Evaluating Graduate Programme Educational Objectives (PEO) in the Diploma in Electronic Engineering (Communication) Program

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Abstract

As the highly skilled professionals in electronic engineering continuously increases, it is essential to examine how well educational programs are equipping graduates for industry needs. Program Educational Objectives (PEOs) are a tool to measure how academic achievements align with the skills required in the professional world. This study assesses how well the Diploma in Electronic Engineering (Communication) (DEP) program equips graduates to meet industry demands, focusing on Program Educational Objectives (PEOs). Four key PEOs were evaluated: practising as technicians in electrical engineering (PEO1), contributing to society with professional ethics (PEO2), engaging in entrepreneurial activities using engineering skills (PEO3), and enhancing knowledge for career advancement (PEO4). The evaluation used a mixed-methods approach, combining structured questionnaires for quantitative data and interviews with an industry advisory panel for qualitative insights, involving 36 graduates from 2018-2019. Findings showed that 67% of graduates met PEO1, 94% achieved PEO2, 67% accomplished PEO3, and 72% fulfilled PEO4. The results suggest that updating the curriculum to emphasise entrepreneurial training, leadership development, and advanced technology integration would better align graduates with workforce needs. Feedback from the Industry Advisory Panel highlights the importance of continuous curriculum improvements to address evolving industry expectations and challenges.

Keywords: Program Educational Objectives, Politeknik Kuching Sarawak, Graduate outcomes, Electronic Engineering (Communication), Curriculum Development

1.0 Introduction

In today's rapidly changing technological landscape, engineering education stands at the forefront of preparing graduates to navigate the evolving demands of the workforce. One key aspect of this preparation is the establishment of Program Educational Objectives (PEOs), which outline the anticipated achievements of graduates within three to five years after they complete their diploma. These objectives are crucial for assessing how well educational programs meet the needs of various industries, particularly in areas like electrical engineering, where there is a constant need for aligning academic outcomes with real-world applications.

Despite the well-structured curricula that have been put in place, there are

still noticeable gaps between the theoretical knowledge imparted in classrooms and the practical skills that employers look for in the workplace. This study aims to investigate how effectively graduates are achieving the PEOs and to identify areas where the program can improve. It specifically focuses on those who graduated during the 2018-2019 academic year and will examine their proficiency in four important areas: technical skills, contributions to society, entrepreneurial initiatives, and career development. The goals of this research are: first, to measure the percentage of graduates who are meeting the PEOs; second, to understand the connection between academic training and practical application; and third, to suggest enhancements to the curriculum that better equip graduates for their professional journeys.

2.0 Literature Review

Graduate outcomes in engineering education are often evaluated based on key factors such as technical expertise, societal contributions, and employability. For instance, Ahmad (2021) notes that a comprehensive understanding of these outcomes is essential in determining the effectiveness of educational programs. Several studies have indicated that engineering graduates tend to possess strong technical skills, enabling them to effectively apply their knowledge in disciplines such as electrical and telecommunications engineering (Brunhaver et al., 2017).

Moreover, the role of ethics and societal engagement cannot be overlooked. Graduates who consciously incorporate ethical considerations and contribute to their communities often achieve more favourable career outcomes. Evaluating how well graduates meet PEOs typically involves a range of research methodologies. These span qualitative methods that delve into the personal and professional journeys of graduates, as well as quantitative analyses that provide a broader statistical perspective. A mixed-methods approach, which combines both qualitative and quantitative data, is particularly advantageous for gaining a comprehensive understanding of PEO success (Dawadi, Shrestha, & Giri, 2021).

However, one notable area that requires attention is the limited exposure to entrepreneurial education, which can hinder graduates' abilities to innovate or start their businesses (Winberg et al., 2020). Additionally, ongoing professional development and continuous learning through acquiring certifications are critical for career advancement (Loffeld et al., 2022). The literature suggests that while technical and ethical training is generally effective, there is an urgent need for a greater focus on communication, leadership, and entrepreneurial skills. This study aims to build on existing findings to assess the current effectiveness of PEOs and offer recommendations for improvements that will better equip graduates to meet the evolving demands of industry.

3.0 Methodology

This research employed a mixed-methods approach, combining both

qualitative and quantitative data to improve the findings. The integration of different perspectives through mixed methods enhances the strength of research outcomes (Schoonenboom & Johnson, 2017). Specifically, a convergence triangulation design was implemented as shown in Figure 1, facilitating independent analysis of both numeric and text data concerning the same phenomenon. Data from these parts were collected simultaneously, prioritised equally, and joined during the interpretation phase to yield comprehensive understandings (Creswell & Plano, 2017). This triangulation design ensured that various data forms contributed to a deeper understanding of graduates' performance across all Program Educational Objectives (PEOs).

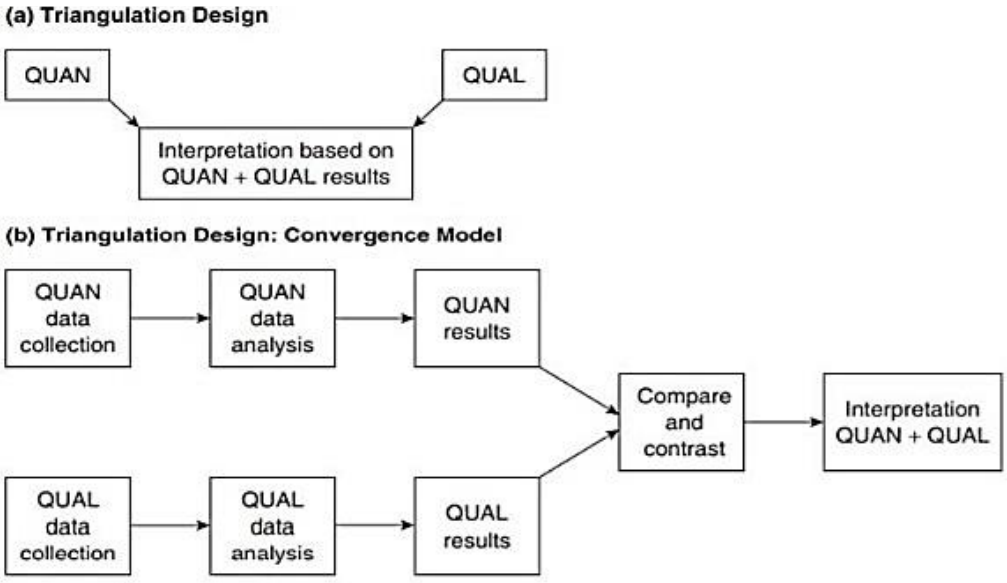

Figure 1: Triangulation design (Creswell & Plano, 2017)

The study focused on graduates from the DEP program at Politeknik Kuching, Sarawak. Out of 42 total graduates, a simple random sample of 36 was selected for analysis. The distribution of graduates by graduation session reveals that 26 completed their studies in December 2018, while 16 graduated in June 2019.

The sample data were analysed to calculate the percentage of graduates achieving each PEO in 2019. Along with the quantitative data, qualitative information was gathered through interviews with the advisory board of Politeknik Kuching Sarawak, where quantitative results were discussed, and feedback from industry representatives was obtained.

Data collection utilised a structured questionnaire made by the Polytechnic and Community College Department, Ministry of Higher Education. The questionnaire consisted of six sections that focused on demographic information and the four PEOs. Most questions were closed-ended and employed dichotomous formats. The areas covered included demographic details, PEO 1, which evaluated graduates' performance as technicians in

electrical engineering fields; PEO 2, which examined the role of graduates in contributing to society with professional ethics and responsibilities; PEO 3, which assessed enterprising activities where graduates applied their engineering knowledge and technical skills; and PEO 4, which measured knowledge enhancement, focusing on graduates' engagement in activities to further their knowledge and career. The questionnaire was distributed online through platforms like WhatsApp, Telegram, and Email, organised according to the PEOs.

Quantitative data were gathered via questionnaires, while qualitative data came from interviews with the advisory board. Each research objective employed descriptive analysis methods. The first objective focused on assessing the frequency of graduates' abilities to work as technicians in electrical engineering (PEO 1). The second objective analysed how often graduates contributed to society with professional ethics (PEO 2). The third objective examined the frequency of graduates engaging in enterprising activities using their engineering skills (PEO 3), while the final objective investigated how often graduates participated in activities aimed at enhancing their knowledge for successful career growth (PEO 4), all using descriptive analysis.

Quantitative data were analysed descriptively to determine the frequency of graduates achieving each PEO. Also, qualitative information from interviews went through thematic analysis, which facilitated the extraction of valuable information regarding graduates' performance and industry expectations. The combination of descriptive statistics and thematic analysis provided a complete understanding of the graduates' accomplishments.

4.0 Results and Discussion

4.1 Demographic Profile of the Respondents

The PEO instrument questionnaire was distributed to all graduates from the DEP program who completed their studies in 2019, which included graduates from both the December 2018 and June 2019 sessions. This survey was done through Google Forms, and the participants were given a month to provide their responses. Out of the 42 graduates who were able to participate, 26 from December 2018 and 16 from June 2019 which 36 chose to respond, resulting in 6 graduates who did not take part. An analysis of the demographic data reveals that female respondents accounted for 44%, while male respondents comprised 56%. In addition, a significant majority of the respondents, 89%, are currently employed, while 8% are continuing their education, and 3% are unemployed.

Table 1: Frequency And Percentage of Practising Technicians in Electrical Engineering-Related Fields Among Graduates (PEO1 Achievement)

No.	Item	Frequency/Percentage)	
		Yes	No
1.	Are you working/have you ever worked, in the	24 / (67%)	8 / (22%)

	electrical/electronic related field?		
2.	If yes, select the sector below:		
	Engineering	11 / (31%)	
	Manufacturing	4 / (11%)	
	Services	3 / (8%)	
	Sales & Marketing	1 / (3%)	
	Telecommunication	5 / (14%)	
	Other	0	
3.	If No, select the sector below:		
	Business	2 / (6%)	
	Services	2 / (6%)	
	Other	4 / (11%)	
		Yes	No
4.	Have you applied/practised any electrical/electronic knowledge in your job scope?	3 / (37%)	5 / (63%)
5.	Designation of the Graduates Applied Electrical/Electronic Knowledge in the Working Sector of Electrical Engineering and Non-Electrical Engineering Field		
	Technician	15 / (47%)	
	Supervisor	3 / (9%)	
	Assistant Engineer	3 / (9%)	
	Administration officer	3 / (9%)	
	Other	8 / (25%)	
6.	Graduate Range of Salary		
	Less than RM 2000	18 / (56%)	
	RM 2001 - RM 3000	14 / (44%)	
	More than RM 3000	0	
KPI PEO1	PEO1 Achievement		
	Yes	24 / (67%)	
30%	No	/ (22%)	

4.2 Quantitative Data Analysis

4.2.1 Analysis of the PEO1 Achievement

The analysis of the PEO1 Achievement data reveals that most graduates (67%) have secured or are currently employed in roles related to electrical or electronic fields, while 22% have chosen not to work in these areas. Among those working in the field, the majority (31%) are in engineering roles, followed by positions in telecommunications (14%), manufacturing (11%), services (8%), and sales and marketing (3%). Interestingly, no graduates reported being employed in other sectors within the electrical field.

For graduates not working in electrical-related fields, the most common employment sectors were categorised as "Other" (11%), with business and services sectors each comprising 6%. Regarding the practical application of electrical/electronic expertise, only 37% of graduates indicated that they use

their skills in their jobs, while 63% reported otherwise. As for job titles, 47% of those in electrical-related fields held technician roles, with smaller percentages working as supervisors (9%), assistant engineers (9%), administration officers (9%), or in other undefined roles (25%).

Looking at salary data, 56% of graduates earned below RM 2000, while 44% had salaries ranging from RM 2001 to RM 3000, with none earning more than RM 3000. The Key Performance Indicator (KPI) for Program Educational Objective (PEO) 1 is set at 30%. The PEO1 achievement target was met by 67% of graduates, reflecting a strong employment rate in the field.

The findings show that most graduates are securing positions in electrical engineering-related fields, with a significant focus on engineering and telecommunications. The high percentage of technicians suggests that the curriculum is effectively preparing students for technical roles. However, the fact that only 37% of graduates apply their electrical/electronic knowledge in their jobs highlights a potential disconnect between theoretical learning and practical use, which may warrant further curriculum enhancements.

Furthermore, salary data aligns with expectations for fresh graduates in the field, with most earning between RM 2000 and RM 3000, consistent with studies on starting salaries for engineering graduates (University of Nottingham Malaysia, 2023). The PEO1 achievement rate of 67% suggests the program is meeting its goals, though efforts to improve the practical application of skills remain necessary.

4.2.2 Analysis of the PEO2 Achievement

The survey aimed at evaluating graduates' contributions to society in terms of professional ethics and responsibilities (PEO2 Achievement) provided useful information. The KPI for Program Educational Objective (PEO) 2 is set at 30%. Out of 36 participants, 34 (94%) confirmed they had achieved PEO2, demonstrating a strong commitment to societal contributions rooted in ethical practices, while only 2 respondents (6%) did not meet this standard. However, only 31% of participants reported having experience in communication-related activities such as report writing, media presentations, or public speaking, leaving a significant 69% without such experience, which highlights a need for more training in these areas.

Teamwork skills were highly prevalent, with 89% of respondents noting experience in team settings during work or further studies, reflecting strong collaborative abilities that are essential in today’s professional world. Leadership results were evenly split, with 49% having held leadership positions in either professional or academic settings, while 51% had not, suggesting potential for enhancing leadership development initiatives. Furthermore, 89% of graduates reported following safety and health protocols in their workplaces, emphasising the importance of maintaining professional standards.

Awareness of social norms, particularly regarding corruption and trust violations, was expressed by 66% of participants, while 34% did not indicate such awareness, suggesting a need for more robust ethics training. Only 19% of participants were members of professional or regulatory bodies, pointing to a gap in engagement with professional organisations and continuous development. Lastly, about one-third (33%) of respondents were involved in community or social initiatives, such as CSR activities or NGO work, indicating that 67% were not actively engaged in societal contributions beyond their professional roles, which presents an opportunity to encourage more involvement in community-focused efforts.

Table 2: Frequency and Percentage of Graduates Contributing to Society with Professional Ethics and Responsibilities (PEO2 Achievement)

No.	Item	Frequency/Percentage)	
		Yes	No
1.	Do you have any experience in communication activities? (eg. report or new media or electronic media writing/ presentation / being a panel or speaker, or chairperson for any event)	11 / (31%)	24 / (69%)
2.	Have you ever worked in a group or team at your workplace / during your further studies?	31 / (89%)	4 / (11%)
3.	Have you held a leadership position at your workplace (eg, manage a team / give instructions to a colleague) / during your further studies (eg, demonstrate procedure/lab group leader)?	17 / (49%)	18 / (51%)
4.	Have you practised safety and health at your workplace or institution (e.g., personal protective equipment (PPE) / safety standard operating procedure (SOP) / fire drill)?	31 / (89%)	4 / (11%)
5.	Are you aware of social norms (e.g., corruption/bribery/breach of trust)?	23 / (66%)	12 / (34%)
6.	Are you a member of any professional body or international society, or regulatory body (e.g., BEM/ MBOT/ IEEE / IEM/ MySet/ CIDB)?	7 / (19%)	29 / (81%)
7.	Have you been involved in any community or social activities (e.g., communal work / Corporate Social Responsibility activities / social work / NGOs)?	12 / (33%)	24 / (67%)
KPI PEO2	PEO2 Achievement		
	Yes	34 / (94%)	
30%	No	2 / (6%)	

The findings indicate that while a substantial majority (94%) of graduates are contributing positively to society in terms of professional ethics and responsibilities, several key areas warrant further attention. The significant lack of communication experience (69%), limited leadership roles (51%), and

low membership in professional bodies (81%) point to possible gaps in the graduates' professional development. Previous research highlights the importance of strong communication and leadership skills as essential components of employability and success in the workplace (Siddique et al., 2022).

Moreover, the graduates' strong commitment to safety and health standards (89%) reflects positively the training they received regarding occupational safety. However, improvements can be made in fostering awareness of social norms (66%) and enhancing community involvement (33%) by integrating more courses focused on ethics and social responsibility into the curriculum. This is in line with recent studies that highlight the significance of professional ethics in shaping responsible and engaged graduates (Coelho & Menezes, 2021).

While the achievements related to PEO2 are impressive, particular attention should be directed toward enhancing leadership, communication, and social engagement to ensure graduates are thoroughly equipped to contribute ethically and responsibly across various professional landscapes.

4.2.3 Analysis of the PEO3 Achievement

Table 3 highlights the entrepreneurial efforts of graduates who utilise their engineering expertise and technical capabilities. The findings reveal that only 17% of the graduates (6 out of 36) are participating in any type of business, whether online or offline. Besides, all of these enterprises are pursued on a part-time basis, as there are no full-time entrepreneurs among the survey participants. None of the businesses are related to the fields of electrical or electronics, suggesting a possible lack of entrepreneurial activities that align with the graduates' technical training.

Table 3: Frequency and Percentage of Engaging in Enterprising Activities that Apply Engineering Knowledge and Technical Skills (PEO3 Achievement)

No.	Item	Frequency/(Percentage)	
		Yes	No
1.	Are you involved in any form of business (online / offline)?	6 / (17%)	30 / (83%)
2.	Your business model:		
	Full time	0	
	Part time	6 / (17%)	
		Yes	No
3.	Does your business activity involve electrical/electronic	0	6 / (17%)
4.	Are you involved in the research and development (R&D) of any products/services/systems / technical projects? (e.g., market survey, improve product quality, innovation in business, process improvement)		
	Electrical/electronic or related field	20 / (56%)	
	Non-engineering	12 / (33%)	
	Further study (academic)	4 / (11%)	

KPI PEO3	PEO3 Achievement	
	Yes	24 / (67%)
25%	No	12 / (33%)

When it comes to involvement in research and development (R&D), many respondents (56%) are engaged in R&D efforts within electrical, electronic, or related sectors, while 33% are participating in R&D projects outside of engineering. Furthermore, 11% of those surveyed are continuing their education, which aids in the ongoing enhancement of their technical skills. The Key Performance Indicator (KPI) for Program Educational Objective (PEO) 3 is set at 25%. In terms of achieving the program educational objective (PEO3), 67% of respondents have shown that they can apply their knowledge and skills in entrepreneurial activities, while the remaining 33% have yet to do so.

The data suggests that there is a relatively low level of entrepreneurial engagement among graduates, with only 17% actively running a business, and none of these efforts reflecting their technical background in electrical or electronics. This observation points to the necessity for improved integration of entrepreneurial training within engineering curricula to better empower graduates to utilise their technical skills in developing innovative products and services, as indicated in recent research on entrepreneurship education designed for engineering students (Sorensen et al., 2022).

On a positive note, the strong involvement in R&D activities (56%) indicates that graduates can innovate and make significant contributions to technological progress. These results support the increasing focus on R&D and innovation as essential elements of engineering education, fostering a mindset geared towards continuous improvement and effective problem-solving (Ueki & Guaita Martínez, 2020).

Despite the encouraging R&D participation, the limited entrepreneurial engagement highlights the necessity for additional support systems aimed at bridging the divide between technical proficiency and business initiatives. Engineering graduates might benefit from specialised programs that cultivate an entrepreneurial mindset, which has been shown to promote innovation and enhance risk-taking behaviours (Joao & Silva, 2020).

4.2.4 Analysis of the PEO4 Achievement

Table 4 illustrates the frequency and percentage of graduates who actively engage in various activities aimed at improving their knowledge and adapting to new technologies or media for effective career advancement, as aligned with the PEO4 objectives. The data reveals that 67% (24 graduates) have taken part in courses or activities, which include seminars, webinars, training sessions, short courses, and professional certifications, while 33% (12 graduates) did not participate in such initiatives. Among those who were involved, 69% (25 graduates) reported an increase in their salaries, 25% (9

graduates) received promotions to higher roles, such as senior technician or supervisor, 11% (4 graduates) established their businesses, and another 25% (9 graduates) opted for further studies.

Table 4: Frequency and Percentage of Engaging in Activities to Enhance Knowledge for Successful Career Advancement Among Graduates (PEO4 Achievement)

No.	Item	Frequency/(Percentage)	
		Yes	No
1.	Have you engaged in any courses/ activities to upgrade your knowledge and/or adapt to new technologies /new media (e.g., seminar/webinar/training / short courses / professional certification, etc)	24 / (67%)	12 / (33%)
2.	What is your achievement thus far?		
	Salary increment	25 / (69%)	
	Promoted to a higher post (etc., senior technician/supervisor)	9 / (25%)	
	Own business	4 / (11%)	
	Further studies	9 / (25%)	
KPI PEO4	PEO4 Achievement		
	Yes	24 / (67%)	
20%	No	12 / (33%)	

Moreover, 67% (24 graduates) met the expected outcomes of PEO4, while 33% (12 graduates) did not achieve this milestone. These findings indicate that ongoing learning and professional development play a crucial role in enhancing graduates' career prospects and employability.

The results highlight the significance of professional development in fostering career growth and adaptability to the evolving demands of the industry. Graduates who participated in skill enhancement activities experienced tangible benefits in their careers, including salary increases and promotions. Previous research supports these findings, indicating that career development learning (CDL) and professional certifications have a considerable impact on increasing employability and career progression.

The Key Performance Indicator (KPI) for Program Educational Objective (PEO) 4 is set at 20%. Furthermore, the 67% success rate observed in PEO4 achievements aligns with research suggesting that graduates who pursue additional training are more likely to reach career milestones and contribute positively to their organisations (Strong et al., 2020). Recent studies have shown that professional certifications and training not only improve technical competencies but also enhance opportunities for career growth (Okolie et al., 2020).

4.3 Qualitative Data Analysis

On May 28, 2024, a significant Industry Advisory Panel (IAP) meeting took place virtually via Microsoft Teams, aimed at evaluating and improving the Department of Electrical Engineering Program (DEP) at Politeknik Kuching Sarawak. Seven industry representatives participated, providing opinions on how the program could better equip students for careers in electronic and communication engineering. The feedback focused on four Program Educational Objectives (PEOs).

4.3.1 PEO 1: Practising Technician in Electrical Engineering-Related Field

The panel highlighted the necessity of exposing students to the latest advancements in electronic and communication technologies, including 5G, Data Centre Infrastructure Management, Fibre Optics, and Internet Service Provider (ISP) services. These technologies were recognised as crucial for the industry's future. The panel encouraged students to pursue certifications such as the Fibre Optic Competency Certificates (CA1C & CA2C) to boost their employability. They also suggested that final-year projects should be grounded in real-world challenges and industry needs, with an emphasis on commercial viability. This aligns with the current trend, which shows an increasing demand for technicians proficient in advanced technology applications (Ahmad, 2020).

4.3.2 PEO 2: Contributing to Society with Professional Ethics and Responsibilities

The panel further recommended that students should be motivated to register with professional organisations like the Malaysian Board of Technologists (MBOT) and the Construction Industry Development Board (CIDB). This membership would enhance their academic credentials, ensure compliance with industry standards, and elevate their career prospects. Previous studies indicate that belonging to professional bodies enhances students' sense of responsibility and adherence to ethical practices (Friedman & Afitska, 2023).

4.3.3 PEO 3: Engaging in Enterprising Activities that Apply Engineering Knowledge and Technical Skills

To foster entrepreneurship among students, the panel proposed organising industry visits and inviting successful entrepreneurs to share their experiences through seminars and talks. They also suggested incorporating entrepreneurial principles into the curriculum to encourage creative thinking, business plan development, and practical applications of engineering solutions, nurturing an entrepreneurial mindset among students. Research has shown that exposure to entrepreneurial activities significantly enhances the innovation and creativity of engineering students (João & Silva, 2020).

4.3.4 PEO 4: Engaging in Activities to Enhance Knowledge for Career Advancement

To support ongoing skill development and career progression, the panel advised introducing new courses focusing on emerging technologies, such as the Internet of Things (IoT). This initiative would help students remain relevant in an ever-evolving industry. Also, providing access to the latest

technologies will ensure that students are well-prepared for industry demands, as emphasised in recent studies related to engineering education (Ahmad, Z., et al., 2021).

The agreed revisions to the KPIs are 50% for PEOs 1, 2, and 4, and 30% for PEO 3, demonstrating a balanced commitment to technical skills, societal contributions, and career growth.

The IAP's feedback highlights the need for DEP to remain adaptive and forward-thinking. The focus on technology and professional development reflects a comprehensive strategy to prepare students for real-world challenges. The panel's recommendations, including certifications, professional membership, and entrepreneurial training, highlight a proactive approach to developing well-rounded graduates equipped with both technical and soft skills. Research by Peon, Martínez-Filgueira, & Rodríguez-Gómez Gomez 2023) supports these strategies, affirming that incorporating industry certifications and entrepreneurial principles produces job-ready graduates.

5.0 Conclusion

This research highlights the effectiveness of the Program Educational Objectives (PEOs) for graduates of the DEP program at Politeknik Kuching Sarawak. The findings show that most graduates meet the objectives related to technical skills (PEO1) and societal contributions (PEO2), but there are noticeable gaps in entrepreneurial activities (PEO3) and career advancement initiatives (PEO4). A significant percentage of graduates are successfully employed in technical jobs and make ethical contributions to society. However, the results indicate that a stronger focus on entrepreneurial education and leadership growth is needed. The qualitative feedback from the Industry Advisory Panel also emphasises the importance of curriculum updates, incorporating advanced technology, practical projects, and entrepreneurship exposure to better equip students for future industry demands. Addressing these gaps by incorporating more entrepreneurial skills and practical applications in the curriculum will help graduates adapt and thrive in an increasingly competitive job market.

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Author Contributions

Jamaah Suud: Abstract, Introduction, Literature Review, Discussion, Conclusion, Writing; **Nur Zakiah Hani Kamarolzaman**: Methodology, Result, Editing, and Writing; **Mohd Nor Fadli Abu Kassim**: Data collection, Editing, Reviewing, Proofreading, and Writing.

Conflicts Of Interest

The manuscript has not been published elsewhere and is not under consideration by other journals. All authors have approved the review, agree with its Submission, and declare no conflict of interest in the manuscript.

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