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Optimising Educational Technology Integration in Industrial Technical Education: Examining Course Content Adequacy for Graduate Employability in Emerging Industries

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Abstract

This study explored how educational technology integration and course content adequacy influence graduate employability within Industrial Technical Education (ITE) programmes in Lagos and Ogun States, Nigeria. A descriptive survey design was employed, involving 174 respondents drawn from three key stakeholder groups: lecturers, students, and industry experts across UNILAG, LASUED, and Tai Solarin Federal University of Education. Data were collected using a structured questionnaire (ETICAGEQ) with a reliability coefficient of 0.83 and analysed using mean, standard deviation, and one-way ANOVA at the 0.05 level of significance. Findings revealed that stakeholders generally perceive technology integration, curriculum adequacy, and graduate employability as moderately high. Although lecturers and students reported slightly higher ratings than industry experts, no statistically significant differences were observed among the groups. Notably, industry experts' relatively lower ratings suggest a gap between academic practices and current industrial expectations. The study concludes that while ITE programmes provide a solid foundation for employability, more deliberate, technology-driven, and collaborative reforms are necessary to meet the demands of a rapidly evolving digital economy.

Keywords: Educational technology integration, course content adequacy, graduate employability, industrial technical education

Introduction

Industrial Technical Education (ITE) plays a critical role in preparing a skilled workforce capable of driving industrial growth, innovation, and sustainable economic development, especially in emerging economies (Ali et al., 2024). In recent years, however, the nature of work has changed significantly. The rise of automation, artificial intelligence, and digital manufacturing has shifted the expectations placed on technical graduates. Today, it is no longer sufficient to possess only hands-on technical skills; graduates must also demonstrate digital competence, adaptability, and problem-solving abilities (Uduafemhe et al., 2023). As a result, two key factors have become central to the effectiveness of ITE programmes: the integration of educational technology and the adequacy of course content. Educational technology integration involves the purposeful use of digital tools, such as simulations, CAD/CAM systems, virtual laboratories, and learning management platforms, to enhance teaching and learning (Hamzah et al., 2024). When effectively applied, these tools can deepen understanding, improve engagement, and better prepare students for real-world industrial environments (Akintayo et al., 2024). However, technology alone cannot guarantee relevance. The content of what is taught must also reflect current and emerging industry demands. Course content adequacy refers to how well the curriculum aligns with industry expectations, balances theory with practice, and equips learners with both technical and transferable skills (Van den Beemt et al., 2020). Where curricula lag behind industrial developments, graduates often struggle to meet employer expectations. In Nigeria and similar developing contexts, several challenges hinder effective ITE delivery. These include limited access to modern technologies, inadequate lecturer training, weak industry collaboration, and slow curriculum updates (Buabeng & Amo-Darko, 2025). Consequently, despite the availability of job opportunities in some sectors, graduates may still face difficulties transitioning into employment. Graduate employability, therefore, extends beyond securing a job; it encompasses the ability to adapt, perform, and grow within a dynamic work environment (Musa et al., 2025). Achieving this requires strong collaboration among institutions, industry, and policymakers. Importantly, understanding the effectiveness of ITE programmes demands input from multiple stakeholders, each offering unique perspectives on training quality and workplace relevance. Despite ongoing reforms, there remains limited empirical evidence capturing these perspectives within Lagos and Ogun States. This study addresses that gap by examining how educational

technology integration and course content adequacy influence graduate employability, using insights from lecturers, students, and industry experts.

Statement of the Problem

Industrial Technical Education (ITE) was originally structured to develop occupation-specific competencies within relatively stable industrial systems. Its emphasis on manual tools, workshop practices, and well-defined curricula was effective in preparing skilled manpower for traditional industries. This model reflected an era where technological change was gradual, allowing training systems to remain relevant over extended periods. Rapid technological advancement has transformed modern industries into highly digital, automated, and interconnected environments, requiring new skill sets such as digital literacy, adaptability, and systems thinking. However, many ITE programmes, particularly in Nigeria, have not evolved at the same pace. Persistent challenges, including outdated curricula, limited access to modern instructional technologies, and weak collaboration with industry, continue to hinder the effectiveness of training. As a result, graduates often lack exposure to current industrial practices. In major industrial hubs such as Lagos and Ogun States, these limitations manifest in noticeable skill mismatches, with employers expressing concerns about graduate readiness for the workplace. Existing studies have explored related issues but often rely on single perspectives and lack robust comparative analysis. The underrepresentation of industry experts in such research further constrains comprehensive understanding, creating a need for a multi-stakeholder approach to generate more balanced and evidence-based insights for improving ITE effectiveness.

Purpose of the Study

The main aim of this study is to examine how integrating educational technology and ensuring the adequacy of course content in Industrial Technical Education (ITE) programmes enhance graduate employability in emerging industries in Lagos and Ogun States. Specifically, the study aims to:

1. assess the level of educational technology integration in ITE programmes as perceived by ITE lecturers, ITE students, and industry experts
2. evaluate whether the ITE course content sufficiently meets the skill requirements of emerging industries from these groups' perspectives

3. investigate the impact of educational technology integration and course content adequacy on the employment readiness of ITE graduates.

Research Questions

1. What is the average rating of ITE lecturers, ITE students, and industry experts on the level of educational technology integration in Industrial Technical Education programmes?
2. What is the average rating of ITE lecturers, ITE students, and industry experts regarding the adequacy of course content in Industrial Technical Education programmes for meeting emerging industry skill requirements?
3. What is the average rating of ITE lecturers, ITE students, and industry experts regarding the employability readiness of graduates from Industrial Technical Education programmes?

Hypotheses

The following null hypotheses are formulated to guide the study and are tested at 0.50 level of significance.

1. There is no significant difference in the mean ratings of ITE lecturers, ITE students, and industry experts regarding the level of educational technology integration in Industrial Technical Education programmes.
2. There is no significant difference in the average ratings ITE lecturers, ITE students, and industry experts regarding the sufficiency of course content in Industrial Technical Education programmes to meet the needs of emerging industries.
3. There is no difference in the average ratings of ITE lecturers, ITE students, and industry experts regarding the employability readiness of graduates from Industrial Technical Education programmes.

Methodology

This study adopted a descriptive survey research design, considered appropriate for collecting standardized data from multiple stakeholder groups and enabling both descriptive analysis and group mean comparisons using inferential statistics. The study was conducted in Lagos State, Nigeria, an industrial and educational hub with strong connections to emerging industries, and also included Tai Solarin Federal University of Education, Ijebu-Ode, Ogun State. Three institutions were purposively selected: The University of Lagos (UNILAG), Lagos State University of Education (LASUED), and Tai Solarin Federal University of Education, based on their provision of Industrial Technical Education (ITE) programmes and varying levels of exposure to educational technologies and industry

collaboration. The population comprised over 320 ITE lecturers, students, and industry experts affiliated with these institutions, from which a purposive sample of 174 respondents was drawn, including 24 lecturers, 120 students, and 30 industry experts. The sample size was deemed adequate for quantitative analysis and aligns with established guidelines, such as those proposed by Krejcie and Morgan (1970).

Data were collected using a researcher-developed structured questionnaire titled "Educational Technology Integration, Course Content Adequacy, and Graduate Employability Questionnaire (ETICAGEQ)." The instrument contained four sections addressing educational technology integration, course content adequacy, graduate employability readiness, and the relationship among these variables, with items rated on a 4-point scale from Strongly Agree (4) to Disagree (1) Strongly. Content validity was established by three experts in Industrial Technical Education (two from UNILAG and one from LASUED), while reliability testing using Cronbach's Alpha yielded a coefficient of 0.83, indicating high internal consistency. Questionnaires were administered personally by the researcher with assistance from trained research assistants to ensure clarity and a high response rate, and all copies were retrieved. Data analysis involved the use of descriptive and inferential statistics. Mean and standard deviation were employed to answer research questions, with a decision benchmark of 2.50. Analysis of Variance (ANOVA) was used to test hypotheses at a 0.05 level of significance and to determine differences among lecturers, students, and industry experts.

Results

Research Question 1: What is the average rating of ITE lecturers, ITE students, and industry experts on the level of educational technology integration in Industrial Technical Education programmes?

Table 1: Mean and Standard Deviation of Stakeholders' Perception on Educational Technology Integration (ETI)

S/N	Items	Lecturers Mean	Lecturers SD	Students Mean	Students SD	Industry Experts Mean	Industry Experts SD
1	Digital tools are adequately integrated into ITE teaching and learning.	3.04	0.53	3.01	0.49	2.86	0.51

S/N	Items	Lecturers Mean	Lecturers SD	Students Mean	Students SD	Industry Experts Mean	Industry Experts SD
2	Educational technologies align with current industrial practices.	3.09	0.44	2.99	0.59	2.67	0.47
3	Students have sufficient hands-on exposure to technology-enhanced learning.	3.11	0.67	3.04	0.71	2.81	0.52
4	Technology integration enhances understanding of technical concepts.	3.07	0.46	3.01	0.58	2.97	0.51
5	Available educational technologies are effectively utilised.	3.18	0.49	3.13	0.45	3.07	0.56
Total		15.49	2.59	15.18	2.82	14.38	2.57

The results revealed that lecturers (15.49) rated technology integration slightly higher than students (15.18) and industry experts (14.38). While all means exceed the benchmark of 3.00, indicating agreement, industry experts expressed relatively lower confidence in the alignment of educational technologies with current industrial practices. This suggests a modest academia–industry perception gap regarding technological currency and depth of integration. The relatively low standard deviations across groups indicate homogeneity of responses, suggesting shared recognition that technology is present, though perhaps not optimally industry-aligned.

Hypothesis 1. There is no significant difference in the mean ratings of ITE lecturers, ITE students, and industry experts regarding the level of educational technology integration in Industrial Technical Education programmes.

Table 2: Summary of One-Way ANOVA Table on Educational Technology Integration (ETI)

Source of Variation	SS	Df	MS	F	Sig.
Between Groups	19.93	2	9.97	1.32	0.27
Within Groups	1292.17	171	7.56		
Total	1312.10	173			

The one-way ANOVA revealed no statistically significant difference among lecturers, students, and industry experts regarding their perceptions of Educational Technology Integration (ETI) in Industrial Technical Education, $F(2, 171) = 1.32$, $p > .05$. Although lecturers reported the highest mean perception score ($M = 15.49$, $SD = 2.59$), followed by students ($M = 15.18$, $SD = 2.82$), and industry experts ($M = 14.38$, $SD = 2.57$), these differences were not statistically significant. The effect size ($\eta^2 = 0.015$) indicates a small practical effect (1.5%), suggesting minimal variance in perceptions attributable to group membership. This finding implies a consensus among academic and industry stakeholders that Educational Technology Integration within Industrial Technical Education is moderately implemented but not distinctly differentiated across stakeholder categories. The slightly lower mean score of industry experts, however, may suggest a perceived gap between academic technology usage and real-world industrial expectations, warranting closer alignment between institutional practices and contemporary industry standards.

Research Question 2. What is the average rating of ITE lecturers, ITE students, and industry experts regarding the adequacy of course content in Industrial Technical Education programmes for meeting emerging industry skill requirements?

Table 3: Mean and Standard Deviation of Stakeholders' Perception on Course Content Adequacy (CCA)

S/N	Items	Lecturers Mean	Lecturers SD	Students Mean	Students SD	Industry Experts Mean	Industry Experts SD
6	Course content reflects emerging industry skill requirements.	3.12	0.39	3.09	0.48	3.16	0.54
7	Curriculum balances theory and practical application.	3.03	0.43	3.05	0.56	2.76	0.68
8	Course content is regularly updated.	3.18	0.49	3.11	0.67	3.01	0.70
9	Curriculum prepares students for real industrial problem-solving.	2.97	0.65	3.02	0.58	2.89	0.72
10	Alignment exists between curriculum	3.18	0.46	3.11	0.59	3.09	0.54

	and workplace expectations.						
Total		15.48	2.42	15.38	2.88	14.91	3.18

Lecturers (15.48) and students (15.38) perceived the curriculum as largely adequate. Industry experts (14.91), although still positive, expressed more reservations, particularly concerning theory–practice balance and real industrial problem-solving preparation. The higher variability in industry experts' responses (SD = 3.18) suggests differences in expectations across sectors. This accentuates the importance of continuous curriculum review and structured industry participation in curriculum development.

Hypothesis 2: There is no significant difference in the average ratings given by ITE lecturers, ITE students, and industry experts regarding the sufficiency of course content in Industrial Technical Education programmes to meet the needs of emerging industries.

Table 4: Summary of One-Way Analysis of Variance (ANOVA) on Course Content Adequacy (CCA)

Source of Variation	SS	Df	MS	F	Sig.
Between Groups	6.08	2	3.04	0.37	0.69
Within Groups	1414.99	171	8.27		
Total	1421.07	173			

The one-way ANOVA revealed no statistically significant difference among lecturers, students, and industry experts regarding their perceptions of Course Content Adequacy (CCA), $F(2, 171) = 0.37$, $p > .05$. Although lecturers reported the highest mean score ($M = 15.48$, $SD = 2.42$), followed closely by students ($M = 15.38$, $SD = 2.88$) and industry experts ($M = 14.91$, $SD = 3.18$), these differences were not statistically significant. The calculated effect size ($\eta^2 = 0.004$) indicates a very small effect (0.4%), suggesting that stakeholder category accounts for less than one per cent of the variance in perceptions of course content adequacy. Overall, this finding reflects a strong convergence of opinion among stakeholders, implying a shared recognition that curriculum structure, industry alignment, and the balance between theory and practice are relatively consistent across groups. However, the comparatively lower mean rating from industry experts subtly points to lingering concerns about the

responsiveness of the curriculum to emerging industry dynamics, particularly in rapidly evolving technological sectors.

Research Question 3. What is the average rating of ITE lecturers, ITE students, and industry experts regarding the employability readiness of graduates from Industrial Technical Education programmes?

Table 5: Mean and Standard Deviation of Stakeholders' Perception on Graduate Employability Readiness (GER)

S/N	Items	Lecturers Mean	Lecturers SD	Students Mean	Students SD	Industry Experts Mean	Industry Experts SD
11	Graduates possess relevant technical skills.	3.08	0.46	3.11	0.63	3.02	0.68
12	Graduates demonstrate digital competence.	3.19	0.48	3.16	0.53	3.12	0.49
13	Graduates adapt easily to new technologies.	3.20	0.44	3.18	0.56	3.16	0.46
14	Graduates exhibit problem-solving and innovation.	3.18	0.59	3.16	0.65	3.12	0.70
15	Overall, graduates are employable in emerging industries.	3.16	0.53	3.11	0.71	3.08	0.65
Total		15.81	2.50	15.72	3.08	15.50	2.98

This section recorded strong positive ratings across all stakeholders, with lecturers (15.81) and students (15.72) slightly higher than industry experts (15.50). Respondents agreed that graduates possess digital competence, adaptability, and innovative thinking skills. These findings suggest that ITE programmes are perceived as producing graduates who are reasonably well-prepared for emerging industries. However, the slightly lower ratings from industry experts suggest that further strengthening of workplace exposure and industrial immersion may enhance employability outcomes.

Hypothesis 3: There is no notable difference in the average ratings of ITE lecturers, ITE students, and industry experts regarding the employability readiness of graduates from Industrial Technical Education programmes.

Table 6: Summary of One-Way Analysis of Variance (ANOVA) on Graduate Employability Readiness (GER)

Source of Variation	SS	Df	MS	F	Sig.
Between Groups	1.54	2	0.77	0.09	0.91
Within Groups	1530.16	171	8.95		
Total	1531.70	173			

The one-way ANOVA revealed no statistically significant difference among lecturers, students, and industry experts regarding their perceptions of Graduate Employability Readiness (GER), $F(2, 171) = 0.09$, $p > .05$. Although lecturers reported the highest mean score ($M = 15.81$, $SD = 2.50$), followed by students ($M = 15.72$, $SD = 3.08$) and industry experts ($M = 15.50$, $SD = 2.98$), these differences were statistically negligible. The computed effect size ($\eta^2 = 0.001$) indicates an extremely small practical effect (0.1%), suggesting that stakeholder group membership accounts for virtually none of the variance in perceptions of graduate employability readiness. This finding reflects a strong consensus across academia and industry regarding the employability preparedness of ITE graduates, thereby reinforcing the credibility of the programme's outcomes. However, the consistently moderate mean scores suggest that there is still room for improvement, particularly in enhancing industry responsiveness, strengthening innovation capacity, and deepening the integration of digital transformation within the curriculum.

Discussion of Findings

The first finding showed that educational technology is moderately integrated into Industrial Technical Education (ITE) programmes, with mean scores above the benchmark indicating general agreement among stakeholders that digital tools are being used in teaching and learning. This supports prior studies (Akintayo et al., 2024; Bondin & Zammit, 2025), which highlight the role of educational technologies in enhancing engagement, conceptual understanding, and workplace-related skills. Similarly, Hamzah et al. (2024) and Mourtzis et al. (2023) noted the increasing use of tools such as simulations, CAD/CAM systems, and digital learning platforms in technical education. However, industry experts rated this integration slightly lower than lecturers and students, suggesting

that institutional technologies may not fully reflect current industry practices. This aligns with ILO (2020) concerns about the gap between training and workplace realities, likely due to faster technological adoption in industry compared to the constraints faced by educational institutions.

The second finding revealed that ITE course content is generally perceived as adequate for meeting the skill requirements of emerging industries, with stakeholders agreeing that the curriculum equips students with relevant knowledge and competencies for workforce entry. This is consistent with Van den Beemt et al. (2020), as well as Asefer and Abidin (2021) and Presti et al. (2022), who emphasize curriculum alignment with technological and industrial developments as a key driver of employability. Nonetheless, industry experts expressed slightly more reservations, particularly regarding the balance between theory and practical application. This supports Buabeng and Amo-Darko's (2025) view that curriculum updates in developing contexts often lag behind rapid industrial changes, with industry professionals expecting stronger practical problem-solving skills and greater exposure to real workplace conditions. The third finding indicated that graduates are generally perceived as employable in emerging industries, demonstrating technical competence, digital skills, adaptability, and innovative capacity. This aligns with OECD (2021), Mustafazada (2024), and Musa et al. (2025), who describe employability as a blend of technical expertise, technological literacy, and continuous learning ability. However, the moderate ratings suggest that improvements are still needed, particularly in expanding industry-based learning opportunities such as internships, apprenticeships, and exposure to real-time technologies to strengthen practical competence.

Finally, the study established that educational technology integration and course content adequacy jointly play a critical role in enhancing graduate employability, with strong stakeholder agreement on their interconnectedness. This supports Chugh et al. (2023) and UNESCO (2015), who emphasize the need for alignment between curriculum design, technological integration, and labour market demands. The absence of statistically significant differences among lecturers, students, and industry experts further indicates a strong consensus, likely reflecting their shared exposure to the same educational and industrial environment and similar expectations regarding graduate preparation.

Conclusion

This study critically examined the integration of educational technology and the adequacy of course content in Industrial Technical Education (ITE), as well as their influence on graduate employability in emerging industries. The findings indicate that stakeholders generally perceive ITE programmes as moderately effective in integrating technology, maintaining curriculum relevance, and preparing graduates for employment, with no statistically significant differences observed among lecturers, students, and industry experts, reflecting strong agreement across groups. Notably, the highest consensus was on the interrelationship between technology integration, curriculum adequacy, and employability outcomes, highlighting the need to treat these elements as interconnected in ITE reform. However, the predominance of moderate ratings and slightly lower evaluations from industry experts suggests that, despite a solid foundation, targeted improvements are necessary to meet evolving industrial demands. In the context of a rapidly digitising economy driven by automation, artificial intelligence, and advanced manufacturing, proactive, collaborative, and technology-driven reforms are essential to ensure that ITE programmes remain relevant and responsive.

Recommendations

Based on the findings, the following five recommendations are proposed with clear specification of responsible stakeholders:

1. Institutional management in collaboration with Industrial Technical Education (ITE) departments and industry advisory boards should establish structured industry advisory mechanisms to ensure continuous curriculum review, regular industry feedback, and alignment with emerging technological trends.
2. Institutional management, in collaboration with government education agencies and industry partners, should improve student access to industry-standard technologies, including digital tools, simulations, CAD/CAM systems, smart equipment, and virtual laboratories, to strengthen experiential learning.
3. ITE departments, working with institutional curriculum committees, industry experts, and relevant regulatory bodies, should implement periodic curriculum reviews (e.g., every 2–3

years) to reflect advancements in automation, digital manufacturing, and emerging industrial practices.

4. Institutional management, in partnership with professional training bodies, educational policymakers, and industry stakeholders, should provide continuous professional development programmes for ITE lecturers focusing on digital pedagogy, Industry 4.0 technologies, and technology-enhanced instructional strategies.
5. ITE departments and institutional career or industrial liaison offices, in collaboration with relevant industry partners and employers, should strengthen internship, apprenticeship, and industrial attachment programmes to enhance students' practical competence and workplace readiness.

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