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# DEVELOPMENT OF INDUSTRY-RELEVANT SKILLED GRADUATES IN TECHNOLOGY EDUCATION IN NIGERIA TERTIARY INSTITUTIONS FOR EFFECTIVE INDUSTRIAL PRODUCTIVITY

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## ABSTRACT

This study assessed industry-relevant skills needs of technology education graduates in the Federal Colleges of Education (Technical) in Nigeria for effective industrial performance. In particular, it analysed the degree of technical, digital communication, soft, entrepreneurial, and problem-solving skills among graduates against the needs on the industry level. A descriptive survey research design was adopted to study the Federal Colleges of Education (Technical) in Anambra, Rivers, Kano and Lagos States. The study population was composed of 421 lecturers and instructors, and 252 of them were sampled through stratified random sampling to make the sample representative. Data were collected through a researcher developed Skills Assessment Scale (SAS) that was consisted of 39 items rated on 4-point scale. The coefficient of reliability of 0.946 of the instrument was high. The data was analysed with the help of the SPSS version 23, using descriptive statistics (mean and standard deviation). The results found that technical skills (M = 2.51), entrepreneurial skills (M = 2.68), and problem-solving skills (M = 2.59) were of the highest necessity in industrial performance, and digital communication and soft skills (M = 2.48) were of the lowest rank. This study finding has implications for holistic training and production of industry-sale graduates. Hence, there is a need to incorporate digital communication and soft skills in technology education programmes. Therefore, recommended the review of the curriculum,

improvement of digital literacy, entrepreneurship developmental programmes, and project based learning, improved industry-institution cooperation, and sustained capacity building of lecturers to make training output in line with the needs of industry and technological development of the country.

**KEYWORDS:** Technology education, Graduates, Industry-relevant skills, Nigeria, Federal Colleges of Education (Technical)**,** industrial performance.

## INTRODUCTION

In the current dynamic technological world, the necessity to produce industry-related graduates has become one of the driving forces of national development. Technology education is one of key part of Technical and Vocational Education and Training (TVET) in Nigeria, which provides learners with both theoretical and practical skills to be engaged in a technology-oriented economy (FRN, 2013). Nevertheless, there have been continuing disparities in skills training institutions or output versus the industry needs, which have adversely impacted the employability of graduates and resulted in the impediment of industrial development in a nation (Ismail, 2015; ITF Skills-Gap Assessments).

Employers have been finding higher and higher demands in employees with technical know-how, digital literacy, problem solving, teamwork, and communication skills. Students who complete technology education are therefore supposed to be in a position to put scientific knowledge and technological knowledge to practical situations that would encourage productivity and innovation (Adeola & Olufemi, 2023). These graduates are educated in various technical spheres, such as mechanical, electrical, building, and automobile technologies, and they are needed in such areas as manufacturing, energy, and telecommunications (Eze & Okeke, 2022). Studies have also revealed that graduates who have developed technologically are relevant in industrial innovations, renewable energy, and ICT advancement (Ogunleye & Musa, 2021).

In Federal Colleges of Education (Technical), the graduates of technology education programmes have the ability to combine pedagogical and technical skills as they can comfortably work in industries besides teaching and passing on technical skills (Adebayo & Nwachukwu, 2022). Employers also underline soft and digital skills of communication such as collaboration, leadership, flexibility, and ethical professionalism as essential to succeed in

the workplace in the 21st century (Purdue University, 2021). There are four main areas of industry-specific competences, which are discussed:

Technical Skills - Basic practical skills that entail operation, repair, and creation of machinery and systems and safe and proper performance of technical jobs (Olojuolawe & Adelowo, 2022; Sini, 2023). These guarantee that graduates are able to operate in the industrial setting with modern technologies (Olasunkanmi & Ogunniran, 2023).

Digital Communication and Soft Skills - These skills means to be able to communicate technical information, work in a team, project work when using digital platforms, demonstrate a sense of professional ethics and time management (Ahmadu, 2025; Jebba, 2024).

Entrepreneurial Skills - Capability to discover the business opportunities, devise business plans, resource management, and market fluctuation, which improve employability and self-reliance (Olasunkanmi & Ogunniran, 2023; Adeniran, 2024). Problem-Solving and Innovation Skills - Analytical and creative abilities needed to resolve complex problems in industries and make sound decisions and cope with technological change (Sini, 2023; Ahmadu, 2025).

Even though these abilities are critical, researches have indicated that there has been a continued discrepancy in the skills trained and demanded by industries (Okolie et al., 2021; Umar & Olawale, 2022). Weaknesses in the aspects of adequate funding, outdated workshops, poor industry-school interaction, and outdated curricula have all contributed to this. Such limitations do not allow graduates to gain a hands-on exposure and get acquainted with new technologies (automation, artificial intelligence, and renewable energy systems) (Ogunleye & Musa, 2021).

As a result, there is an immediate need to determine the industry-relevant capabilities of the graduates of technology education to address the gap that is currently witnessed in the sector. And to coordinate the curriculum with the requirements of the labor market, to make the technology education more effective towards industrialization of Nigeria, and the diversification of the economy. The research then seeks to establish the degree to which graduates have the major technical, digital, entrepreneurial and soft skills and to analyze the

results of how what is produced in education matches the industry requirements, and how to enhance the quality and employability of graduates in the technology sector in Nigeria.

**Objectives of the Study**

The aim of this study is to assess the industry-relevant skills need of technology education graduates in Federal Colleges of Education (Technical) in Nigeria for effective industrial performance. Specifically, the study seeks to:

1. Determine the level of technical skills possessed by technology education graduates in relation to industry requirements.
2. Examine the extent to which technology education graduates possess digital communication and soft skills relevant to industrial operations.
3. Assess the entrepreneurial competencies required by technology education graduates for industry and self-employment.
4. Investigate the problem-solving and innovation skills needed by technology education graduates to function effectively in the industrial sector.

**Research Questions**

To guide the study, the following research questions are raised:

1. What is the level of technical skills possessed by technology education graduates in Federal Colleges of Education (Technical) in Nigeria for effective industrial performance?
2. What digital communication and soft skills are essential for technology education graduates in Federal Colleges of Education (Technical) in Nigeria for effective industrial performance?
3. What are the entrepreneurial competencies required of technology education graduates in Federal Colleges of Education (Technical) in Nigeria for effective industrial performance?
4. What problem-solving and innovation skills are necessary for technology education graduates in Federal Colleges of Education (Technical) in Nigeria for effective industrial performance?

**METHODS AND MATERIALS**

The study adopted the descriptive survey design, the area of the study was Nigeria where samples of Federal Colleges of Education (Technical) in Anambra, Rivers, Kano, and Lagos States were selected. These places are the various geopolitical regions and have been selected

due to their applicability in technology-oriented education and industrial growth. A study population of 421 lecturers and instructors at eight Federal Colleges of Education (Technical) in Nigeria was used. Based on this, 252 respondents (60 percent of the population) were selected as a sample by a stratified random sampling technique in a fashion that ensure all categories of institutions and staff members were fairly represented. The data collection instrument was the Skills Assessment Scale (SAS), structured questionnaire that the researcher developed, which had 39 questions that determined the relative level of skill development of graduates in technology education. The ratings of the instrument were taken on 4-point rating scale which was categorised into Very Low Extent (1) to Very High Extent (4). The validity of the instruments was done using the expert review by the technology education and measurement and evaluation specialists, and reliability was done using a pilot test of 30 respondents on the Ignatius Ajuru University of Education, Port Harcourt. Reliability indices of the instrument and subscales have a range of 0.752 to 0.837 and the alpha coefficient of the instruments was 0.946, which shows that they consist of strong internal consistency. The research assistants in all institutions were used in data collection and they assisted in the collection using both mailed and hand-delivered questionnaire. Among the total number of 252 sent questionnaires, 231 (92 percent of all mailed) of them were returned (the return rate) and 215 of them could be employed in the analysis after data cleansing. To answer the research questions, SPSS version 23 was applied by use of descriptive statistics (mean and standard deviation), where criterion mean was set to 2.50 to be used as the decision benchmark. The means that are no less than 2.50 reflected high extent and means that are lower than 2.50 reflected low extent.

## RESULTS

### Research question 1

What is the level of industry relevant technical skills technology education graduates in Federal Colleges of Education (Technical) in Nigeria need to possess for effective industrial performance?

**Table 1 Mean Response on Technical Skills Possessed By Technology Education Graduates.**

| S/N | Items descriptions | N | Mean | SD | Remark |
|---|---|---|---|---|---|
| **1** | Proficiency in using modern technology tools and equipment. | 215 | 3.14 | .754 | HE |
| **2** | Ability to interpret technical drawings and diagrams. | 215 | 2.54 | .970 | HE |

| | | | | | |
|---|---|---|---|---|---|
| **3** | Competency in applying engineering principles to solve practical problems. | 215 | 2.18 | .561 | LE |
| **4** | Hands-on skills in machine operation and maintenance. | 215 | 2.39 | .499 | LE |
| **5** | Knowledge of emerging technologies relevant to the industry. | 215 | 2.54 | .527 | HE |
| **6** | Proficiency in conducting experiments and analyzing data. | 215 | 2.80 | .645 | HE |
| **7** | Ability to design and implement technical projects. | 215 | 2.28 | .452 | LE |
| **8** | Troubleshooting and repair skills for maintenance of equipment and systems. | 215 | 2.33 | .668 | LE |
| **9** | Ability to work effectively in a workshop or laboratory environment. | 215 | 2.16 | .583 | LE |
| **10** | Competence in handling and maintaining tools and equipment. | 215 | 3.17 | .962 | HE |
| **11** | Skill in assembling and disassembling machines and systems. | 215 | 2.20 | .752 | LE |
| **12** | Competence in managing practical projects from conception to completion. | 215 | 2.75 | .476 | HE |
| **13** | Ability to work with precision and accuracy in technical tasks. | 215 | 2.75 | .903 | HE |
| **14** | Application of safety procedures in workshops and laboratories. | 215 | 2.54 | .499 | HE |
| **15** | Proficiency in organizing and executing fieldwork related to technology education. | 215 | 2.55 | .326 | HE |
| | **Grand Mean** | **215** | **2.51** | **.603** | **HE** |

Results in table 1 showed that respondents had a grand mean score of M = 2.51, and SD = .603. This is above the criterion mean of 2.50. This indicated the high extent industry relevant technical skills are needed of technology education graduates in Federal Colleges of Education (Technical) in Nigeria for effective industrial performance. However, the respondents rated low extent on items 3,4,7,8, 9, and 11, while the other 9 items were rated high extent. Furthermore, the standard deviation ranges from .326 to .970 indicating homogeneous response means.

**Research question 2**

What digital communication and soft skills are essential for technology education graduates in Federal Colleges of Education (Technical) in Nigeria for effective industrial performance?

**Table 2 Mean Response on Digital Communication and Soft Skills Essential for Technology Education Graduates.**

| S/N | Items descriptions | N | Mean | SD | Remark |
|---|---|---|---|---|---|
| **16** | Ability to communicate technical information clearly and effectively. | 215 | 2.42 | .705 | LE |
| **17** | Skill in writing technical reports and documentation. | 215 | 2.81 | .789 | HE |
| **18** | Competence in presenting technical concepts to a non-technical audience. | 215 | 2.14 | .748 | LE |
| **19** | Ability to work collaboratively with team members on technical projects. | 215 | 2.55 | .759 | HE |
| **20** | Effective communication with industry professionals and stakeholders. | 215 | 2.12 | .745 | LE |
| **21** | Proficiency in using digital communication tools for project collaboration. | 215 | 2.35 | .623 | LE |
| **22** | Time management skills in handling multiple technical tasks. | 215 | 2.93 | .683 | HE |
| **23** | Leadership abilities in managing technical teams. | 215 | 2.41 | .529 | LE |
| **24** | Ability to work under pressure in technical environments. | 215 | 2.35 | .707 | LE |
| **25** | Adaptability in dealing with new challenges and technologies. | 215 | 2.54 | .682 | HE |
| **26** | Ethical behavior and professional responsibility in technical fields. | 215 | 2.75 | .676 | HE |
| **27** | Ability to self-motivate and pursue continuous professional development. | 215 | 2.45 | .526 | LE |
| | **Grand Mean** | **215** | **2.48** | **.594** | **LE** |

Results in table 2 showed that respondents had grand mean score of M = 2.48 and SD = .594. This is below the criterion mean of 2.50. This indicated the low extent digital communication and soft skills are essential for technology education graduates in Federal Colleges of Education (Technical) in Nigeria for effective industrial performance. However, the respondents rated high extent on items 17, 19, 22, 25, and 26, while the other 7 items were rated low extent. Furthermore, the standard deviation ranges from .526 to .789 indicating homogeneous response means.

**Research question 3**

What are the relevant entrepreneurial and business competencies required of technology education graduates in Federal Colleges of Education (Technical) in Nigeria for effective industrial performance?

**Table 3 Mean Response on Entrepreneurial and Business Competencies Required of Technology Education Graduates.**

| S/N | Items descriptions | N | Mean | SD | Remark |
|---|---|---|---|---|---|
| **28** | Competence in identifying business opportunities within the technology field. | 215 | 2.76 | .645 | HE |
| **29** | Knowledge of basic principles of entrepreneurship and business management. | 215 | 2.77 | .565 | HE |
| **30** | Ability to manage resources (financial, human, material) in technical projects. | 215 | 2.47 | .528 | LE |
| **31** | Understanding of market trends and how they affect technology-based businesses. | 215 | 2.23 | .483 | LE |
| **32** | Capacity to start and manage a small-scale technical enterprise. | 215 | 3.38 | .678 | HE |
| **33** | Ability to develop business plans for technical ventures. | 215 | 2.48 | .501 | LE |
| | Grand Mean | 215 | 2.68 | .343 | HE |

Results in table 3 showed that respondents had a grand mean score of M = 2.68 and SD = .343. This is above the criterion mean of 2.50. This indicated the high extent entrepreneurial and business competencies are required for technology education graduates in Federal Colleges of Education (Technical) in Nigeria for effective industrial performance. However, the respondents rated low extent on items 30, 31 and 33, while the other items 28, 29 and 32 were rated high extent. Furthermore, the standard deviation ranges from .483 to .678 indicating homogeneous response means.

**Research question 4**

What problem-solving and innovation skills are necessary for technology education graduates in Federal Colleges of Education (Technical) in Nigeria for effective industrial performance?

**Table 4 Mean Response on Problem-solving and Innovation Skills Necessary for Technology Education Graduates.**

| S/N | Items descriptions | N | Mean | SD | Remark |
|---|---|---|---|---|---|
| **34** | Ability to analyze and solve technical problems effectively. | 215 | 2.63 | .648 | HE |
| **35** | Competency in decision-making when faced with complex technical challenges. | 215 | 3.01 | .714 | HE |
| **36** | Creative thinking in developing innovative technical solutions. | 215 | 2.49 | .820 | LE |
| **37** | Ability to troubleshoot technical issues independently. | 215 | 2.78 | .726 | HE |
| **38** | Proficiency in evaluating alternative solutions to technical problems. | 215 | 3.04 | .816 | HE |

| | | | | | |
|---|---|---|---|---|---|
| **39** | Capacity to adapt to changes in technology and industry practices. | 215 | 2.94 | .841 | HE |
| | **Grand Mean** | **215** | **2.59** | **.256** | **HE** |

Results in table 4 showed that respondents had a grand mean score of M = 2.59 and SD = .256. This is above the criterion mean of 2.50. This indicated the high extent problem-solving and innovation skills are necessary for technology education graduates in Federal Colleges of Education (Technical) in Nigeria for effective industrial performance. However, the respondents rated low extent on items 36, while the other 5 items were rated high extent. Furthermore, the standard deviation ranges from .648 to .841 indicating homogeneous response means.

**DISCUSSION OF FINDINGS**

The research results of this study give substantial information on the degree to which the industry-relevant skills are needed by technology education graduates in Federal Colleges of Education (Technical) in Nigeria to perform effectively in the industrial sector. According to the results, in Tables 1-4, there exist certain differences in the degree of importance awarded to technical, digital communication, entrepreneurial and problem-solving skills, all of which are necessary in the current dynamic technological and industrial setting.

Table 1 showed a grand mean score of M = 2.51 and SD = 0.603 which indicated that the level of significance regarding the required application of the technical skills by the technology education graduates in the effective working in the industry is high. This observation highlights the key role of technical competence as the essence of technology education and industrial productivity. The result was in line with Olojuolawe and Adelowo (2022), who have stressed that technical skills are represented by the skills to work, maintain, and develop machinery and systems with safety and efficiency. On the same note, Olasunkanmi and Ogunniran (2023) concluded that these skills guarantee that the graduates become capable of operating in an industrial environment where modern technologies are becoming a common aspect of doing business. Therefore, the finding means that the technical skills continue to play a leading role in terms of employability and industrial relevance in the minds of graduates in technology education.

Table 2 showed the grand mean of M = 2.48, and SD = 0.594, which is relatively low and indicates that respondents give low rating to the importance of digital communication and soft skills. It is an indication that even though these skills are understood, it is not clearly

emphasised on the training model of technology education in Federal Colleges of Education (Technical). This result is consistent with Ahmadu (2025) and Jebba (2024), who hypothesised that communication, teamwork, ethics, and time management are paramount to success in web-based and team-based workplaces. The results of low mean score indicate the gap in the skills, i.e. the necessity to introduce digital literacy and interpersonal competence into the curriculum in order to teach graduates the realities of Industry 4.0 where teamwork and virtual communication are central.

The respondents grand mean value of M = 2.68 and SD = 0.343 in Table 3 exemplified a high degree to which the entrepreneurial and business competence is needed by the graduates of technology education to perform effectively. This result is consistent with the previous ones of Olasunkanmi and Ogunniran (2023) and Adeniran (2024), who argued that entrepreneurial skills help graduates to recognize business opportunities, allocate resources, or respond to market changes, which increase their employability, innovation, and self-sufficiency. The large average value indicates the increased awareness of the fact that entrepreneurial education as a part of technology education has become important in the context of youth unemployment and sustainable economic growth spreading via small and medium-sized enterprises (SMEs).

The results in Table 4 revealed that the grand mean score = 2.59 and SD = 0.256 were low enough, which implied that there is a high degree of requirement of problem-solving and innovation skills when it comes to industrial performance. This contributes to the argument by Sini (2023) and Ahmadu (2025), who affirm that analytical and creative skills will be instrumental in solving the problem of industry, making an appropriate decision, and managing the technological change. Innovation and adaptability are the two inseparable qualities in the graduates of technology education in the contemporary competitive and dynamic industrial environment. The outcome, thus, highlights how critical thinking, creativity and innovation-oriented learning are crucial elements of technology education curriculum.

**Implications of the Findings**

The results reveal that respondents accept the technical, entrepreneurial, and problem-solving skills to be the most important to provide the proper industrial performance and the digital communication and soft skills are viewed to a lesser degree.

This implies that there is need to ensure that Federal Colleges of Education (Technical) in Nigeria invest more in the incorporation of digital and interpersonal competencies in their programmes to complement the prevailing training of technical and entrepreneurial competencies.

It is also important to align these skills with the industry requirements so as to produce industry ready graduates who can effectively play part in the development of Nigeria in terms of technological and economy.

## CONCLUSIONS

The researchers came up with the following conclusions based on the results of the research: Technology education graduates have very high demands of relevant technical skills to perform well in the industry. These are the skills that are necessary to conveniently run, repair and to maintain machinery and systems within the contemporary industrial settings. There was also low level of demand of digital communication and soft skills in graduates. It shows that there is a deficiency in aspects including collaboration, technological literacy, professional ethics, and purposeful communication-things that are essential in modern technology-centered work environments. Graduates needed high-level of entrepreneurial and business skills in the industries. These competencies contribute to innovation, employability, and self-reliance so that the graduates are capable of generating and handling business opportunities in industrial and technological disciplines. The level of requirement of problem-solving and innovation is also high in order to make graduates perform successfully. Such skills make them have the capability of analyzing, developing, and applying solutions to technical and industrial problems and the capability of adapting to change in technology.

In general, the research findings show that even though technical, entrepreneurial, and problem-solving aspects are properly covered, there is a strong necessity to enhance digital communication and soft skills within the technology education programmes in Federal Colleges of Education (Technical) in Nigeria to provide whole-brained development of graduates who will be able to perform in the modern industry and digital environments.

## RECOMMENDATIONS

Based on the findings and the conclusion of the study, the following recommendations are put down:

1. Review and Integration of Curriculum: National Commission of Colleges of Education (NCCE) ought to revise and change cluster of technology education curriculum to incorporate digital communication, team work and professional ethics in addition to technical content to ensure that training is in line with international industry standards.
2. Increased Digital Literacy Education: To ensure graduates are ready to operate in the digital workplace, Federal Colleges of Education (Technical) must launch digital skill training programmes that focus on the utilization of the modern communication tools, online collaboration tools as well as digital project management techniques.
3. Entrepreneurship Development Programmes: Colleges ought to enhance entrepreneurship in learning by introducing viable business incubation centres, innovation hubs, and mentorship programmes that would stimulate students to be innovative, take risks, and create small businesses.
4. Publicity of Problem- solving and Innovation activities: The approaches to teaching and learning must be oriented towards project-based learning, innovation challenges, and industrial simulations which develop the students critical and innovative approaches to solving problems.
5. Industry-Institution Collaboration: Industries and technical colleges should have a closer alliance to be guaranteed of constant feedback in terms of skills needed, relevance of the curriculum taught and available industrial training, industrial internships, and real-world project experiences.
6. Capacity Building amongst Lecturers: The Federal Colleges of Education (Technical) lecturers must also be subjected to frequent professional growth, and digital training to increase the level of competence to teach the technical and soft skills through the modern instruction technologies.

With these recommendations, Federal Colleges of Education (Technical) in Nigeria are able to graduate graduates, who are not only technologically skilled, but also innovative, entrepreneurial and digitally competent- fit to be useful in the industrial and economic growth of the nation.

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