

**UPSKILLING ENTREPRENEURIAL AND DIGITAL SKILLS FOR OPTIMIZING  
TERTIARY STUDENTS' ENGAGEMENT IN STEM EDUCATION, NIGERIA**

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**ABSTRACT**

*Strengthening STEM education through upskilling entrepreneurial and digital skills is imperative for actualizing sustainable development goals in Nigeria. The paper focuses on tertiary students' engagement in STEM education with upskilling for sustainable national development. Descriptive survey design was adopted for the study conducted in Akwa Ibom State, Nigeria. Three research questions guided the study. The population was all the 580 Year One and Year Two undergraduate students across all the units of the department of Science Education, University of Uyo for the 2023/2024 session. A sample size of 300 students was selected using purposive sampling technique. Questionnaire on Tertiary students' engagement in STEM education through upskilling consisting of 45 multiple-choice test items on hands-on entrepreneurship activities and digital tools was the instrument used for data collection. Instrument standardization and validation was done by three experts, one in Test and Measurement from the departments of Educational Foundation and two in Science Education, all in the Faculty of Education, University of Uyo. Questionnaire reliability of .81 was obtained from Cronbach alpha coefficient. Mean and standard deviation were used for analysis. Findings show that many students have skills for entrepreneurial upskilling to carry out STEM activities but need added value on retraining to update already acquired skills. Findings also showed that many students have knowledge of digital skills they employ in their day-to-day school tasks but upgrading is necessary to compete effectively in a dynamic changing world. Remedies were proffered for creativity on sustainability.*

**Keywords:** Students' Engagement, STEM Education, Upskilling, Entrepreneurial skill, Digital skill

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**INTRODUCTION**

STEM represents Science, Technology, Engineering and Mathematics. STEM education is the education given to learners to make them all round students in seeking knowledge and to acquire appropriate skills, abilities and competencies that would enable them contribute meaningfully to their lives and to the development of the society. A lesson or unit in a STEM class is typically based around finding a solution to a real-world problem and emphasizes project-based learning. AguIgwe, Ugochukwu, Okolie and Chioma (2022) stated that an important part of STEM education is creativity as an essential part of innovation to ensure that students understand the connection to the real world and this can be achieved through upskilling. Upskilling comes in because skill-gap is wide. Upskilling is the supply to improve learner's capacity in a fast-paced technological era. Many students

lack the competencies and knowledge on the know-how to perform critical tasks to increase productivity. Many areas of digital devices are rapidly expanding and changing as technology advances changing facets of everyday living. Insufficient application to provide unending demands to better learning and work skills make room for upskilling. According to Johnson (2020), most common skill-gap among students are critical thinking and problem-solving skills, supervisory and managerial skills and communication and interpersonal skills. These skills are needed for successful productivity engagement in learning and workplace. Skills boost productivity of learners, retention of learnt concepts and job suitability. Students can make great impact to improve on their training and reduce negative goal performance with appropriate tools on upskilling. Skills create variety, determines autonomy and give feedback to enrich and motivate learning. Akpan and Udoh (2022) opined that science teachers and students need to acquire new skills to bridge existing gaps to expand knowledge on existing careers; in the areas of organizational and analytical skills. For teachers and students to cater for changing needs and realities outside the classroom they need upskilling.

Upskilling is the process of using additional training and education to build upon and advance on current skills. It is the process of learning new skills and how to apply them. Johnson (2020) opined that upskilling is the process of acquiring new and relevant competencies needed for today and the future. Upskilling is supporting and impacting teaching and learning in many useful ways. It provides unique opportunities and responsibilities in redefining the role of knowledge, mindsets, competencies and skills to face a dynamic changing world. It enables teachers and learners reprioritize knowledge and work towards improving barriers to upgrade quality and productivity to manage emerging challenges. Igwe, Lock and Rugara (2020) added it is a workplace trend that facilitates continuous learning by providing training programmes and development opportunities to expand students' abilities and maximize skill gap. Upskilling is the future of education and it can prepare students for the future through conversational skills, interpersonal skills, emotional skills and social skills.

Upskilling enable teachers' flexibility and help students shift options to explore new dynamics without abandoning their main career focus. They need to know current and future trends in specific domains to keep up with technology and consumption patterns evolving. With better equipping, students can choose right and make informed decisions that give attention to their study and work. Teachers should update knowledge with latest virtual presence with their students. Johnson (2020) stated that the objectives of upskilling include to; close competitive skills gaps of institutions of higher learning; decrease the need to recruit outside specialists to fill skill gaps; increase learners' satisfaction, boost learner's performance, motivation and morale. Igwe, Lock & Rugara (2020) posits that teachers training on latest gadgets is imperative to appropriately interact with the students.

Upskilling is important for students because it increases competition, boosts morales, rises employee needs and brings innovation in technology which made it essential to keep growing in learning. Etiubon and Akpan (2021) stated that students' academic knowledge has to be supplemented with in-demand skills, hands-on experience, and creative thinking. Students who have training and development opportunities are happier in their roles and have a brighter outlook on their future with the careers. Udoh, Anidu, Ekon, (2024) added that upskilling has been made possible through rapid changes in technological innovations, urbanization, resource scarcity and climate change. As a result, students are ensuring that they are active in their acquisitions of skills and need to contend with the shifts in change for the better, through learning, experimenting and collaborating. Upskilling also ensures students' skillsets do not become obsolete through entrepreneurship and digital skills.

Entrepreneurship skills are students' personal attributes, abilities and competencies that enable them to succeed as good entrepreneurs. The skills are essential for identifying opportunities, creating value, and managing the risks associated with starting and running of a business. Etiubon and Udoh (2019) opined that entrepreneurial skills are the intelligence and talents students develop to succeed in entrepreneurial endeavours both within and outside the educational setting. They added that developing entrepreneurial skills can be beneficial to students who plan to start businesses or work in an existing organization to innovate, solve problems or drive the growth of the organisation.

Nigeria, with its dynamic youthful strength and economy has strong entrepreneurial spirit to explore global opportunities. With an ambitious, vibrant youth population of over 70%, the drive for entrepreneurship is large scale. Entrepreneurship and local private enterprise are critical components of Nigeria's sustained economic growth (AguIgwe, Ugochukwu, Okolie, Chioma & 2022). Etiubon and Akpan (2021) stated that universities are making attempts to promote entrepreneurship as one of the solutions to reduce unemployment among youths. Learners engage in different local entrepreneurial activities. This is inadequate but ongoing. There is much to be done to improve capacity on students' knowledge to upskill. Johnson (2020) suggested some ways to upskill students' entrepreneurship which include; communication skills, managing your own finance, volunteering to lead, helping others in their business, keep learning for personal development and active input on variety of digital skills.

Digital skills refer to the abilities and knowledge required to effectively use digital tools like computers, smartphones and the internet to achieve personal, educational or professional goals. Etiubon and Akpan (2021) stated that digital skills refer to tools that students, teachers and educators need to effectively use digital technologies to enhance teaching, learning and assessment. Igwe, Lock and Rugara (2020) described digital teaching tools for upskilling as interactive white board, LCD projectors, computers, digital cameras, digital microscopes, student response system can be used to complement digital instructions. These tools include the social media, video- editing software, micro-learning platform, project management and planning tools, content authoring tools, learning experience platform and communication tools. Different resources of programming, web development, software development, information technology support, UX/UI design, data visualization and digital product management give wide access to information.

They are employed to equip students for upskilling, they are fast, emerging, easy-to-use, reliable tools that maximize knowledge. This encourages deep understanding, motivation, interest and engagement providing authentic content. Learning to upskill makes it possible to access learning resources at any time and at any place. A major intention of digital upskilling is to enable more flexible, self-directed and mobile types of learning to greatly benefit all shades of students competing in the work space to meet global demands necessitated by family, society, economy and health (Emembolu, Emembolu, Umechukwu & Aderinwale, 2020). Students need to stay abreast with relevant and upcoming digital technologies to cover wide skill gap, these technologies require digitally sound-minded students to handle and manage them and it can be achieved through students' engagement.

Students' engagement in education is the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught. It extends to the level of motivation they have to learn and progress in their education. Ottman (2023) opined that, in students' engagement, learning improves when students are inquisitive, interested, inspired, and that learning

tends to suffer when students are bored, dispassionate, disaffected or disengaged. Students' engagement has grown in popularity resulting from an increased understanding of the role that certain intellectual, emotional, behavioural, physical, and social factors play in the learning process and social development. Udoh, Anidu and Ekon, (2024) added that students should be seen as innovators, sources of new ideas, goods, services, business or procedures to bring about sustainable development.

Sustainable development is a process that brings out stability in the requirements of the environment by making the resources available for the use of future generations. It is an approach to the economic development of a country without compromising with the quality of the environment for future generations. Udoh, Anidu and Ekon (2024) stated that sustainable development is a way of organizing society so that it can exist in the long term by taking into account both the imperatives present and those of the future, such as the preservation of the environment and natural resources or social and economic equity. Sustainable development is also referred to as the idea that human beings should sustain by meeting their basic needs, while also making sure that the future generations are able to meet their basic economic needs (Akpan & Udoh, 2022). To sustain economic development, the environmental damages in form of land degradation, soil erosion, air and water pollution, deforestation should be avoided for quality output of goods and services. Sustainable development ensures to promote the kind of development that minimizes environmental problems and helps in ensuring a better life for present and future generations. It lowers the impact on the environment by reducing air, water, soil pollution and helps in achieving long term economic growth and it can be achieved by sensible use of natural resources. Ottman (2023) concluded that sustainable development is an amazing way to conserve the resources provided by nature.

### **STATEMENT OF THE PROBLEM**

Wide skill gap exists and needs to be closed through upskilling to meet tertiary students' learning of STEM to meet global competitiveness. School must find relevance in the curriculum. Curriculum

of tertiary institution is limited on upskilling instruction. Many universities are not sufficiently dedicated on training with upskills to engage students in creative ways. These challenges are curbed through upskilling. Hence, the focus of the study.

### **OBJECTIVES OF THE STUDY:**

The study objectives were to:

1. Ascertain the tools adopted to upskill students' entrepreneurial engagement for sustainable development.
2. Examine the tools employed to upskill students' digital skills for sustainable development.
3. Determine the remedies proffered to enhance students' creativity necessary for upskilling STEM Education for sustainable development.

### **RESEARCH QUESTIONS**

The following research questions will guide the study:

1. What tools have been adopted to upskill students' entrepreneurial engagement for sustainable development?
2. What tools have been employed to upskill students' STEM engagement on digital

skills for sustainable development?

3. What remedies can be proffered to enhance students' creativity necessary for upskilling STEM Education for sustainable development.

## METHODOLOGY

The design adopted for the study was descriptive survey. It was conducted in Akwa Ibom State, Nigeria. The population of the study comprised of 580 year one and year two science education undergraduate students of University of Uyo, Akwa Ibom State in 2023/2024 academic year. Purposive sampling technique was used to select the sample size of 300 final year undergraduate students from biology education (80), chemistry education (76), integrated science education (50), physics education (40) and mathematics education (54). A 45-item questionnaire developed on optimizing students' engagement in STEM education through upskilling for sustainable development was used to collect data for the study.

The instrument was of two parts. Part A consisted of four items that elicited information on name of school, area of specialization, sex and year of study. Part B comprised of 45-items on optimizing students' engagement in STEM education through upskilling for sustainable development. Three experts in Test and Measurement from the departments of Educational Foundation and Science Education validated the instrument to ensure face and content correctness. The items were selected and restructured based on their comments, corrections, suggestions, and modifications. The instrument, OSEISETUTFSD was adapted from Mahajan and Singh (2017) and Little (2012). The instrument elicited opinions on students' engagement in STEM education through upskilling for sustainable development.

The instrument was trial-tested for reliability on 50 students that were not part of the main study for reliability using the split half method. A reliability coefficient of .81 was obtained using Cronbach alpha. A total of 300 copies of questionnaire were successfully administered and all copies were retrieved from the students, which gave 100% return rate. The data obtained were analyzed using mean and standard deviation to provide answers to the research questions. A mean of 1.00 to 1.75 was regarded as low extent, 1.76 to 2.50 was moderate extent, 2.51 to 3.25 was great extent, while 3.26 to 4.00 was very great extent. The result from the sample of students was generalized on the entire population of students.

## DATA ANALYSIS AND RESULTS

**Research Question One:** What tools have been adopted to upskill students' entrepreneurial engagement for sustainable development?

**Table 1: Mean and standard deviation scores of participants on tools adopted to upskill students' entrepreneurial engagement for sustainable development**

S/N	Students' entrepreneurial engagement skills	Mean	SD	Remarks
1	I know quality nutritional skills to set up and manage poultry farm	2.99	0.05	Great extent
2	I use well-drained soil to cultivate plantain, cashew,cocoa, coconut and palm fruit trees	2.74	1.25	Great extent
3	I avoid water and extreme temperature to maintain and service mobile phones, electrical generating set, television, radio, pressing iron and other household electronics	3.36	0.48	Great extent
4	I do seam finishes for dress making	1.69	0.47	Moderate extent
5	I find design trick ideas for making interior decoration	3.36	0.48	Very great extent
6	I use vegetable glycerin to produce body cream	1.69	0.48	Moderate extent
7	I do screen printing for textile designing	1.33	0.49	
8	I make creative patterns for knitting and crouching	1.65	0.51	Moderate extent
9	I do casing and capping electrical wiring in the home	2.62	0.49	Great extent
10	I speak boldly in public	2.32	0.47	
11	I use forging process to fabricate metals for production of farming implements like hoe and machete	2.62	0.49	Great extent
12	I ferment palm wine and fruits to produce ethanol and wine beverages alcoholic	2.30	0.47	Moderate extent
	<b>Overall Mean</b>	<b>2.22</b>	<b>0.47</b>	<b>Moderate extent</b>

Data from research question one indicated that the mean range for the responses on tools adopted to upskill students' entrepreneurial engagement for sustainable development are all between 1.33 - 3.36. The findings also showed that the standard deviation scores of the participants range from 0.05 - 0.51. However, the overall mean of 2.22 for all the items indicated that there is moderate extent of tools adopted to upskill students' entrepreneurial engagement for sustainable development.

**Research Question Two:** What tools have been employed to upskill students' digital skills for sustainable development?



**Table 2: Mean and standard deviation scores of the participants on tools employed to upskill students' digital skills for sustainable development.**

S/N	Students' digital tools for sustainable development	Mean	SD	Remarks
13	I have skills for artificial intelligence and making robotics for learning	2.31	0.47	Moderate extent
14	I have skill for data science and analytics	2.63	0.48	Great extent
15	I have skill for cyber security tracking	2.63	0.48	Great extent
16	I have skill for digital marketing	2.00	0.57	Moderate extent
17	I have skills for cloud computing	2.63	0.48	Great extent
18	I have skill for designing web and app development	2.31	0.46	Moderate extent
19	I have skill for digital business analysis	2.68	0.46	Great extent
20	I have skill for digital coding	2.00	0.00	Moderate extent
21	I have skill digital security	1.69	0.47	Low extent
22	I have skill digital career development	2.00	0.81	Moderate extent
23	I have skill for computer programming	2.31	0.48	Moderate extent
24	I have skill for social media networking	3.33	0.48	Very great extent
25	I have skill in digital product management	3.30	0.48	Very great extent
26	I have skill in data visualization	3.30	0.49	Very great extent
27	I have skill in software development	3.66	0.49	Very great extent
	<b>Overall Mean</b>	<b>2.58</b>	<b>0.47</b>	<b>Great extent</b>

Data from research question two indicated that the mean range for the responses on tools employed to upskill students' digital skills for sustainable development are all between 1.69 - 3.66. The findings also showed that the standard deviation scores of the respondents range from 0.00 - 0.81. However, the overall mean of 2.58 for all the items indicated that there is great extent on tools employed to upskill students' digital skills for sustainable development.

**Research Question Three:** What remedies can be proffered to enhance students' creativity necessary for upskilling STEM Education for sustainable development.

**Table 3: Mean and standard deviation scores of the participants on remedies to enhance students' creativity necessary for upskilling STEM Education for sustainable development.**

S/N	Remedies to enhance students' creativity necessary for upskilling STEM Education	Mean	SD	Remarks
28	I take initiatives on acquiring new skills on block moulding	3.30	0.47	Very great extent
29	I like to use my free time wisely	2.69	0.47	Great extent
30	I get creative ideas listening to others on debates	3.00	0.57	Great extent
31	I embrace utilize technology to surf sites for knowledge on the internet	3.00	0.57	Great extent
32	I like to be my own boss after graduation	3.99	0.57	Very great extent
33	I love self-motivated learning through arts	2.01	0.14	
34	I like sharing ideas and knowledge with myclassmates on how to make neck beads and earrings	2.68	0.46	Great extent
35	I enjoy teaching group activities during lessons	3.36	0.48	Very great extent
36	I like raising awareness on up-to-date innovations in class lessons	3.62	0.48	Very great extent
37	I like drawing	3.99	0.57	Very great extent
38	I like constructing chairs with wood and recycled plastic	2.67	0.46	Great extent
39	I like to socialize with other students	2.00	0.08	Moderate extent
40	I am willing to be mentored on creative skills.	2.01	0.14	Moderate extent
41	I like to participate in e-learning	3.63	0.48	Very great extent
42	I enjoy engraving craft work on plates, and cutleries	2.00	0.00	Moderate extent
43	I like making decorative confectioneries	3.63	0.48	Very great extent
44	I enjoy managing screen adverts for film industries	2.00	0.00	Moderate extent
45	I enjoy building beach resorts for tourism events	2.00	0.00	Moderate extent
	<b>Overall Mean</b>	<b>2.68</b>	<b>0.36</b>	<b>Great extent</b>

Data from research question three indicated that the mean range for the responses on remedies to enhance students'creativity necessary for upskilling STEM Education for sustainable development are all between 2.00 – 3.99. The findings also showed that the standard deviation scores of the respondents rangefrom 0.00 – 0.57. However, the cluster mean of 2.68 for all the items indicated that there is great extent on remedies to enhance students'creativity necessary for upskilling STEM Education for sustainable development.

## DISCUSSION OF FINDINGS

The findings of the study on tools adopted to upskill students' entrepreneurial engagement for sustainable development showed that there is moderate extent of tools adopted to upskill students' entrepreneurial engagement for sustainable development. This may be because many students have skills for entrepreneurial upskilling to carry out STEM activities but need added value on retraining to update already acquired skills. This finding collaborates the findings of Etiubon and Akpan (2021) and Akpan and Udoh (2022) who



maintained that retraining on skills can empower undergraduates for lifelong learning.

The findings of the study on tools employed to upskill students' digital skills for sustainable development showed that there is great extent on tools employed to upskill students' digital skills for sustainable development. This may be due to the fact that many students have knowledge of digital skills that have been employed in their day-to-day school tasks but need to upskill to compete effectively in a dynamic changing world. The findings support Ottman (2023) and Johnson (2020) that students need to stay abreast with relevant and upcoming digital technologies to cover wide skill gap.

The findings of the study on remedies to enhance students' creativity necessary for upskilling STEM Education for sustainable development showed that there is great extent on remedies to enhance students' creativity necessary for upskilling STEM Education for sustainable development. This is because technologies require digitally sound-minded students to handle and manage them. This finding collaborates the findings of Igwe, Lock & Rugara (2020) and Etiubon and Akpan (2021) who maintained that sufficiently dedicated students on training with upskills will engage them in creative ways to compete in an increasingly competitive world.

## **CONCLUSION**

Based on the findings of the study, it was concluded that there is great extent of students' engagement in STEM education through upskilling for sustainable development and students are eager to learn with new technologies.

## **RECOMMENDATIONS**

- Encouraging STEM teachers on use of integrating upskilling tools during instruction. This will help students contribute in many ways to strengthen upskilling for a fulfilling life.
- Schools administrators should commit to facilitating the provision of digital tools to enhance students' learning choices, decisions and career focus.
- Training and retraining STEM teaching on upskilling entrepreneurial skills will define employment opportunities and help students contribute positively to instructional processes.
- Management of tertiary institutions should make provisions for ease of accessing digital tools with well- equipped studios and efficient laboratories.
- Educational stakeholders should give priority attention for adequate provision of skilled STEM teachers to implement up-to-date skills for students' engagement.

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