An Evaluation of Program Education Objectives for Electrical and Electronic Engineering Programme at Politeknik Mukah

Nik Aznan bin Ab. Hadi, Kumar bin Boniface Jubilee, and Bong Siaw Wee[(✉)]

Department of Electrical Engineering, Politeknik Mukah, Sarawak, Malaysia
bongsw@pmu.edu.my

Abstract. Programme Educational Objectives (PEOs) are broad statements that describe the general declarations of graduates within three to five years of graduation. This survey is an assessment of the PEOs for the programmes offered at Polytechnic to ensure the philosophy of Outcome-Based Education (OBE) and the programme objectives set by the Department of Polytechnic Education, Ministry of Education Malaysia. There are four (4) Program Educational Objectives (PEOs) in Diploma in Electrical and Electronic Engineering (DEE). The PEOs instrument questionnaire was distributed to all June 2014 admission cohort students through a google form to analyse the PEO assessment for the Diploma in Electrical and Electronic Engineering (DEE). The results showed that DEE graduates have successfully achieved the target of PEOs. The achievement for PEO 1 was also satisfactory, 67% of the respondents were technicians in electronic and electrical engineering fields. In comparison, 9% of the respondents worked in other fields, and another 24% of the respondents were studying or unemployed. The achievement for PEO 2 was the best (95%), while the accomplishment for PEO 3 was the lowest (47.5%). Therefore, most of our graduates have contributed to society with professional ethics and responsibilities. The achievement for PEO 4 is also good (86%), which means our graduates have involved in activities that can increase knowledge for successful career advancement. Hence, it is proven that OBE has been implemented well in the teaching and learning process with the Program Advisory Committees, staff, and students' cooperation.

Keywords: Program Education Objectives · Evaluation Process · Programme Outcomes · Electrical and Electronic Engineering

1 Introduction

In Malaysia, education is a continual endeavour to maximise each person's potential in a holistic and integrated way in order to create people who are harmonious and balanced on all stages, spiritually, emotionally, and physically [1]. Malaysia Education Blueprint 2015–2021 (High Education) is designed based on current achievements that require significant changes in terms of the system, which also involves the Ministry's role to achieve the targeted goals [2]. The teaching and learning processes in engineering

education have also experienced a significant evolution with the advent of output-based education [3–5].

According to the Fourth Industrial Revolution, Green Technology and Sustainable Development initiatives, the programmes offered are designed based on the latest trends in education and industries' future needs [6, 7]. As a result, they have gained accreditation from the Malaysian Qualification Agency (MQA) [8] and The Engineering Technology Accreditation Council (ETAC) [9].

The full-time programmes are divided into five (5) semesters of school work and one semester of industry training. Apart from the technical knowledge and skills, the programmes offered by the Electrical engineering department are designed to develop the individual potential of each student in an integrated and holistic manner through courses such as Islamic studies, moral studies, soft skills and entrepreneurship. The Electrical engineering department aspires to ensure the students are well-prepared for real case studies and function as highly qualified, competent engineering professionals. Therefore, the Electrical engineering department is responsible for verifying that its graduates satisfy its programmes' education objectives. The achievement of educational goals should be measured three to five years after graduation [10, 11]. Therefore, the Department of Polytechnic and Community College Education has developed an assessment process outlined in a companion document entitled "Programme Educational Objectives (PEO) Assessment for Polytechnic Malaysia, Electrical and Electronics Engineering Programmes".

This survey is an assessment of the PEO for the programmes offered in Polytechnic to ensure the philosophy of Outcome-Based Education (OBE) [12] and the programme objectives set by the Department Polytechnic Education, Ministry of Education Malaysia are achieved. In this regard, the findings will also be used to improve the quality of education and training at Malaysian Polytechnic and improve polytechnics' programme planning in the future. Polytechnic Alumni need to fill out this questionnaire and submit it to the Electrical Engineering Unit, Curriculum Division, Department of Polytechnic and Community College Education. The results of this analysis will be presented to the Program Advisory Committee. Program Advisory Committee will give the improvement feedback for this PEO analysis.

2 Programme Educational Objectives (PEO)

There are four (4) Program Educational Objectives (PEO) in Diploma in Electrical and Electronic Engineering (DEE) [13], which are:-

PEO1: Practicing technician in electrical engineering related field.

Describes a technician who works in any industry with a job function in the electrical or electronic discipline.

PEO2: Contributing to society with professional ethics and responsibilities.

Engineering and non-engineering work pertaining to society, health, and safety are among the community activities that recent graduates are involved in. Graduates still understand the culture of safety and health throughout the exercises, and they provide the community ideas about the environment and sustainability. By abiding by the field's

norms and regulations while carrying out the activities, the graduates are upholding their professional obligations and ethical standards.

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

Any company endeavours requiring excellent teamwork and communication, such as engineering, research and development (R&D), and new technological projects, are considered entrepreneurial. Graduates who work full- or part-time in an offline or online firm are also engaging in entrepreneurial activity.

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

Activities that help graduates achieve more success include continuing their education to get a higher level diploma, degree, master's, or PhD, updating their expertise to keep up with technology advancements, and acquiring professional certification. Having a senior position, such as a senior technician, project manager, consultant, or supervisor, is what is meant by career promotion.

3 Data Collection Method

The Procedures of PEO measurement and data collection are as shown below:-

Step 1:   Development of PEO assessment instrument
Step 2:   Circulation of instruments
Step 3:   Pilot Test
Step 4:   Study Report
Step 5:   Goal Setting

- Setting the target percentage of their respective PEOs according to the programme based on raw data from the collection of pilot tests

Step 6:   Improvements to the PEO instrument
Step 7:   Instrument verification
Step 8:   Instrument Circulation

- The improved instrument was distributed to students of the June 2014 admission cohort

Step 9:   Study Data Analysis
Step 10:   Prepare an achievement report
Step 11:   Presentation to the Program Advisory Committee
Step 12:   Triangulation Data Proses

- Do the data triangulation and get the feedback from the Program Advisory Committee.

Step 13:   Report submission to Electrical Engineering Unit, Curriculum Division, Department of Polytechnic and Community College Education.

Fig. 1. Google form platform for PEO Assessment

A questionnaire for "Programme Educational Objectives (PEO) Assessment for Polytechnic Malaysia - Electrical and Electronics Engineering Programmes" is created in the Google Form platform, as shown in Fig. 1. The Google Form link is shown below:-
https://docs.google.com/forms/d/e/1FAIpQLSchvNbG5ZSC4cM0W60yHkzNX2_luVsH4yLzfRU1yeBmaWHOcQ/viewform.

4 Results and Discussion

The analysis of PEO 1, PEO 2, PEO 3, and PEO 4 will be presented in this paper. The study of overall PEOs achievement also will be discussed in this section.

4.1 Profile of Respondents

The PEOs instrument questionnaire was distributed to all June 2014 admission cohort students through a google form to assess the PEO for the Diploma in Electrical and Electronic Engineering (DEE). Students were given one month to answer this survey. The target respondents are students who graduated in 2017 and 2018. In 2017, 125 students successfully obtained DEE, while 84 students received their DEE in 2018. In terms of gender, male (90.48%) respondents outnumbered female (9.52%) respondents. From this study, 62% of respondents were graduates in 2017, while 28% were in 2018. Most respondents are employed (76%), while 19% are in further studies, and 5% are unemployed. None of the respondents has involved in entrepreneurship. Most of the respondents are employed as a technician (52%), others are as assistant engineers (14%), supervisors (5%), other positions (5%), further studies (19%) and unemployed (5%). The range of respondent's income less than RM2000 is 33%, RM2001-RM 3000 is 33%, more than RM3000 (10%), and the other is not applicable (24%).

Table 1. Research findings for PEO 1

Item	Instrument	Achievement (%)	
1(a)	Are you working in the electrical or electronic field?	Yes	67%
		No	24%
		*NA	9%
1(b)	If yes, select the sector below:	Engineering/Manufacturing	64%
		Education	0%
		Information Technology/Computing	0%
		Sales and Marketing	0%
		Transporting/Logistic	0%
		Defence/Security	0%
		Services	22%
		other	14%

*NA = Further Study and Unemployed
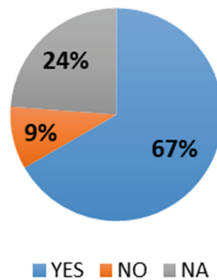
Fig. 2. Achievement of PEO 1

4.2 Analysis of PEO 1 Achievement

PEO 1 is related to the practising technician in the electrical engineering related field. Based on Table 1, 67% of the total respondents work in the electrical or electronic field, while 9% work in other areas. 24% of the respondents further studies or unemployed.

The percentage of graduates working in different sectors in electrical and electronics. Most of the respondents are working in the industry of Engineering/Manufacturing (64%), and the rest are working in the sector of services (22%) and others (14%). On the other hand, none of the respondents has been involved in the Information Technology/Computer, Transporting/Logistic, Education, Sales and Marketing, Defence/Security, and Training/Consultation sectors.

Figure 2 shows an achievement of PEO 1 for Diploma in Electrical and Electronic Engineering (DEE). This pie chart shows that 67% of respondents have achieved Program Educational Objective (PEO) 1, while 24% of respondents have not completed PEO 1, and 9% further studies or unemployed. Program Educational Objective (PEO) 1

Table 2. Research findings for PEO 2

Item	Instrument	Achievement (%)	
2(a)	Do you have any experience in any of these activities? (e.g.. Report writing/presentation/being a panel/speaker for a forum/communication via email)	Yes	57%
		No	38%
		NA	5%
2(b)	Have you ever worked in a group or team at your workplace/during your further studies?	Yes	57%
		No	38%
		NA	5%
2(c)	Have you ever led a team or group at your workplace/during your further studies? (e.g.: demonstrate procedure/give instructions to colleague)	Yes	62%
		No	33%
		NA	5%
2(d)	Are you a member of any professional body or regulatory body (e.g., BEM/IEEE/MySet/CIDB)	Yes	57%
		No	43%
2(e)	Do you practice safety and health at your workplace? (e.g.: personal protective equipment (PPE))	Yes	90%
		No	10%
2(f)	Have you ever been involved in many community activities? (e.g., Committee member of any residential area, NGOs)	Yes	48%
		No	52%

*NA: Unemployed

is related to Program Learning Outcome (PLO) 1 until PLO 5. PLO1 applies knowledge of applied mathematics, science, engineering fundamentals, and an engineering specialisation specified in DK1 to DK4, respectively, to comprehensive practical procedures and practices. PLO2 identifies and analyses well-defined engineering problems reaching substantiated conclusions using codified analysis methods specific to their field of activity (DK1 to DK4).

PLO3 supports in creating systems, components, or processes to suit specific demands while taking into account public health and safety, cultural, social, and environmental aspects. PLO3 involves building solutions for clearly defined technical difficulties (DK5). PLO4 carries out inquiries into clearly specified issues, finds and searches pertinent codes and catalogues, and carries out regular testing and measurements. Last but not least, PLO5 requires using suitable methods, resources, and contemporary engineering and IT technologies to solve clearly defined technical challenges while being conscious of their constraints (DK6).

4.3   Analysis of PEO 2 Achievement

Table 2 shows the research findings for Program Educational Objective (PEO) 2. PEO 2 is providing back to society by upholding their obligations and following professional ethics. Graduates participate in both engineering and non-engineering projects that are concerned with society, health, and safety. The graduate instilled an awareness of the
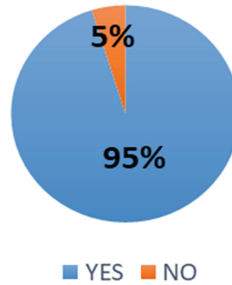
Fig. 3. Achievement of PEO 2

Table 3. Research findings for PEO 3

Item	Instrument	Achievement (%)	
3(a)	Are you involved in any business (including online/part-time)?	Yes	38%
		No	57%
		NA	5%
3(b)	Have you ever been involved in researching or developing any products/services/systems/technical projects?	Yes	38%

safety and health culture during the activities and suggested solutions to the environment and sustainability. In performing the activities, the graduates adhere to professional ethics and responsibilities by following the field's rules and regulations.

Figure 3 shows an achievement of PEO 2 for Diploma in Electrical and Electronic Engineering (DEE). This pie chart shows that 95% of respondents have achieved Program Educational Objective (PEO) 2, while 5% have not completed PEO 2 because they are still unemployed. Program Educational Objective (PEO) 2 is related to PLO 6 – PLO 8. PLO 6 displays understanding of societal, health, safety, legal, and cultural concerns, as well as the duties that come with them, that are pertinent to the work of engineering technicians and the solutions to clearly specified engineering problems (DK7). Understanding and assessing the viability and effect of engineering technician labour to address clearly specified technical issues in social and environmental contexts is the goal of PLO7 (DK7). Understanding professional ethics, obligations, and technical practise guidelines is part of PLO8.4.3. Analysis of PEO 3 Achievement.

Table 3 shows the research findings for Program Educational Objective (PEO) 3. In Item 3(a), 38% of the respondents are involved in business, either online or part-time. However, most respondents are not yet engaged in the industry, 57%, and 5% are not applicable because they are unemployed.

Item 3(b) presents the respondents involved in researching or developing any products/services/system/technical project. The findings indicate that only 38% of respondents were engaged in research or development. In comparison, 57% of respondents had
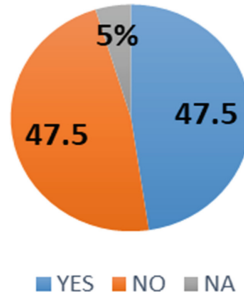
Fig. 4. Achievement of PEO 3

never been involved before, and 5% of respondents were not applicable because they were unemployed.

Figure 4 shows an achievement of PEO 3 for Diploma in Electrical and Electronic Engineering (DEE). This pie chart shows that 47.5% of respondents have achieved Program Educational Objective (PEO) 3. Program Educational Objective (PEO) 3 is related to PLO 9 – PLO 11. PLO9 functions effectively as an individual and as a member of diverse technical teams. PLO10 effectively communicates well-defined engineering activities with the engineering community and society by comprehending others' work, documenting their work, and giving and receiving clear instructions. Finally, PLO11 demonstrates knowledge and understanding of engineering management principles and applies them to one's work as a member or leader in a technical team and managing projects in multidisciplinary environments.

4.4 Analysis of PEO 4 Achievement

Table 4 shows the research findings for Program Educational Objective (PEO) 4. Item 4(a) offers the starting position for alumni DEE, with 52% of respondents working as a technician, Assistant Engineer (5%), Supervisor (9.5%), and other positions (9.5%). 24% of respondents are not applicable because they are either further studies or unemployed. Item 4(b) shows the achievement of all respondents, 44% of respondents have achieved a salary increase, 23% of respondents got a professional certificate, 17% of respondents continued their studies, 10% of respondents have their own business, 3% of respondents got a higher promotion, 3% get other achievements.

Figure 5 shows an achievement of PEO 4 for Diploma in Electrical and Electronic Engineering (DEE). This pie chart shows that 86% of respondents have achieved PEO4, either further study, self-employed holding a senior position post or salary increment, being involved in technical projects or being involved in research and development, and upgrading technical knowledge. Program Educational Objective (PEO) 4 is related to PLO 12. PLO 12 recognises the need for and can engage in independent updating in the context of specialised technical knowledge.

Table 4. Research findings for PEO 4

Item	Instrument	Achievement (%)	
4(a)	Starting position	Technician	52%
		Assistant Engineer	5%
		Supervisor	9.5%
		Other	9.5%
		*NA	24%
4(b)	What is your achievement thus far?	Salary Increment	44%
		Own business	10%
		Promoted to a higher post	3%
		Further Studies	17%
		Professional Certification	23%
		other	3%

*NA = Further Study and Unemployed
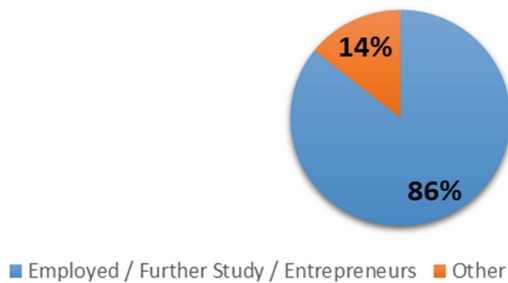
Fig. 5. Achievement of PEO 4

4.5 Target PEOs Achievement for DEE

Outcome-based Education (OBE) emphasises two main components of students' achievement in an academic programme. One is the Programme Outcomes (POs) which are measured at the point of graduation, and the other, the Programme Educational Objectives (PEOs), are assessed over a more extended period (around 3–5 years) after graduation. Therefore, the Head of the Electrical Engineering Department, Politeknik Mukah (PMU), has determined the PEO achievement target for DEE for the June 2014 admission cohort of students who have graduated in 2017 and 2018, as shown in Table 5.

Figure 6 presents the target and achievement of PEOs in a column chart. PEO 1 achieved 67%, which is above the target level. According to this study, the alumni were employed and competent in Electrical and Electronic Engineering. JPPKK needs to continuously update the curriculum according to Industry Revolution 4.0 to be more relevant to the industry. PEO 2 achieved 95%, which is above the target level. Graduates

Table 5. PEOs achievement target for DEE

| PEOs		Target
PEO1	Practicing technician in electrical engineering related field	At least 20% of technicians operate in any industry with an electrical or electronic job function.
PEO2	Contributing to society with professional ethics and responsibilities	At least 30% of graduates are involved in community activities, including engineering and non-engineering works related to society's health and safety.
PEO3	Engaging in enterprising activities that apply engineering knowledge and technical skills	At least 20% of the graduates will be involved in enterprising activities.
PEO4	Engaging in activities to enhance knowledge for successful career advancement	At least 30% of the graduates will further study, become self-employed, hold a senior position, be involved in/work on technical projects, or participate in research and development activities.
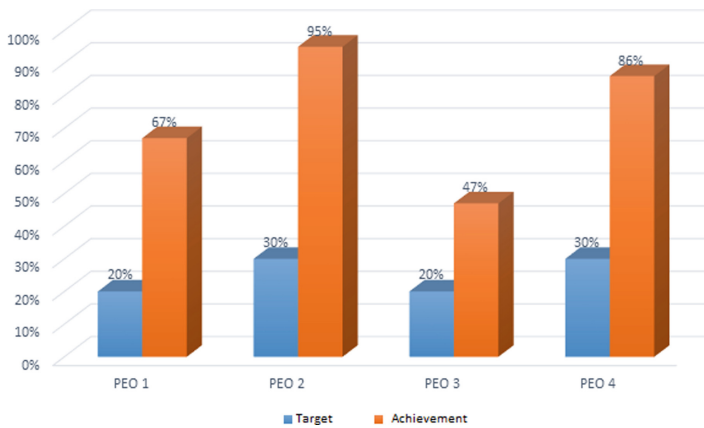
Fig. 6. Target and Achievement of PEOs

with more than 3–5 years' experience can lead/manage projects and companies to a higher level. The alumni possess managerial skills, able to lead the team and complete their tasks. PEO 3 achieved 47.5%, which is above the target level. According to the survey, half of the graduates have engaged with social and entrepreneurial skills. PEO 4 achieved 86%, which is more than the target level. This study shows that most graduates continue to pursue higher studies, research, professional development, self-employed, holding a senior position post, and related activities.

4.6   Triangulation Process with the Program Advisory Committees

The Department of Electrical Engineering, Politeknik Mukah has successfully implemented a triangulation process with the Program Advisory Committee on 18 June 2021. This program aims to present and discuss an achievement analysis of the Programme Educational Objectives (PEOs) with the Program Advisory Committee. By holding this program, our department can get feedback from the Program Advisory Committee on the results of the PEO analysis and suggestions for improvements that need to be implemented for the DEE Program. In addition, the program can also create collaboration between the Department of Electrical Engineering and the Program Advisory Committee from the industry. This program has successfully invited four (4) Program Advisory Committees from industry companies (Mutiara Technology Center Sdn Bhd, Konsortium Bumi Consultant & Service Sdn. Bhd., Digital Two Way Communications Sdn. Bhd., and TM Unit 1).

The following action plans must be implemented to improve the performance of PEOs:

PEO 1: Continue to update the curriculum according to Industry Revolution 4.0 to be more relevant to the industry.

PEO 2: To increase the number of mini-project or manage confidence among the graduates.

PEO 3: More student activities to achieve the target level. To improve the Entrepreneur skills, to arrange more technical talks.

PEO 4: Electrical engineering department needs to conduct many skills courses for students to get a professional certificate such as a wireman. The Electrical Engineering Department can also invite companies/industries to come to the Politeknik Mukah to open a large-scale interview booth for interested students. As a result, students are more likely to get the jobs they want. At the same time, Politeknik Mukah also can invite the university to provide information on how to apply for further study for a degree in Electronic or Electrical Engineering.

5   Conclusion

Based on the data gathered and analysed from the raw data and document analysis, it was discovered that the graduates of DEE, Electrical Engineering Department, Politeknik Mukah, have successfully achieved the target of PEOs. The majority of graduates have achieved PEO 1, a practising technician in an electrical engineering related field. This analysis also shows that graduates are also successfully contributing to society with professional ethics and responsibility (PEO 2). The graduates also showed good performance when participating in active activities that required technical knowledge and technical skills (PEO 3). This study also shows that graduates have engaged in activities to increase understanding for successful career advancement (PEO 4). This research also indicates that the philosophy of Outcome-Based Learning (OBE) and program objectives set by the Department of Polytechnic Education and Community Colleges (JPPKK), Ministry of Higher Education Malaysia (MOE) were achieved. OBE is implemented to ensure that academic programs, teaching systems, assessments and students as graduates are

of high quality. OBE requires students to show that they know and can implement what is needed for the learning outcomes. As a complete education system, OBE includes Curriculum, Teaching and Learning, Assessment and Continuous Quality Improvement (CQI).

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