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ENHANCING ENGINEERING GRADUATES' EMPLOYABILITY THROUGH INDUSTRY-RELEVANT TRAINING AND PLACEMENT

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ABSTRACT

This study aims to enhance the employability of engineering graduates by focusing on industry-relevant training and strategic placement. It addresses the significant gap between the skills of engineering graduates in developing nations and the technical needs of industries. Many industries often express dissatisfaction with the readiness of new engineering graduates due to a lack of essential technical skills, primarily resulting from inadequate training during and after graduation. To assess this issue, the research involved a comprehensive demographic survey of 60 industries within the Agbara Industrial Estate in Ogun State. This survey evaluated their hiring criteria and their absorption of National Youth Service Corps (NYSC) engineering graduates. Additionally, an online questionnaire was distributed to 340 engineering corps members to understand their primary assignment locations. The findings reveal that many engineering graduates are not placed in industries, and many often find themselves in roles unrelated to their field of study. Furthermore, a significant number of corps members are deployed to non-engineering locations or educational institutions. The study highlights the critical need for well-structured and supervised industrial training during internships. It advocates for assigning all engineering graduates to industry-related fields during the one-year NYSC service programme to equip them with the necessary skills for successful employment. This strategic approach is essential for enhancing their employability and effectively bridging the gap between academic training and industry demands.

Keywords: *Employability, engineering graduates, industrial training, internship, placement, technical skills*

INTRODUCTION

In many countries, especially those with developing economies, there is a significant gap between what engineering graduates learn in their programmes and the skills required by the job market (Adegbite & Hoole, 2024; Brennan et al., 2023; James, 2023). Employers often express frustration that new engineering graduates lack the technical abilities and real-world experience for their roles. This gap has led to calls for educational programmes that focus more on industry needs and for strategic placements of graduates in industry settings to bridge the divide between academic learning and workplace requirements (Hughes & Davis, 2024; Kelly et al. 2024; Kayyali, 2024; Ravichandran, 2023). Research has shown that internships and industry placements can significantly improve the skills and job prospects of engineering graduates (Eiljah et al., 2023; Mohammed, 2023; O'Grady et al., 2023; Pandey & Azeem, 2023). Programmes like the NYSC in Nigeria provide students and recent graduates with on-the-job experience, allowing them to apply classroom knowledge in real-world settings and develop the skills employers seek. Internships also expose them to industry standards and expectations, making them more adaptable and ready for entry-level jobs (Cho et al., 2023; Herbert et al., 2024; O'Toole et al., 2023; Peng et al., 2024; Zhu et al., 2023).

Despite these efforts, challenges remain. Graduates often lack the specific skills needed in industry; there are insufficient internship opportunities for gaining practical experience, and many graduates have a limited understanding of industry demands (Ademtsu & Pathak, 2023; Pitan & Muller, 2023). The increasing use of technology in the workplace further

5 PJMH vol 7(2) 2024.indd 45 12/31/2024 3:53:02 PM

emphasises the need to align academic education with the practical skills employers require (Adelakun, 2023; Adelakun & Mosaku, 2021; Olajide et al., 2024; Shomoye et al., 2023). While internships are common in fields like medicine, law, and accounting, their implementation in other disciplines is limited, preventing many graduates from gaining valuable on-the-job training (Kaushal, 2016; Marsono et al., 2017). In developing countries, engineering graduates often struggle due to a lack of practical skills, a concern frequently highlighted by industries (Pang et al., 2019; Patki & Patki, 2015). Collaboration between industries and universities is crucial for providing quality training opportunities through initiatives like the Student Industrial Work Experience Scheme (SIWES) and Industrial Training (IT), ensuring graduates acquire essential technical skills (Adelakun & Mosaku, 2021; Ibrahim et al., 2023; Osang & Asu-Nandi, 2024).

In 2020, Nigeria's unemployment rate reached a staggering 27.1%, with 21.7 million people unemployed (Oyekanmi, 2020). Despite having a robust higher education system with nearly 200 universities and 155 polytechnics enrolling over 2.3 million students annually, the country faces the challenge of finding employment for over 600,000 graduates each year (Adelakun, 2021). Engineering graduates, in particular, face difficulties entering the job market due to perceived deficiencies in practical skills (Babalobi, 2019; Dalzira & Jonas, 2019). Recent research underscores the urgent need for internship programmes to bridge the gap between graduates' skills and employers' expectations, thereby boosting employability. Studies have explored the impact of various aspects of internships on employability, such as duration, formalisation, and motivation techniques. For instance, Jerez Gomez et al. (2023) found a non-linear relationship between internship duration and employability, with initial benefits followed by diminishing returns. They also noted that motivational practices and formalisation significantly influence interns' perceptions of their employability. Additionally, Roe (2023) conducted a qualitative study on how service-learning experiences contribute to graduate students' career readiness, highlighting the importance of practical experience in preparing graduates for the workforce.

Research has shown that service-learning experiences are valuable for both professional training and building abilities and confidence that are crucial for future careers. Teachers considering incorporating service learning to help their graduate students achieve their professional goals should review the recommendations. Yong and Foo (2024) studied how work-related skills were developed in a work-integrated learning (WIL) programme that was not in a job setting but was part of chemical engineering projects. Despite academic projects showing similar results, qualitative data revealed essential skills fostered through internships, such as building professional connections, virtual collaboration, technology proficiency, problem-solving, and critical thinking. These skills are especially critical in engineering work due to the pandemic.

Internships are crucial in preparing graduates for modern job market requirements by providing hands-on experience, developing industry-relevant skills, and building professional networks (Adelakun, 2022; Khasawneh, 2024; Sam & Fred, 2023). Despite efforts to make internship programmes effective, ongoing obstacles remain. Sometimes, businesses struggle to hire interns because they lack sufficient resources or because the students' skills do not match the needs of the industry (Agbonghale & Iserameiya, 2017). To address these issues, stakeholders need to work together to create internship programmes that meet industry demands and provide meaningful learning experiences for students (Adebesin & Adelakun, 2020).

MATERIALS AND METHODS

The study employed a mixed-methods approach to investigate the impact of industry-relevant training programmes on the employability of engineering graduates in Agbara Industrial Estate, Lagos. Initially, the study was guided by a set of research questions focusing on key components of training programmes, employer perceptions, and curriculum alignment with industry needs.

Research Questions

1. How does participation in industry-relevant training programmes influence the employability of engineering graduates?
2. What are employers' perceptions regarding the effectiveness of industry-relevant training and placement programmes in preparing engineering graduates for the workforce?

5 PJMH vol 7(2) 2024.indd 46 12/31/2024 3:53:02 PM

3. Where are the places of primary assignment (PPA) of engineering corps members?
4. What specific skills or competencies do you find most beneficial in engineering graduates who have completed industry-relevant training programmes?
5. How often did the tertiary institution update the content of the curriculum to align with current industry needs?

Survey Questions

1. How frequently are NYSC members posted to your organisation?
2. How would you rate the competence of recently graduated engineers assigned to your organisation?
3. Do you believe internships are necessary for engineering graduates before employment?
4. How would you rate the effectiveness of the industry-relevant training in improving your employability?
5. How many industry-relevant training programmes did you participate in during your engineering studies?
6. How important is industry-relevant training when considering new engineering graduates for employment?

Quantitative Data Collection

Quantitative data were collected through structured surveys distributed to two primary groups: engineering graduates and employers.

1. Graduate Survey: Included questions on the number of training programmes attended, perceived effectiveness of programmes in enhancing employability, and self-ratings of competence.
2. Employer Survey: Assessed perceptions of graduates' readiness and the importance of industry-relevant training in hiring decisions. Responses were measured using a Likert scale to facilitate statistical analysis.

Qualitative Data Collection

Qualitative insights were gathered through semi-structured interviews with a subset of survey respondents. This approach allowed for deeper exploration of specific skills and competencies valued by employers and detailed feedback on curriculum updates.

Data Analysis

Data analysis involved two main methods:

1. Descriptive Statistics: Used to summarise survey responses from both graduates and employers.
2. Thematic Analysis: Applied to interview transcripts to identify recurring themes related to skills, competencies, and curriculum feedback.

RESULTS

The study integrated both quantitative and qualitative findings to provide a comprehensive understanding of the relationship between industry training and employability. This approach ensured a robust examination of factors influencing job readiness among engineering graduates and the effectiveness of industry-relevant training programmes.

Table 1 illustrates the impact of industry training on the employability of engineering graduates, categorised by gender. Among male graduates, 110 found the training highly influential, 84 moderately influential, 57 slightly influential, and 23 not influential. Among

Table 1 Impact of industry training on engineering graduate employability

Response Category	Gender	Highly Influential	Moderately Influential	Slightly Influential	Not Influential	Total Respondents
How does participation in industry-relevant training programmes influence the employability of engineering graduates?	Male	110	84	57	23	274
	Female	39	15	9	3	66
Total Graduates		149	99	66	26	340

5 PJMH vol 7(2) 2024.indd 47 12/31/2024 3:53:02 PM

Table 2 Employer perceptions of industry training programmes for engineering graduates

Response Question	Highly Effective	Moderately Effective	Somewhat Effective	Not Very Effective	Not Effective at All	Total Employers
What are the perceptions of employers regarding the effectiveness of industry-relevant training and placement programmes in preparing engineering graduates for the workforce?	24	17	10	6	3	60

female graduates, 39 found it highly influential, 15 moderately influential, nine slightly influential, and three not influential. Hence, participation in industry-relevant training programmes significantly enhances employability for both genders, with the majority finding it highly or moderately influential.

Table 2 illustrates employers' perceptions of industry training programmes for engineering graduates. Among 60 respondents, 24 found these programmes highly effective, 17 moderately effective, 10 somewhat effective, six not very effective, and three not effective at all. This range of responses reflects varying degrees of satisfaction and suggests areas where improvements in program alignment with industry needs could enhance their perceived effectiveness in preparing graduates for the workforce.

Table 3 displays the place of primary assignment locations for engineering graduates based on gender. Among male respondents, 47 are assigned to primary schools, 142 to secondary schools, 32 to tertiary schools, 17 to local government, and 36 to industries. Among female respondents, 15 are assigned in primary schools, 35 in secondary schools, 9 in tertiary schools, 3 in local government, and 4 in industries. Therefore, secondary schools are the most prevalent assignment location, with 177 graduates, followed by primary schools with 62 graduates.

Table 4 presents the key skills and competencies employers find beneficial from industry-relevant training for engineering graduates. Of 60 employers, 52 value practical experience, 48 appreciate technical skills, and 41 prioritise industry-specific knowledge. Other important skills include critical thinking (37), teamwork and collaboration (32), problem-solving (29), communication (26), project management (26), adaptability (24), innovation (19), and leadership (18). This indicates a broad range of skills deemed essential by employers for engineering graduates' success in the workforce.

Table 3 Engineering graduates' place of primary assignment

Place of Primary Assignment	Male Respondents	Female Respondents	Total number of respondents
Primary School	47	15	62
Secondary School	142	35	177
Tertiary School	32	9	41
Local Government Area	17	3	20
Industries	36	4	40
Total Respondent	274	66	340

5 PJMH vol 7(2) 2024.indd 48 12/31/2024 3:53:02 PM

Table 4 Key skills and competencies from industry-relevant training in engineering graduates

Skill/Competency	Number of Employers Finding It Beneficial
Technical Skills	48
Problem-Solving Skills	29
Communication Skills	26
Teamwork and Collaboration	32
Adaptability and Flexibility	24
Project Management	26
Critical Thinking	37
Industry-Specific Knowledge	41
Practical Experience	52
Leadership Skills	18
Innovation and Creativity	19
Total Employers	60 (assuming some employers selected multiple skills)

Table 5 presents the frequency of curriculum updates in tertiary institutions to meet industry demands, segmented by gender. Male respondents reported 36 updates occurring very often, 49 often, 89 occasionally, 76 rarely, and 24 never. Female respondents reported seven updates very often, 10 often, 25 occasionally, 21 rarely, and three never. Most respondents mentioned occasional updates or less, indicating a need to enhance the alignment of educational content with current industry needs. Notably, males reported more frequent updates compared to females, suggesting a gender disparity in curriculum responsiveness to industry changes.

Table 6 illustrates the frequency of NYSC member postings to Organisations based on employer responses. Among the 60 employers surveyed, 25 reported never receiving NYSC members, 14 rarely, nine occasionally, seven often, and five very often. This suggests varied engagement levels with the NYSC programme across employers, potentially impacting their exposure to and utilisation of young graduate talent through this national service initiative.

Table 7 displays the employer ratings of competence among recently graduated engineers in their respective Organisations. Five of the 60 surveyed employers rated competencies as excellent, eight as very good, 12 as good, 20 as fair, and 15 as poor. This indicates a varied perception of the competence levels of these engineers, with a significant number expressing reservations about their preparedness for professional roles within the organisation.

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Table 8 illustrates opinions on the necessity of internships for engineering graduates before employment. Among 60 respondents, 45 believe internships are necessary, 10 do not, and five are unsure (maybe). This highlights a strong consensus among most respondents regarding the importance of internships in preparing engineering

Table 5 Frequency of curriculum updates to align with industry needs

Research Question	Gender	Never	Rarely	Occasionally	Often	Very Often	Total Respondents
How often did the tertiary institution update the content of the curriculum to align with current industry needs?	Male	24	76	89	49	36	274
	Female	3	21	25	10	7	66
Total Number of Respondents		27	97	114	59	43	340

5 PJMH vol 7(2) 2024.indd 49 12/31/2024 3:53:02 PM

Table 6 Frequency of NYSC member postings to an organisation

Research Question	Never	Rarely	Occasionally	Often	Very Often	Total Employers
How frequently are National Youth Service Corps (NYSC) members posted to your organisation?	25	14	9	7	5	60

Table 7 Rating of competence in recently graduated engineers assigned to an organisation

Research Question	Excellent	Very Good	Good	Fair	Poor	Total Employers
How frequently are National Youth Service Corps (NYSC) members posted to your organisation?	5	8	12	20	15	60

Table 8 Importance of internships for engineering graduates

Research Question	Yes	No	Maybe	Total Number of Respondents
Do you believe internships are necessary for engineering graduates before employment?	45	10	5	60

graduates for the workforce, emphasising practical experience and skill development as crucial for career readiness.

Table 9 presents perceptions on the effectiveness of industry-relevant training in enhancing employability, categorised by gender. Among male respondents, 73 strongly agree and 96 agree that such training is effective, while 31 disagree and 20 strongly disagree. For females, 19 strongly agree and 22 agree, while nine disagree and five strongly disagree. Overall, the majority of both genders perceive industry-relevant training positively, indicating its significant impact on improving their employability skills and prospects.

Table 10 illustrates the varying significance of industry-relevant training in assessing new engineering graduates for employment among 60 employers. Specifically, 28 employers consider it extremely important, 19 very important, seven moderately important, four slightly important, and two not important. This highlights a prevailing perspective among employers that such

Table 9 Effectiveness of industry-relevant training in improving employability

Research Question	Gender	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total Respondents
How would you rate the effectiveness of the industry-relevant training in improving your employability?	Male	20	31	54	96	73	274
	Female	5	9	11	22	19	66
Total Number of Respondents		25	40	65	118	92	340

5 PJMH vol 7(2) 2024.indd 50 12/31/2024 3:53:02 PM

Table 10 Importance of industry-relevant training in hiring new engineering graduates

Research Question	Not Important	Slightly Important	Moderately Important	Very Important	Extremely Important	Total Employers
How important is industry-relevant training when considering new engineering graduates for employment?	2	4	7	19	28	60

training substantially improves the preparedness and appeal of engineering graduates for professional positions within their Organisations.

Table 11 presents the participation of engineering students in industry-relevant training programmes, segmented by gender. Among male students, 50 did not participate, 96 participated in 1-2 programmes, 73 in 3-4 programmes, 37 in 5-6 programmes, and 18 in 7 or more programmes. Among female students, 15 did not participate, 23 participated in 1-2 programmes, 17 in 3-4 programmes, 8 in 5-6 programmes, and 3 in 7 or more programmes. Overall, the data indicates diverse levels of participation in industry-relevant training programmes, with the majority engaging in 1-4 programmes during their engineering studies.

RESULTS AND DISCUSSION

The data provides a detailed insight into the integration of engineering graduates into the professional world. Employers hold varied opinions on the effectiveness of industry training programmes for engineering graduates: out of 60 surveyed, 24 consider them highly effective, 17 moderately effective, 10 somewhat effective, six not very effective, and three ineffective. This spectrum of opinions highlights the necessity for improved alignment between training programmes and industry expectations to enhance their efficacy in preparing graduates for the workforce. Regarding primary assignment locations, secondary schools are the most common destinations for engineering graduates, suggesting a trend towards educational roles after graduation. Employers place the highest value on practical experience gained from industry-relevant training, followed by technical skills and industry-specific knowledge, indicating a preference for hands-on, applicable skills.

The frequency of curriculum updates to align with industry needs varies, with occasional updates being the most common. This indicates that while educational institutions are trying to adapt, there may still be gaps in meeting the rapidly evolving demands of the industry. Engagement with NYSC members for graduate placements seems limited, suggesting this resource may be underutilised.

Employer assessments of the competence of recent engineering graduates vary, with some expressing concerns about their readiness for professional roles. Internships are widely regarded as essential for improving engineering graduates' employability, emphasising the importance of practical experience and skill development. Both genders generally agree on the positive impact of industry-relevant training on employability, highlighting its crucial role in preparing

Table 11 Number of industry-relevant training programmes participated in during engineering studies

Research Question	Gender	0	1-2	3-4	5-6	7 or more	Total Respondents
How many industry-relevant training programmes did you participate in during your engineering studies?	Male	24	76	89	49	36	274
	Female	15	23	17	8	3	66
Total Number of Respondents		65	119	90	45	21	340

5 PJMH vol 7(2) 2024.indd 51 12/31/2024 3:53:02 PM

graduates for their careers. These findings reveal the intricate relationship between education, industry demands, and employment outcomes for engineering graduates, highlighting areas where enhancements can be implemented to better equip them for successful careers.

CONCLUSION

The study provides a nuanced understanding of the challenges and opportunities faced by engineering graduates entering the workforce. It highlights the need to align educational curricula with industry demands to enhance employability. The predominance of assignments in secondary schools suggests a prevalent career path for graduates, while employers prioritise practical experience, highlighting the importance of hands-on training. Despite occasional curriculum updates by educational institutions, the limited engagement with National Youth Service Corps (NYSC) members suggests the underutilisation of this valuable placement, which could serve to bridge the gap between academia and industry. Internships are crucial for providing practical skills and enhancing job readiness. To address discrepancies in training program effectiveness, the study recommends regular curricula updates, expanded internship opportunities, stronger academia-industry partnerships, promotion of gender equity in training participation, improved NYSC engagement, and enhanced technical competencies. It also advocates robust mechanisms to monitor and evaluate programmes, support lifelong learning initiatives, expanded career counselling and guidance services, and foster a culture of research and innovation within educational institutions. Collectively, these strategies can empower engineering graduates to thrive in the competitive job market, meeting evolving technological and industrial challenges.

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