International Journal of Academic Pedagogical Research (IJAPR)
ISSN: 2643-9123
Vol. 10 Issue 8 August - 2026, Pages: 130-134

Repositioning Technology and Vocational Education in Nigeria towards Production of Graduates with Skills Relevant to Navigate the Fourth Industrial Revolution (4IR)

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Abstract: *This study examined repositioning of technology and vocational education in Nigeria towards production of graduates with skills relevant to navigate the fourth industrial revolution. A descriptive survey research design was adopted for the study. The population comprised lecturers, instructors, and final-year students in technology and vocational education programmes in selected tertiary institutions in Nigeria. A sample of 2015 respondents was selected using purposive sampling techniques. Data were collected using a structured questionnaire based on a 4-point rating scale and analyzed using mean, standard deviation, and Pearson Product Moment Correlation. The findings revealed that innovation significantly enhances instructional methods, curriculum modernization, practical skills acquisition, and creativity, with a grand mean of 2.87. Artificial intelligence integration was also found to improve personalized learning, students' engagement, digital competencies, and preparedness for technology-driven industries, with a grand mean of 2.94. Entrepreneurship education positively influenced self-employment, business development, innovation, and job creation abilities among graduates, recording a grand mean of 2.91. The study concluded that repositioning technology and vocational education through innovation, AI integration, entrepreneurship education, and curriculum modernization is essential for producing competent graduates capable of navigating the fourth industrial revolution. The study recommended increased investment in digital infrastructure, curriculum reform, AI-driven instructional systems, entrepreneurship training, and stronger school-industry collaboration.*

Keywords: Artificial Intelligence, Employability, Entrepreneurship Education, Fourth Industrial Revolution (4IR), Innovation, Skills Training, Technology Education, Vocational Education.

Introduction

Technology and Vocational Education (TVE) is well known as an important tool for industrial development, labour market preparation, technological innovation and sustainable economic development at the international level. Technology and vocational education is a source for developing skills and capacities in the practical aspects, technical knowledge, entrepreneurship and employability skills of learners in developed and developing countries for national productivity and competitiveness. In Nigeria, the tertiary institution providing TVET is expected to produce graduates with the skills and capacity that can meaningfully participate in industrialization, technological development and socio-economic development. But the changing nature of globalization, technological development, digitization and the Fourth Industrial Revolution (4IR) has radically transformed the needs of the labour market, forcing the transformation of education to produce graduates who are capable of solving problems, entrepreneurial, digital and practically skilled for the 21st century economy (OECD, 2020).

However, as technology-driven economies become important, problems have been raised about the skills of many technology and vocational education graduates to meet today's workplace demands in Nigeria. The inadequacy of graduates' technical skills, digital literacy, entrepreneurial orientation and problem solving skills in today's industries is still a cause of concern to employers (Ogunleye & Musa, 2021). The gap between the skills of graduates and the labour market requirements has been a positive contributor to the unemployment, underemployment, low productivity, and low adaptability of the Nigerian youths especially in technological adaptation. The problems have been attributed to the following factors: outdated curricula, lack of funding, obsolete facilities and equipment, lack of collaboration between industry and school, lack of good digital infrastructure, ineffective delivery of instruction and the lack of integration of emerging technologies into programmes of technology education (Adeola & Olufemi, 2023).

Technology and vocational education are learning programs that provide technical expertise, occupational skills and employability competencies to the learners in different career and industrial areas. Based on the view of Adebayo and Musa (2022), technology education offers learners the chance to participate in technological innovation, industrial productivity, and practical learning experiences to prepare them for the contemporary workplaces. But the success of TE and technology will only come if it is flexible

enough to respond to the changing technological realities and needs of the workforce. This has increased the need to reorient the technology and vocational education in tertiary institutions in Nigeria towards the global best practices and emerging industrial trends.

Repositioning of technology and Vocational Education implies curriculum modernization, integration of technology, artificial intelligence (AI), entrepreneurship education, competency-based learning, and innovative teaching methods that will produce graduates that are ready for the job market (Adeola & Olufemi, 2023). According to Nwachukwu and Aina (2021), modern technology education should not stick to theoretical teaching but should be innovative and flexible, have hands-on learning and be learner-centered to train students to have practical skills as well as employability skills. The developing world is facing a highly competitive global economy and educational institutions need to encourage the cultivation of creativity, critical thinking, collaboration, communication and technological literacy to produce students that are able to operate in a technologically driven world.

Innovation is thus a key element in repositioning technology and vocational education. Innovation is addressing the use of new teaching methods, new technologies, new instructional methods, and hands-on learning experiences that result in enhanced learning outcomes and workforce readiness. Laleye (2022) noted that innovation improves learner's creativity, practical competence, problem-solving skills and adaptive. Innovative learning environments enable experiential learning, enhance students' participation in learning and introduce students to real world industry applications. Thus, innovation is vital in the process of curriculum updating, enhancement of instruction and learning of skills in technology education.

Similarly, Artificial Intelligence is now making a difference in the education system worldwide by making education personal, intelligent simulation, automation, virtual labs, and digital instruction delivery. AI-driven education enables adaptive learning processes, increases students' engagement, strengthens digital skills, and introduces learners to new technologies that are important in the 4th Industrial Revolution (4IR) (OECD, 2020). According to Gonski and Shergold (2021), the use of AI in education enhances students' hands-on experience and equips them for jobs in the future that have an increasing technological component. Despite the advantages of AI and digital learning, there remain infrastructural limitations, inadequate funding and technological capacity across many Nigerian tertiary institutions to effectively use AI and digital learning to support technology and vocational education programmes (Bali et al., 2024). This means that students don't have access to intelligent technologies, virtual simulations, automation systems and digital learning environments required to be productive in the modern industry.

It is also notable that entrepreneurship education has become a major part of the modern day technology education and vocational education. Due to the high rate of unemployment in Nigeria, it is imperative for graduates to acquire entrepreneurial skills that enhance self-reliance, innovation and enterprise development. Entrepreneurship Education is a process of providing education that helps students develop competencies in entrepreneurship such as skills in managing their businesses, innovative skills, financial literacy, and skills in self-employment that will enable them to participate in the economy and create employment opportunities. According to Okolie et al. (2019), entrepreneurship education improves employability and job creation by its graduates instead of seeking jobs. Likewise, Yakubu (2020) noted that entrepreneurship education was one of the key strategies that could help alleviate poverty, diversifying the economy and foster sustainable national development in Nigeria. Lack of integration of entrepreneurship education in technology and vocational education programmes, however, has restricted graduates' entrepreneurial opportunities to commercialize innovations, create enterprises and cope with new and emerging labour market conditions.

Technology and vocational education systems have been open to innovation, digitalization, competency-based learning, entrepreneurship training and close partnerships with industry in most developed countries to equip learners for technology-based industries and global competitiveness. But, Nigerian tertiary institutions are still having problem in the successful implementation of these modern educational methods (Bali et al., 2024). The continued use of the outdated teaching methods, as well as the lack of practical experiences in the classroom, pose a risk to Nigeria's capacity to produce globally competitive graduates with the capacity to contribute to the nation's industrialization, technology advancement and sustainable national development.

The repositioning of technology and vocational education in Nigeria is thus, urgent and inevitable. Incorporation of innovation, AI, entrepreneurship education, digital technologies and competency based learning in technology education programs is critical to enhance the quality of instruction, learn to do competency, employability competencies, technological literacy and workforce readiness. This repositioning will not only make our graduates more adaptable to the modern labor market, it will also significantly build the capacity of Nigeria to grow its industries, transform its economy and be competitiveness in the global market.

Last, the study will add to the existing literature on the relationship between technology and vocational education, innovation, integration of AI in education and entrepreneurship education in Nigeria, and will provide reference for future researcher in education for workforce development and educational reform.

Aim and Objectives of the Study

The aim of this study is to examine the repositioning of technology and vocational education in Nigeria towards production of graduates with skills relevant to navigate the fourth industrial revolution. The study specifically sought to:

1. examine the role of innovation in repositioning technology and vocational education towards production of graduates with skills relevant to navigate the fourth industrial revolution;

2. determine the role of artificial intelligence (AI) integration in repositioning technology and vocational education towards production of graduates with skills relevant to navigate the fourth industrial revolution;
3. assess the impact of entrepreneurship education skills acquisition and employability of technology and vocational education graduates with skills relevant to navigate the fourth industrial revolution.

Research Questions

The following research questions guided the study:

1. What is the role of innovation in repositioning technology and vocational education towards production of graduates with skills relevant to navigate the fourth industrial revolution?
2. What is the role of artificial intelligence integration in repositioning technology and vocational education towards production of graduates with skills relevant to navigate the fourth industrial revolution?
3. What is the impact of entrepreneurship education on skills acquisition and employability of technology and vocational education graduates with skills relevant to navigate the fourth industrial revolution?

Methodology

The study adopted a descriptive survey research. The population comprised academic staff, non-academic staff, and final-year students in selected public tertiary institutions offering technology education programs in Nigeria's South/South region. A sample size of 2011 respondents was selected through stratified/purposive random sampling from universities, polytechnics, and colleges of education (technical). Data were collected using a structured questionnaire titled: Innovation, AI and Entrepreneurship in Technology Education Questionnaire (IAETEQ). The instrument consisted of 15 items on a 4-point rating scale: Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). The instrument was face and content validated by experts in educational management and technology education. Reliability was established using Cronbach Alpha, yielding a coefficient of .86. Mean and Standard Deviation were used to answer Research questions, with cut-off mean set at 2.50. The SPSS version 23.0 was used as the main statistical tool for all analysis.

Results and Discussions

1. What is the role of innovation in repositioning technology and vocational education towards production of graduates with skills relevant to navigate the fourth industrial revolution?

Table 1: Mean Response on Role of Innovation in Repositioning Technology Education

S/N	Items	N	Mean	SD	Remark
1	Innovation improves instructional methods in technology education	2011	2.89	.75	Agree
2	Innovation enhances practical skills acquisition	2011	2.91	.71	Agree
3	Innovation promotes creativity and critical thinking	2011	2.85	.73	Agree
4	Innovation modernizes curriculum delivery	2011	2.83	.77	Agree
5	Innovation improves overall educational quality	2011	2.87	.72	Agree
	Grand Mean	**2011**	**2.87**	**.74**	**Agree**

Data in Table 1 showed that the respondents had a grand mean of 2.87 which was above the cut off mean of 2.50. This indicated a positive perception regarding the importance of innovation in improving instructional quality, curriculum modernization, creativity, and practical skills acquisition. This implied that respondents agreed that innovation significantly contributes to repositioning technology and vocational education towards production of graduates with skills relevant to navigate the fourth industrial revolution.

2. What is the role of artificial intelligence integration in repositioning technology and vocational education towards production of graduates with skills relevant to navigate the fourth industrial revolution?

Table 2: *Mean Responses on Role of Artificial Intelligence Integration in Repositioning Technology Education*

S/N	Items	N	Mean	SD	Remark
6	AI enhances personalized learning	2011	2.96	.74	Agree
7	AI improves students' engagement	2011	2.91	.76	Agree
8	AI promotes digital competencies	2011	2.97	.73	Agree
9	AI enhances instructional delivery	2011	2.92	.71	Agree
10	AI prepares students for emerging industries	2011	2.94	.75	Agree
	Grand Mean	**2011**	**2.94**	**.74**	**Agree**

The results in Table 2 showed that respondents had grand mean score of 2.94, which was above the cut-off mean of 2.50. This means that the respondents agreed that AI integration significantly contributes to repositioning technology education in Nigeria. it implies that AI enhances digital literacy, instructional delivery, personalized learning, and preparedness for technology-driven industries.

3. What is the impact of entrepreneurship education on skills acquisition and employability of technology and vocational education graduates with skills relevant to navigate the fourth industrial revolution?

Table 3: *Mean Responses on Impact of Entrepreneurship Education in Repositioning Technology Education*

S/N	Items	N	Mean	SD	Remark
11	Entrepreneurship promotes self-employment	2011	2.93	.76	Agree
12	Entrepreneurship enhances innovation	2011	2.88	.72	Agree
13	Entrepreneurship improves business development skills	2011	2.95	.74	Agree
14	Entrepreneurship develops financial management skills	2011	2.89	.75	Agree
15	Entrepreneurship encourages job creation	2011	2.90	.71	Agree
	Grand Mean	**2011**	**2.91**	**.74**	**Agree**

Data in Table 3 showed that respondents had grand mean score of 2.91, which was above the cut off mean score of 2.50. The findings indicated that entrepreneurship education positively impacts the repositioning of technology education in Nigeria by enhancing employability, innovation, self-reliance, and job creation abilities.

Discussion of Findings

The findings of the study demonstrated that innovation, artificial intelligence integration, and entrepreneurship education are critical factors in repositioning technology and vocational education towards the production of 21st-century skilled graduates in Nigeria. Innovation enhances practical learning, creativity, and curriculum modernization, which are necessary for workforce readiness. This finding supports Laleye (2022), who emphasized that innovative educational practices improve employability and technical competence.

Artificial intelligence integration was also found to significantly improve instructional delivery, personalized learning, and digital competencies. This agrees with OECD (2020), which maintained that AI technologies improve educational productivity and workforce preparedness. Similarly, Gonski and Shergold (2021) observed that AI-driven systems increase students' engagement and readiness for technologically advanced industries.

Entrepreneurship education emerged as a strong factor for self-reliance and economic productivity. This finding aligns with Okolie et al. (2019), who argued that entrepreneurship education equips graduates with enterprise development and business management skills necessary for economic participation and job creation.

The study findings further established that innovation integration, AI integration, entrepreneurship education are components that should be beneficial if integrated into technology education; it enhances employability competencies, technological literacy, creativity, and workforce preparedness.

Conclusion

The study concluded that repositioning technology and vocational education in Nigerian tertiary institutions is essential for producing 21st-century skilled graduates capable of meeting contemporary labour market demands. Innovation, artificial intelligence integration, and entrepreneurship education significantly improve instructional quality, practical competence, digital literacy, employability skills, and workforce readiness. Therefore, government and educational stakeholders should prioritize investment in digital infrastructure, curriculum modernization, AI-driven learning systems, and entrepreneurship-oriented education.

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