Comparative Analysis of PEO Attainment Among Diploma in Electronic Engineering (Communication) Graduates at Politeknik Sultan Mizan Zainal Abidin, Terengganu, Malaysia

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ABSTRACT

Programme Educational Outcomes (PEO) serve as long-term indicators of graduate achievement and curriculum effectiveness within the Outcome-Based Education (OBE) framework. This study examines and compares the attainment of PEO among graduates of the Diploma in Electronic Engineering (Communication) (DEP) programme at Politeknik Sultan Mizan Zainal Abidin, Malaysia. The analysis focuses on four key outcomes: the ability to practice as technicians in electronic engineering related fields, contribute to society with ethical and professional responsibility, engage in enterprising activities using engineering and technical skills, and participate in ongoing knowledge enhancement for career development. The findings show that all PEOs met the target Key Performance Indicators (KPIs) across the evaluated cohorts, indicating strong alignment between the programme's educational objectives and the curriculum delivered. Although overall attainment was satisfactory, the comparative analysis highlights variations between cohorts that reveal both strengths and areas for further enhancement. These insights support continuous quality improvement efforts and reinforce the effective implementation of OBE within Malaysian polytechnic education.

Keywords: Programme Educational Outcomes (PEO), Outcome-Based Education (OBE Curriculum Alignment.

INTRODUCTION

In engineering and technical education, outcome-based education (OBE), which emphasizes quantifiable accomplishments and ongoing enhancement of student learning and graduate performance, has become a dominating paradigm. In contrast to conventional input-based methods, OBE focuses on the qualities, abilities, and competences that students should exhibit after finishing a course. Programme Educational Outcomes (PEOs), which assess graduates' professional accomplishments three to five years after joining the workforce, and Programme Outcomes (POs), which gauge student performance at the time of graduation, are essential components of this system. By documenting how graduates use their knowledge, ethics, technical skills, and professional behaviors in real-world settings, PEOs offer a long-term view of program effectiveness. OBE has gained widespread acceptance throughout the world in order to guarantee accountability, transparency, and conformity between educational systems and business demands. In Malaysia, this paradigm is reinforced through national quality assurance mechanisms, particularly those administered by the Board of Engineers Malaysia (BEM) and the Engineering Technology Accreditation Council (ETAC), which mandate clear articulation, systematic assessment, and continuous review of PEOs.

Within the Malaysian polytechnic system, PEO assessment plays a critical role in evaluating curriculum relevance, graduate readiness, and institutional performance. As technological advancement and industrial digitalization accelerate, ensuring that engineering graduates possess the competencies required for evolving job markets becomes increasingly important. At Politeknik Sultan Mizan Zainal Abidin (PSMZA), the Department of Electrical Engineering (JKE) conducts periodic PEO assessments to maintain alignment with accreditation standards and stakeholder expectations. The Diploma in Electronic Engineering (Communication) (DEP) programme is structured around four PEOs that reflect the expected achievements of

graduates in their early career stages, including their ability to function effectively as practicing technicians, uphold ethical and professional responsibility, apply engineering and technical skills in entrepreneurial contexts, and engage in continuous learning for career advancement (Norfadhilah et al, 2021). This study provides a comparative analysis of PEO attainment among DEP graduates from the 2018 to 2020 cohorts, using tracer study data to identify trends, strengths, and areas requiring improvement. By examining cohort level variations, the study offers evidence based insights to support ongoing curriculum enhancement and reinforce the effectiveness of OBE implementation within Malaysian polytechnic education.

LITERATURE REVIEW

Outcome-Based Education (OBE) has been widely adopted as a core educational framework in engineering and technical education to enhance graduate competencies and align academic programmes with industry and societal needs (Mahrishi et al., 2025). In Malaysia, OBE is implemented across engineering and engineering technology programmes to fulfil accreditation requirements and ensure graduates meet professional and workplace expectations. For diploma level engineering technology programmes, accreditation is conducted by the Engineering Technology Accreditation Council (ETAC) under the Board of Engineers Malaysia (BEM) (ETAC, 2019).

OBE emphasizes the attainment of explicitly defined learning outcomes rather than traditional input-driven instruction, ensuring that students progressively achieve specific competencies at different stages of the educational process (Qadir et al., 2020). Within this framework, Programme Educational Objectives (PEOs) represent long-term goals that describe the expected achievements of graduates in their professional and career development several years after graduation.

The formulation and systematic assessment of PEOs play a critical role in Continuous Quality Improvement (CQI) processes and are a key requirement of accreditation standards set by BEM through ETAC. PEOs are typically developed based on input from key stakeholders such as industry partners, alumni, employers, and academic staff to ensure alignment with industry needs and national competency standards (Board of Engineers Malaysia, 2024). Regular evaluation of PEO attainment provides evidence that academic programmes remain relevant, effective, and responsive to stakeholder expectations.

By linking curriculum design, teaching and learning strategies, and assessment methods to desired graduate attributes, OBE enhances transparency and accountability in educational outcomes. This outcome-oriented approach enables institutions to respond effectively to evolving employer requirements and global competency demands, particularly within technical and vocational education and training (TVET) contexts (McGrath, S. 2022).

Empirical studies in Malaysian technical and engineering education have demonstrated that systematic OBE implementation and PEO assessment support curriculum improvement and programme sustainability. Research indicates that PEO assessment not only validates alignment between programme objectives and industry expectations but also strengthens stakeholder engagement in quality assurance practices. However, the literature also highlights challenges in OBE implementation, including inconsistent assessment practices, faculty readiness, and the need for stronger feedback mechanisms (Mahrishi et al., 2025).

Effective PEO evaluation requires coherent alignment between course learning outcomes, programme outcomes, and long term graduate achievements. This underscores the importance of continuous data collection, stakeholder feedback, and longitudinal analysis across graduate cohorts. Comparative evaluation of PEO attainment over time can provide valuable insights into curriculum effectiveness, the impact of programme improvements, and strategic directions for enhancing graduate employability in a dynamic employment landscape.

METHODOLOGY

All graduates from the Diploma in Electronic Engineering (Communication) program (DEP) at Politeknik Sultan Mizan Zainal Abidin (PSMZA) from the 2018, 2019, and 2020 cohorts were included in this study,

yielding a total of 241 respondents. These cohorts were selected because the Engineering Technology Accreditation Council (ETAC) requires that Programme Educational Outcomes (PEOs) be assessed within three to five years after graduation, ensuring that graduates have had adequate time to develop their professional competencies and gain relevant work experience.

The data were obtained through a standardized online questionnaire developed and distributed by the Jabatan Pengajian Politeknik dan Kolej Komuniti (JPPKK). This questionnaire is used across all Malaysian polytechnics to ensure uniformity and comparability of PEO attainment data. The instrument measures graduate perceptions of PEO achievement according to four defined PEOs for the program.

The questionnaire items were dichotomous, offering only "Yes" or "No" responses to each indicator under the respective PEOs. This approach was adopted to facilitate straightforward interpretation of whether graduates perceive each outcome as achieved or not achieved. Because the response options are binary, Likert-type statistical analyses were not applicable; instead, the data were analyzed using descriptive statistics such as frequency counts and percentages to summarize the level of PEO attainment among cohorts.

The indicators and variables measured under each PEO, as defined by JPPKK's official instrument, are summarized in Table 1. These indicators represent the expected graduate accomplishments aligned with ETAC's accreditation outcomes and institution-specific goals.

Table 1. Indicator / Variable measured in the instrument

PEO 2019	Indicator / Variable measured and the description	Instrument
PEO1: Practicing technician in electrical engineering related field	**Career as a technician**	Are you working in electrical and electronics field?
	Describes a technician who works in any industry with job function in electrical or electronic discipline.	(Yes/No)
PEO2: Contributing to society with professional ethics and responsibilities	**Role in the society**	Do you have any experienced in any of these activities? (e.g., report writing/ presentation/ being a panel / speaker for a forum / communication by email)
		(Yes/No)
	Graduates' involvement in community activities which includes engineering and non-engineering work related to society, health, and safety. During the activities, graduate instill awareness of the safety and health culture and suggest solution pertaining to environment and sustainability to the community. In performing the activities, the graduates adhere to professional ethics and responsibilities by following rules and regulation of the field.	Have you ever been working in group or team at your workplace?
		(Yes/No)
		Have you ever lead a team or group at your workplace?
		(Yes/No)
		Are you a member of any professional body or regulatory body (e.g.: BEM/ IEEE/MySet)?
		(Yes/No)

		Do you practice safety and health at your workplace?
		(Yes/No)
		Have you ever been involved in any community activities?
		(Yes/No) ☐ give example communities activities (IAP, etc.)
PEO3: Engaging in enterprising activities that apply engineering knowledge and technical skills	**Enterprising**	Are you involved in any form of business (online/offline/part time/full time)?
		(Yes/No)
	Enterprising is any activities involving business in engineering, research, and development (R&D) and new technical project, which require effective communication and contribution as a team member. Enterprising activities also include an involvement of graduates in an online or offline business either on a full time or part time basis.	
PEO4: Engaging in activities to enhance knowledge for successful career advancement	**Advancement**	Have you been involved in the research or development of any products/services/system/technical project?
		(Yes/No)
	Activities that contribute to the further achievement of the graduates; furthering studies to a higher level such as advanced diploma, degree, master or PhD, upgrading of knowledge to adapt to technological changes and obtaining professional certification.	
	Career advancement is described as holding a senior position post such as senior technician, project manager, consultant, and supervisor.	

To identify issues associated with the current instrument used by JKE to evaluate the achievement of PEOs, this study adopted a triangulation approach to strengthen data validity through cross-verification from multiple stakeholder groups. Data were first gathered using a structured questionnaire distributed to students. The analysed findings were subsequently presented to the Industrial Advisory Panel (IAP), comprising industry representatives, academic staff, and alumni, for further review and input.

The IAP examined the results and provided constructive feedback to ensure that the interpretation of data was comprehensive, relevant, and aligned with current industry expectations. Based on their recommendations, appropriate revisions were made to improve the robustness of the report. This triangulation approach minimizes potential bias and enhances the credibility and industry relevance of the findings (Taylor & Wallace, 2007).

Following data collection, appropriate statistical analyses were performed to evaluate the measured outcomes and support evidence-based conclusions.Quantitative data are analyzed and depicted in graphs and charts to determine with percentage of various elements of the PEOs being rated as 'high (above 70%)', 'medium (50–69%)' and 'low (49% and below)' as a guideline to identify the most crucial elements of the PEOs for continuous quality improvement in the education system of the engineering program (Tshai et.al. 2014). JKE, PSMZA also have set target to see whether all the PEOs achieve its objective or not (refer Table 2).

Table 2: PEOs target for programme in JKE, PSMZA

POLITEKNIK
MALAYSIA
SULTAN MIZAN ZAINAL ABIDIN
DEPARTMENT OF ELECTRICAL ENGINEERING

PEO TARGET

	PEOs	Target
PEO1	Practicing technician in electrical engineering related field	At least 20% of the graduates work as technician in any industry with job function in electrical or electronic discipline. Justification: This is because there are a number of students who continue their studies to a higher level and are not included in this category.
PEO2	Contributing to society with professional ethic and responsibilities	At least 50% of the graduates involve in community activities which includes engineering and non-engineering work related to society, health and safety. Justification: Half of the graduates will contribute to society.
PEO3	Engaging in enterprising activities that apply engineering knowledge and technical skills	At least 30% of the graduates will be involved in enterprising activities. Justification: Base on KPI JPPKK & industrial panel.
PEO4	Engaging in activities to enhance knowledge for successful career advancement	At least 70% of the graduates will either further study, self-employed, holding senior position post, involve in technical project or in research and development activities. Justification: All the graduates fully motivated to enhance knowledge for their career advancement.

RESULT AND DISCUSSION

This analysis is based on attainment results of four PEOs.

PEO1 – Practicing technician in electrical engineering related field

The analysis of three graduating cohorts from the Diploma in Electronic Engineering (Communication) programme (2018–2020) indicates a declining trend in employment within electrical and electronic engineering–related fields. By referring to Figure 1, the highest attainment was recorded among the 2018 graduates, with 66% employed in relevant engineering positions. This strong performance may be attributed to favourable economic conditions prior to the COVID-19 pandemic and steady industry demand in sectors such as telecommunications and network maintenance.
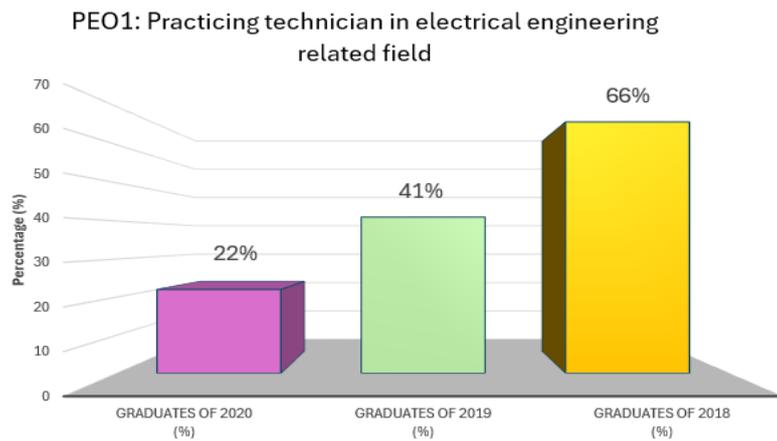
Figure 1: Comparison of PEO1 attainment across 2018, 2019, and 2020 graduate cohorts

The employment rate declined to 41% for the 2019 cohort. Although this figure still exceeded the programme's minimum KPI requirement, the reduction suggests emerging challenges in graduate placement within engineering-related roles. These challenges may be associated with changing labour market conditions and differing graduate career pathways.

A more pronounced decrease was observed among the 2020 graduates, where only 22% were recorded as being employed in electrical or electronic engineering–related fields. However, this result should be interpreted with caution, as the reported percentage does not include graduates who pursued further studies, such as bachelor's degree programmes or other higher-level qualifications. A substantial proportion of graduates from this cohort are believed to have continued their education, which temporarily excludes them from employment-based PEO measurement and consequently lowers the recorded employment rate. In addition, the economic disruption caused by the COVID-19 pandemic significantly affected recruitment activities within the engineering sector during this period.

Overall, although all cohorts exceeded the minimum KPI requirement, the downward trend from 2018 to 2020 highlights the importance of contextual factors in interpreting PEO1 attainment. The findings suggest that the decrease does not necessarily reflect reduced programme effectiveness, but rather a combination of external economic conditions and graduates' decisions to pursue further education. This insight supports the need for refined data collection methods that separately capture employment and further study pathways, thereby providing a more comprehensive evaluation of graduate outcomes for continuous quality improvement purposes.

PEO2 – Contributing to society with professional ethics and responsibilities

Programme Educational Objective 2 (PEO2) focuses on the extent to which graduates contribute positively to society through ethical behaviour, responsible professional conduct, and involvement in community-oriented activities. This objective reflects the broader aim of the polytechnic system to produce graduates who not only possess technical competence but also demonstrate social awareness, leadership qualities, integrity, and adherence to safety and ethical standards. The institutional Key Performance Indicator (KPI) for this objective is 50 percent, meaning that at least half of the surveyed graduates should report active engagement in social, ethical, or community-based responsibilities for the programme to be considered successful in meeting PEO2.

Analysis of the three cohorts in Figure 2 shows consistently strong performance across all groups, demonstrating that graduates of different years share a solid foundation in ethics and societal responsibility. The graduates of 2020 recorded an achievement level of 84 percent, which reflects a high level of ethical awareness and civic engagement despite this cohort completing their studies during a period significantly impacted by the COVID-19 pandemic. Their reported involvement suggests that the programme's emphasis on professionalism, safety practices, and responsible conduct has effectively shaped their behaviour even in challenging circumstances.
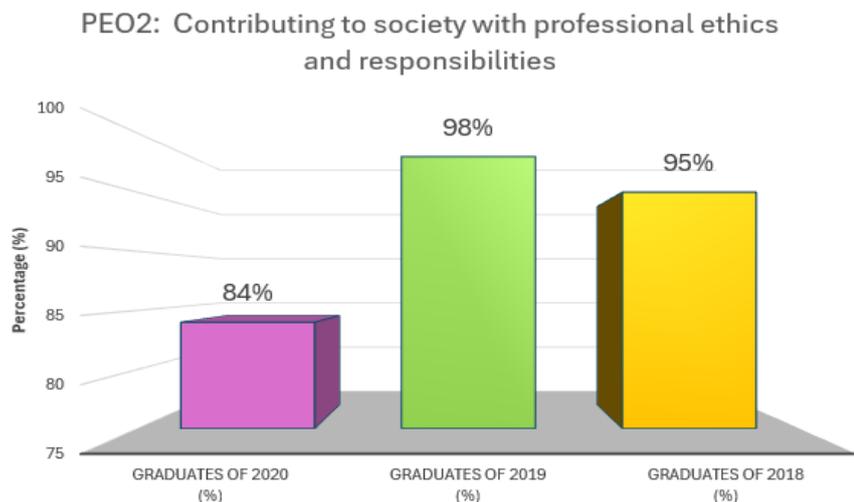
Figure 2: Comparison of PEO2 attainment across 2018, 2019, and 2020 graduate cohorts

The highest achievement was observed among the graduates of 2019, who reported a remarkable 98 percent involvement in ethical and socially responsible activities. This near-perfect score indicates that the programme successfully instilled strong values related to community service, workplace ethics, and leadership. It may also reflect the cohort's greater access to volunteer activities, social initiatives, and workplace environments that emphasised teamwork and professional integrity. Their exceptional performance suggests that the curriculum and co-curricular experiences for this batch were particularly impactful in strengthening ethical decision-making and social responsibility.

Similarly, the graduates of 2018 achieved a very high percentage of 95 percent, demonstrating that almost all members of this cohort actively contributed to society in meaningful ways. This outcome may be associated with the cohort's exposure to structured activities such as industrial training, student leadership programmes, and academic projects that required them to apply ethical principles, safety guidelines, and professional responsibility in real-world situations. Their performance reaffirms the programme's effectiveness in shaping graduates who are not only technically capable but also socially conscious and ethically grounded individuals.

Overall, the results from all three cohorts reflect a consistent pattern of excellence, with each group significantly surpassing the 50 percent KPI. This demonstrates that the Diploma in Electronic Engineering (Communication) programme at PSMZA is highly successful in fostering graduates who embody the values of professionalism, ethical conduct, and community responsibility. The strong outcomes align with national educational aspirations outlined in documents such as the Pelan Tindakan PSMZA (2023), which emphasise the development of holistic, responsible, and community-oriented Technical and Vocational Education and Training (TVET) graduates.

PEO3 – Engaging in enterprising activities that apply engineering knowledge and technical skills

The graph in Figure 3 illustrates the level of entrepreneurial engagement among DEP graduates specifically those from the 2018 to 2020 cohorts based on data collected from the graduating years 2018, 2019, and 2020. Entrepreneurial engagement within PEO3 refers to graduates' involvement in business ventures, technical innovation projects, small-scale enterprise activities, and research and development initiatives that apply engineering knowledge and skills. The results show that graduates of 2020 achieved the highest engagement rate at approximately 46%, indicating a strong inclination toward applying their engineering competencies in entrepreneurial or technical contexts. Meanwhile, graduates of 2019 and 2018 recorded engagement levels of around 41%, demonstrating consistent participation in enterprise-related activities across the earlier years. Although there is some variation between batches, all three cohorts significantly exceeded JPPKK's KPI benchmark of 8%, reflecting an excellent performance in entrepreneurial readiness and application of technical expertise. These findings suggest that the DEP programme's practical and application-focused curriculum particularly its emphasis on electrical and electronic systems has effectively nurtured students' confidence and capability to pursue entrepreneurial paths. Overall, the consistently high engagement percentages indicate that

DEP graduates from the 2018 to 2020 cohorts were well-prepared to contribute to technical, innovative, and enterprise-driven activities, fulfilling the expectations of PEO3 and demonstrating the programme's success in cultivating entrepreneurial competence.
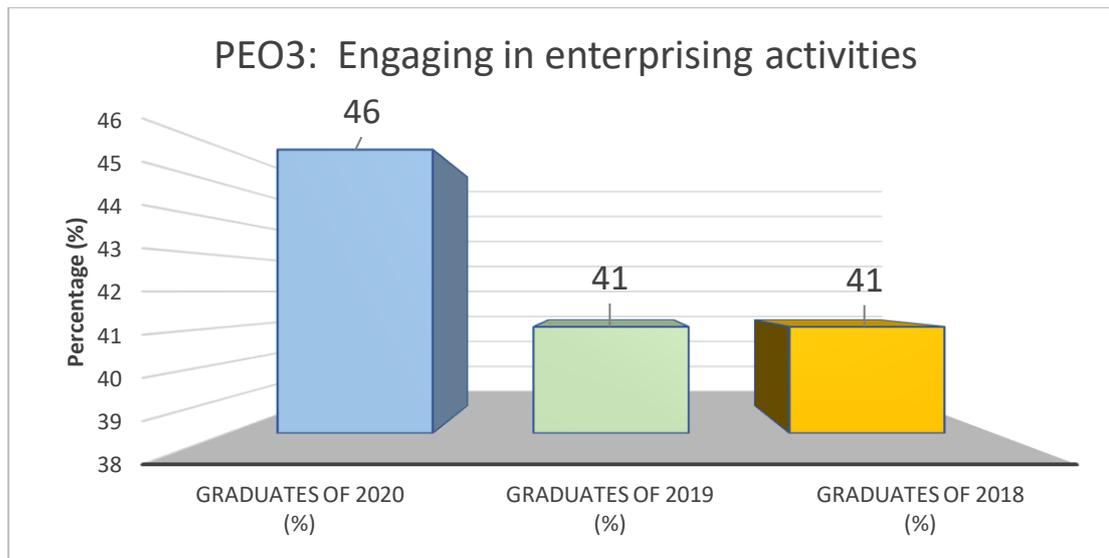

Figure 3: Comparison of PEO3 attainment across 2018, 2019, and 2020 graduate cohorts

PEO4 – Engaging in activities to enhance knowledge for successful career advancement.

PEO4 focuses on graduates' pursuit of further studies, professional certification, and other self-development initiatives that contribute to improved employability and upward career mobility. The results in Figure 4 show a consistently strong commitment to career development across all three graduating years. Graduates of 2018 recorded the highest level of engagement at 100%, indicating that every respondent from this cohort participated in at least one form of knowledge-enhancing activity. Graduates of 2020 followed with 79%, while the 2019 cohort reported 71%, showing slightly lower but still substantial participation. Importantly, all cohorts exceeded the JPPKK KPI benchmark of 70%, demonstrating that DEP graduates maintained a high level of motivation to continue learning and improving their qualifications. This strong engagement suggests that the DEP programme effectively instilled a culture of lifelong learning and professional growth among its students. Overall, the findings show that graduates from the 2018 to 2020 batches were proactive in advancing their knowledge and careers, fulfilling the expectations of PEO4 and reflecting the programme's success in producing graduates who are committed to continuous development in line with industry and academic demands.
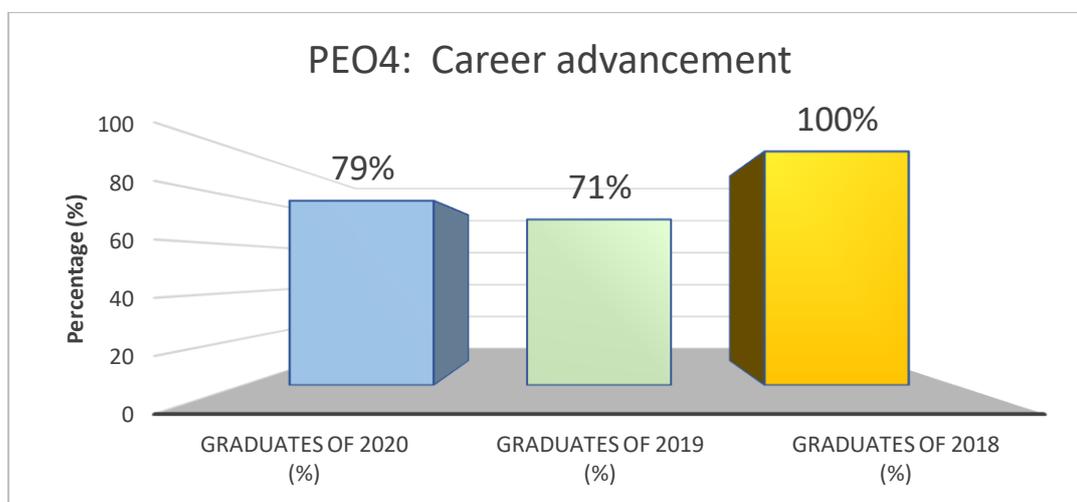

Figure 4: Comparison of PEO4 attainment across 2018, 2019, and 2020 graduate cohorts

All three cohorts surpassed the JPPKK KPI benchmark of 70%, signifying that the majority of graduates actively pursued further studies, professional certifications, or other forms of self-improvement to strengthen their qualifications and support long-term career advancement. The exceptionally high engagement shown by the 2018 cohort, which achieved a full 100% participation rate, further reinforces the positive impact of the programme's emphasis on continuous learning.

CONCLUSION

This study has presented a comparative analysis of Programme Educational Outcome (PEO) attainment among graduates of the Diploma in Electronic Engineering (Communication) programme at Politeknik Sultan Mizan Zainal Abidin across three graduating cohorts. The findings demonstrate that all four PEOs consistently met or exceeded the Key Performance Indicators (KPIs) set by JPPKK, indicating strong alignment between the programme's educational objectives, curriculum implementation, and graduate outcomes. In particular, PEO2, PEO3, and PEO4 recorded exceptionally high attainment levels, reflecting the programme's success in nurturing ethical responsibility, entrepreneurial engagement, and lifelong learning among graduates.

Although variations were observed across cohorts especially in employment-related outcomes under PEO1, these differences can be reasonably attributed to external factors such as economic conditions and the impact of the COVID-19 pandemic. Despite these challenges, the overall results confirm that the programme remains effective in producing graduates who are technically competent, socially responsible, enterprising, and committed to continuous professional development. The consistently positive attainment trends across multiple cohorts further validate the effectiveness of the Outcome-Based Education (OBE) approach adopted by the programme.

Overall, the findings confirm the effective implementation of Outcome-Based Education (OBE) and provide valuable input for Continuous Quality Improvement (CQI), particularly in improving data collection practices, strengthening industry collaboration, and enhancing curriculum responsiveness to future workforce demands. The insights derived from the comparative PEO analysis support curriculum enhancement, stakeholder engagement, and strategic planning to ensure long-term programme relevance and graduate employability in a rapidly evolving engineering landscape.

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