Individual Performance Study Based on Correlation between Programme Outcomes Attainment and CGPA

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ABSTRACT – This study evaluates the individual student performance in the Faculty of Electrical Engineering, Universiti Teknikal Malaysia Melaka (UTeM)- based on programme outcomes attainment and cumulative grade point average (CGPA). The performance of students from cohort 2017 for Bachelor of Electrical Engineering (BEKG) courses, which graduated in 2021, was used as the dataset. A sample of three student categories was categorized, and each was rated and assessed according to its characteristics: excellent, honours, and pass. The study found that students with higher CGPA reflect significantly on the overall achievement of the Programme Outcome attainment.

1. INTRODUCTION

Preparing electrical engineering graduates to fulfill the Engineering Accreditation Council (EAC) and the Malaysian Qualifications Agency (MQA) requirements challenged Malaysia's academic community. Programme outcomes (PO) are statements describing what students are expected to know and do or be able to do by the time they graduate from EAC [1]. These relate to the knowledge, skills, and attitude that students acquire through the Programme. Students for the Electrical Engineering Bachelor Programme in the Faculty of Electrical Engineering (FKE) are expected to attain a practice-oriented learning environment to design solutions and conduct the investigation for complex electrical engineering problems [2]. FKE strives hard to produce competent, capable, knowledgeable, and ethical human capital to assist the nation. These specific goals have been captured in the programme educational objectives (PEO) for Electrical Engineering Bachelor Programme. To achieve this, FKE decided to implement an Outcome-Based Education (OBE) curriculum [2,3], as shown in Figure 1. Student achievement in OBE is measured by their acquired abilities to ensure the attainment of the PO.

Recently, [5,6,7] discuss methods to perform PO attainment for various case studies. In particular, for our preliminary works in [8], the student's performance for the Electrical Engineering programme is analyzed based on the student's grade in each course. However, no study investigates the individual performance based on the correlation between PO attainment and cumulative grade point average (CGPA). Therefore, this paper investigates the individual performance based on the correlation between PO attainment and CGPA in FKE, UTeM. The findings of this paper provide the correlation between PO and CGPA for the continuous Quality Improvement (CQI) process.
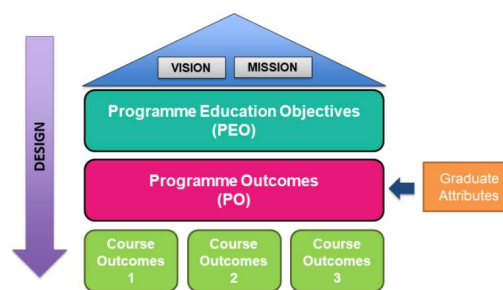

Figure 1: Overview of OBE implementation [4]

2. BUILDING DATA SET

2.1 Test System

This study aims to determine the individual student performance based on the PO attainment relationship towards the CPGA. The case study separates into three groups: excellent, honours, and pass (see Table 1). Note that the group indicates a different category of achievement based on the grading system as presented in the FKE's Handbook [3]. In this study, we test at the 0.05 level of significance whether the higher CGPA is an indicator for all PO attainment which is the claim in our null hypothesis statement.

Table 1 Grade point system used in the proposed test system.

Group	Grade point
Excellent	3.70-4.00
Honours	3.00-3.69
Pass	2.00-2.99

2.2 Data Extraction

Data extraction is critical in developing different datasets in evaluating individual students' BEKG based on their PO attainment and CGPA categories. Overall implementation steps of the proposed method can be described as follows and in a flowchart shown in Figure 2.

Step 1 Select the number of the dataset, N

Step 2 Test the subject, j with grades, g based the grading

system as presented in the FKE's Handbook [3].

Step 3 Evaluate the individual students' performance of the subject, *j*, by checking their Learning Outcome (LO) and PO for each subject,*j*.

Step 4 Perform the PO weight calculator. The calculation is obtained using the formulation of the weight average method presented in [7].

Step 5 Category, *m* is identified based on the CGPA group in Table 1.

Step 6 Record and plotted each graph according to the category, *m*. The comparative study and analysis are performed based on the result recorded.

Step 7 Repeat processes in **Step 2** to **Step 6** until the counting number of the dataset is achieved.
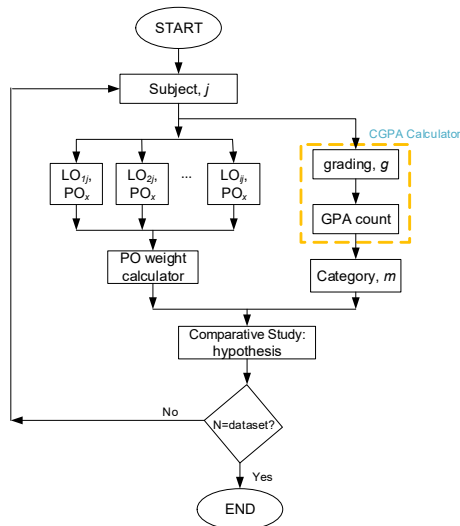

Figure 2 Implementation step for the individual students' performance

This study analyzed the performances of students from cohort 2017, which graduated in 2021, as the dataset. Note that, number of student intake for cohort 2017 is 173 students, where 10 excellent, 62 honours, and 101 pass have been identified from their CGPA categories. Figure 3 shows the distribution of CGPA students' performance from cohort 2017. From the figure, the mean and variance of the sample are 2.92 and 0.403, respectively.

3. RESULT AND DISCUSSION

Individual PO attainment performance is influenced by 12 PO measures in FKE, UTeM as stated in [2,3]. These 12 factors are put on a 0-100% scale, with 0 indicating very low and 100% indicating very high PO attainment. The indicator for each PO attainment for the cohort in FKE is defined as more than 60% of the students get above 50% of the allocation marks in the assessment [9]. For instance, Figure 4 shows the PO attainment sample of student Y with excellent CGPA. From the observation, the web chart starts growing from Year 1 until Year 4, depending on the subject that maps to a specific PO. Thus, the growth of development knowledge can be seen in line with the education goal in producing graduates with relevant knowledge, technical competency, soft skills, social responsibility, and
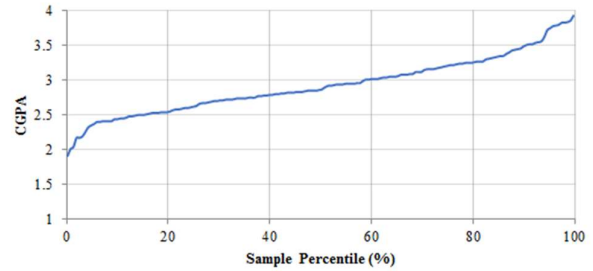
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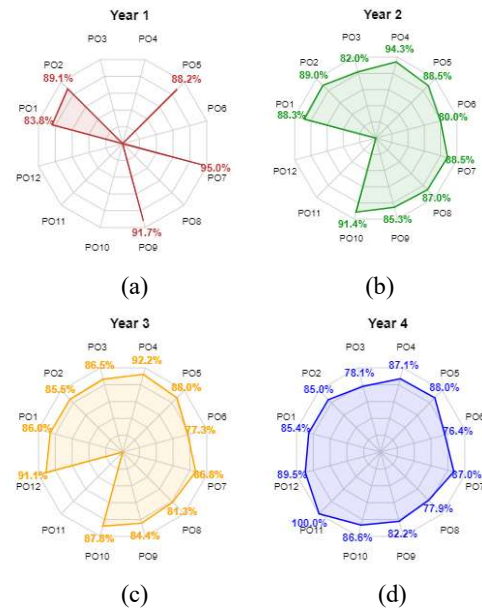

Figure 3 Distribution CGPA students' performance

Figure 4 PO attainment performance of Student Y based on: (a) Year 1, (b) Year 2, (c)Year 3, (d) Year4

Meanwhile, Figures 5, 6, and 7 represent the sample of the top 3 individual PO attainment performance for the student in the final year with excellent, honours, and pass CGPA, respectively. From the observation, all of the students are passed with the indicator set by the FKE. However, as we set, the mean for this cohort is 75% for each of the PO attainment. Thus, some of the PO is not excellently fulfilled by the students even though there are excellent CGPA category students.

For instance, from Figure 5, student R successfully fulfilled the entire PO with a mean indicator larger than 75%. Meanwhile, student S not excellently fulfilled PO6. On the other hand, student T not excellently fulfilled PO3. Surprisingly, the PO attainments for the top 3 pass CGPA outperform the top 3 honours CGPA based on the mean indicator, as shown in Figures 6 and 7. Therefore, the null hypothesis is accepted. It shows from the evidence that higher CGPA is an indicator for all PO attainment achieved.

4. CONCLUSION

This study investigates the correlation between PO attainment and CGPA in FKE, UTeM. This can be achieved by comparing individual PO attainment performance with CGPA. From the findings, students with higher CGPA will reflect significantly on the overall

achievement of the PO attainment. Therefore, the extended works of the authors will include extensive analysis for investigating the correlation between PO attainment and CGPA evaluation in a different cohort at FKE, based on this proposed method.
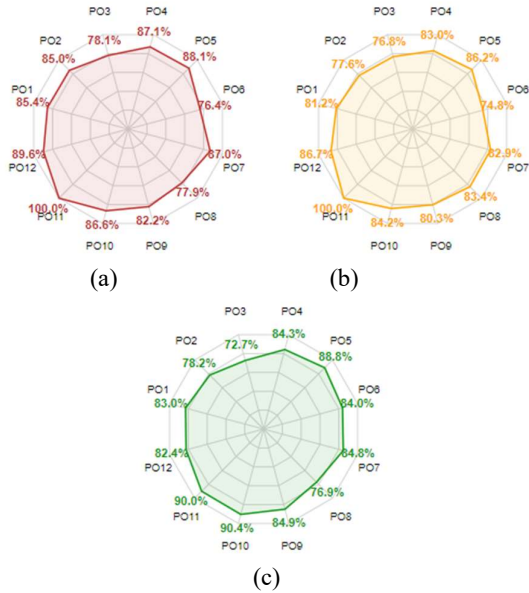
Engineering (FKE), UTeM, in providing the data for the research work.

(a)

(b)

(c)

Figure 5 PO attainment performance based on top 3 excellent CGPA for sample: (a) Student R, (b) Student S, (c) Student T
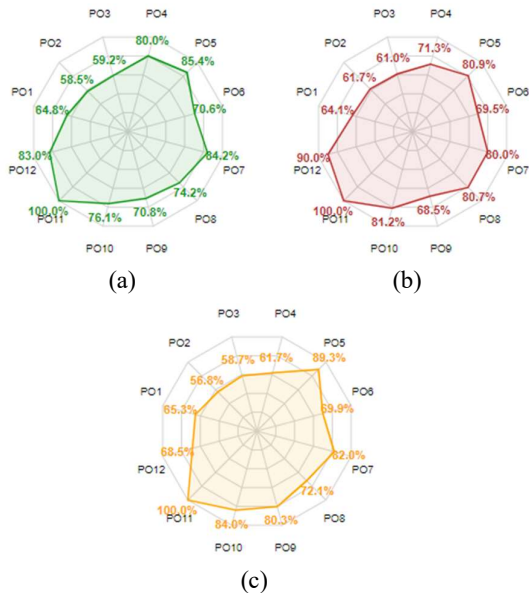

(a)

(b)

(c)

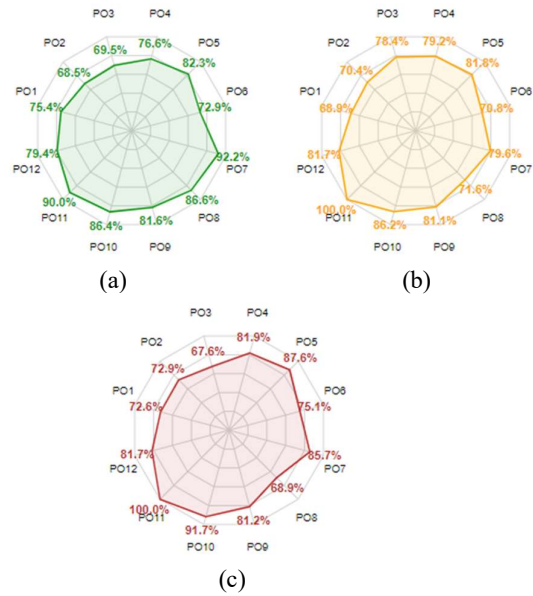Figure 6 PO attainment performance based on top 3 honours CGPA for sample: (a) Student U, (b) Student V, (c)Student W

(a)

(b)

(c)

Figure 7 PO attainment performance based on top 3 pass CGPA for sample: (a) Student X, (b) Student Y, (c) Student Z

5. ACKNOWLEDGEMENT

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