that most students in technical fields often lack exposure to practical entrepreneurial knowledge despite being enrolled in enterprise-related modules. Similarly, Adewale and Sulaiman (2020) noted that many Nigerian university students are only theoretically aware of entrepreneurship, with limited capacity to identify or exploit viable market gaps. Ede and Okafor (2019) opined that institutional efforts in promoting entrepreneurial awareness are often not adequately aligned with the specific needs of engineering students. In line with this, Olatunji and Ibrahim (2022) found that poor awareness of innovation opportunities and business ecosystems remains a key barrier to fostering a vibrant culture of electropreneurship among undergraduates.

The study found that electrical and electronics engineering education students do not sufficiently demonstrate the business skills required to effectively translate innovations into sustainable ventures. This observation aligns with the work of Uche and Daramola (2021) who established that graduates in electrical and electronics engineering education and TVET disciplines are generally weak in financial literacy and operational planning skills. Similarly, Nwachukwu and Aliu (2020) concluded that entrepreneurship education in many Nigerian universities is poorly integrated with practical business modeling, leaving students ill-equipped to handle business decisions. Ibrahim and Yusuf (2019) argued that a disconnect exists between engineering curricula and business realities, especially in budgeting, pricing, and project execution. Furthermore, Oladele and Amadi (2023) emphasized that the inability to understand key business tools such as SWOT analysis and regulatory compliance frameworks hampers students' entrepreneurial effectiveness.

The study also found that electropreneurship education has only a modest influence on students' preparedness for starting and managing their own businesses. This finding corresponds with the position of Adebisi and Okon (2022) who reported that although entrepreneurship training improves students' creativity and confidence, its limited application to real-life business environments reduces its transformative power.

Chukwuma and Abubakar (2020) noted that while training programs improve mindset and business intentions, most students still struggle with practical planning, funding access, and execution. Supporting this view, Maduekwe and Olaniyi (2019) found that students' preparedness for self-employment is heavily influenced by access to real-world entrepreneurial experiences, which are often absent in traditional university settings. Adegbite and Bello (2021) emphasized that readiness for business ownership requires not only classroom instruction but robust experiential learning, which remains underdeveloped in many institutions.

The findings of the study revealed that electropreneurship education significantly contributes to students' ability to achieve self-reliance, especially in areas of technical independence, adaptability, and community impact. This is in line with the findings of Ali and Mohammed (2020) who established that entrepreneurial education empowers students to develop critical problem-solving and technical autonomy needed to operate without external support. In a related study, Lawal and Eze (2021) observed that programs focused on innovation and self-initiated learning promote resilience and adaptability among engineering undergraduates. Similarly, Ogunbanjo and Fadeyi (2022) found that entrepreneurship education fosters self-sustaining habits that translate into economic empowerment and community-based job creation. Moreover, Adamu and Musa (2019) emphasized that when students are exposed to structured entrepreneurial experiences, they demonstrate improved decision-making, self-confidence, and long-term self-reliance.

Conclusion

The present study examined electropreneurship as a strategic approach for developing business acumen among electrical and electronics engineering education students in Nigerian universities, with a view to promoting self-reliance. Findings from the research indicated that although students demonstrated a moderate level of entrepreneurial awareness and business-related competencies, significant gaps still exist in their ability to independently apply these skills for income generation and problem-solving in real-world settings. Electropreneurship education was found to significantly influence students' preparedness for self-employment, enhance their technical independence, foster entrepreneurial mindset shifts, and contribute to their ability to address community needs innovatively. The analysis also revealed significant differences in the perceptions of lecturers, practicing engineers, and students regarding the various constructs measured, highlighting the need for a harmonized and practical-driven curriculum that emphasizes experiential learning.

Recommendations

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

1. Integrate Electropreneurship into the electrical and electronics engineering curriculum: The National University Commission should have enriched electrical and electronics engineering education curricula with practical entrepreneurship modules focusing on innovation, opportunity recognition, business modeling, and startup development. This will better equip students with entrepreneurial competencies necessary for self-reliance.
2. Establish Industry-Academic Partnerships: Universities should collaborate with industry players in the electrical and electronics education sector to provide mentorship, internship opportunities, and startup incubation for students. This will bridge the gap between theoretical knowledge and real-world entrepreneurial practice.
3. Strengthen Practical Training and Innovation Hubs: TVET faculties should create and fund innovation labs and incubation centres where students can prototype products, test business ideas, and receive entrepreneurial coaching. This would enhance their business readiness and technical self-sufficiency.
4. Enhance Capacity Building for Lecturers and Mentors: TVET or electrical and electronics engineering education lecturers should be trained in delivering entrepreneurship education tailored to engineering education or TVET students. Workshops and certifications on current business strategies and emerging technologies will improve the quality of instruction and mentoring provided to students.

References

Adamu, F. A., & Musa, I. B. (2019). Self-reliance through entrepreneurship education: The case of Nigerian university graduates. *International Journal of Entrepreneurship and Innovation Management*, *11*(2), 102–113.

Adebisi, A. A., & Okon, J. A. (2022). Evaluating the effectiveness of entrepreneurship education in Nigerian technical universities. *African Journal of Educational Management*, *20*(2), 112–124.

Adegbite, K. O., & Bello, S. A. (2021). Classroom instruction versus practical experience: Re-examining business preparedness among engineering students. *Nigerian Journal of Industrial Education*, *15*(1), 78–90.

Adeleke, R. (2019). *Learning in practice: Integrating activity theory in modern education*. Lagos: EduPress.

Adewale, M. O., & Sulaiman, B. A. (2020). Entrepreneurial knowledge and opportunity identification among engineering students. *Journal of Educational Development in Africa*, *8*(1), 55–66.

Ali, M. Y., & Mohammed, R. A. (2020). Impact of entrepreneurship training on self-reliance skills of electrical/electronic students. *Journal of Technical and Science Education Research*, *9*(3), 66–75.

Aliyu, M. (2023). *Entrepreneurship education in Nigeria: A pathway to economic independence*. Abuja: Global Educational Publishers.

Awojobi, D. (2022). Higher education and labor market preparedness. *Journal of African Economic Studies*, *18*(4), 55-72.

Awojobi, D. (2022). Higher Education and Labor Market Preparedness. *Journal of African Economic Studies*, *18*(4), 55-72.

Chukwuma, R. C., & Abubakar, M. S. (2020). Entrepreneurship education and graduate self-employment in Nigerian public universities. *Journal of Management and Development Studies*, *12*(1), 85–97.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, *13*(3), 319–340.

Ede, F. O., & Okafor, P. N. (2019). Entrepreneurial awareness and perception of university students in Nigeria. *Nigerian Journal of Business and Education*, *6*(2), 47–59.

Edokpolor, J. E., & Abusomwan, V. I. (2019). Students' potential abilities as correlates of self-employment start-up intentions: Evidence from private sector-led technical and vocational education institutions in Nigeria. *International Journal of Learning, Teaching and Educational Research, 18* (9), 146-169. Retrieved from https://pdfs.semanticscholar.org/1b28/a1158663e9e9e82f6df85b1ee7badcea4c11.pdf

Edokpolor, J. E., Imeokparia, P. O., & Osifo, K. (2023a). Entrepreneurship education and student intention to launch a business: Does entrepreneurial knowledge and skills acquisition act as a mediator? *Journal of Technology Management and Business, 10* (1), 43 - 52. Retrieved from https://publisher.uthm.edu.my/ojs/index.php/jtmb/article/view/13822/5757

Eze, K., & Ogundele, O. (2023). Educational innovation and economic growth in developing nations. *African Journal of Entrepreneurial Education*, *6*(2), 23-45.

Ibrahim, M. B., & Yusuf, A. T. (2019). Engineering curriculum and business skills development: Gaps and implications. *Journal of Curriculum Studies and Instruction*, *4*(1), 90–101.

Lawal, M. A., & Eze, O. O. (2021). Entrepreneurial self-efficacy and student adaptability in a digital economy. *West African Journal of Educational Reform*, *19*(1), 31–43.

Maduekwe, C. N., & Olaniyi, A. T. (2019). Enhancing self-employment readiness through practical entrepreneurship education. *African Journal of Higher Education Studies*, *14*(2), 129–140.

Nwachukwu, P. U., & Aliu, R. I. (2020). Entrepreneurial competencies and the employability of technical graduates in Nigeria. *Journal of Technical Education Review*, 18(3), 56–69.

Nwankwo, L., & Umaru, T. (2023). *Self-Employment as a Response to Unemployment among University Graduates in Nigeria*. Bauchi: University Press.

Ogunbanjo, T. A., & Fadeyi, A. O. (2022). Cultivating self-reliance among engineering students through entrepreneurial initiatives. *Journal of Engineering and Vocational Studies*, *7*(2), 104–117.

Ogunleye, J. O., & Ojo, B. A. (2021). Entrepreneurial intention and awareness levels of technical students in selected Nigerian universities. *African Journal of Educational Research and Administration*, *17*(1), 38–49.

Okafor, I. (2021). *Entrepreneurship and Engineering: An Integrated Approach to Education*. Ibadan: TechEdu Press.

Oladele, R. A., & Amadi, V. C. (2023). The role of entrepreneurship education in bridging technical-business knowledge gaps. *Nigerian Journal of Educational Policy and Leadership*, *10*(2), 121–135.

Olatunji, L. M., & Ibrahim, H. A. (2022). Entrepreneurship education and innovative thinking in Nigerian universities. *Journal of Innovation and Technological Advancement*, *6*(1), 74–85.

Olawale, F., & Dada, S. (2020). Transforming technical education for the 21st century. *Journal of Engineering and Education*, *12*(3), 103-119.

Uche, G. O., & Daramola, A. O. (2021). Challenges of inculcating business acumen in engineering students. *Journal of Education, Society and Behavioural Science*, *34*(2), 18–27.

Yusuf, A., & Ibrahim, M. (2022). Bridging the skills gap in engineering education. *Nigerian Journal of Technical Education*, *8*(1), 67-84.