COMPARATIVE STUDY FOR THE BACHELOR OF ELECTRICAL ENGINEERING STUDENTS' PERFORMANCES BASED ON DIFFERENT CURRICULAR STRUCTURE

Aziah K.*, Nur Ilyana A. A.& Nor Aishah M.

Faculty of Electrical Engineering, Universiti Teknikal Malaysia Melaka,
Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia

*Corresponding e-mail: aziah@utem.edu.my

ABSTRACT

This study measures the effectiveness of two curricular structures in Faculty of Electrical Engineering, Universiti Teknikal Malaysia Melaka (UTeM) that are based on the conventional academic program and the broad-based program referred to as conventional electrical engineering (EE) and BEKG, respectively, for Bachelor of Electrical Engineering courses. Three categories of subjects were selected to compare the evaluation and assessment in the students' performances for the conventional EE and BEKG, i.e., mathematics and basic science, laboratory, and electrical subjects. The results show that the performance of BEKG students outperforms the conventional EE students in all the categories.

Keywords*: Teaching Performance; Electrical Engineering subject; Student Performance*

1. INTRODUCTION

Preparing electrical engineering graduates to fulfill the Engineering Accreditation Council (EAC) and the Malaysian Qualifications Agency (MQA) requirement brought a challenge to the academic community in Malaysia. Assessment plays a significant role in the continuous improvement of the quality of the electrical engineering program [1]. Since 2010, the teaching and learning activities in Faculty of Electrical Engineering (FKE), Universiti Teknikal Malaysia Melaka (UTeM) are conducted based on outcome-based education approach that is based on the conventional academic program, namely the conventional electrical engineering (EE) courses. For conventional EE courses, the curriculum content is based on 60% practical and 40% theoretical [2]. Starting academic session 2013/2014, FKE substitutes the curriculum of conventional EE to a new broad-based program for Bachelor of Electrical Engineering course with the specialization starts in the second semester of the third year, referred to BEKG [3]. To date, there is no study that investigates the quality of EE programme in FKE in terms of evaluation and assessment in the students' performances. Thus, this paper provides a comparative analysis for the conventional EE and BEKG programme based on the difference in the curriculum structure. The findings in this paper provide a promising step for improving the quality of EE programme in FKE. In the following section, the details of these curriculum structures are generally explained and reviewed.

2. DESCRIPTION OF CASE STUDY APPROACH

2.1 Conventional Electrical Engineering

In the conventional EE programme, the students are divided into three major courses at the beginning of the programme, which is industrial power (BEKP), power electronics (BEKE), and control (BEKC) [2]. All student needs to follow the curriculum structure that has been provided by the faculty, which can be divided into five main categories as illustrated in Figure 1. Basically, there

are 136 total credit hours for conventional EE programme. Figure 1(a) shows the summary of curriculum content for conventional EE taken by the students' FKE, UTeM that is divided based on the total credit hours. Based on Figure 1(a), the conventional EE is more focusing on the electrical engineering subject and general knowledge as it contributed 60% and 17%, respectively, contents of the programme. This is due to the principle of FKE, UTeM that to inspire more students with good basic of electrical engineering knowledge. Moreover, FKE stakeholders such as the faculty's external examiner, visiting professor, adjunct professor, and industrial advisory panel have revised the curriculum structure.

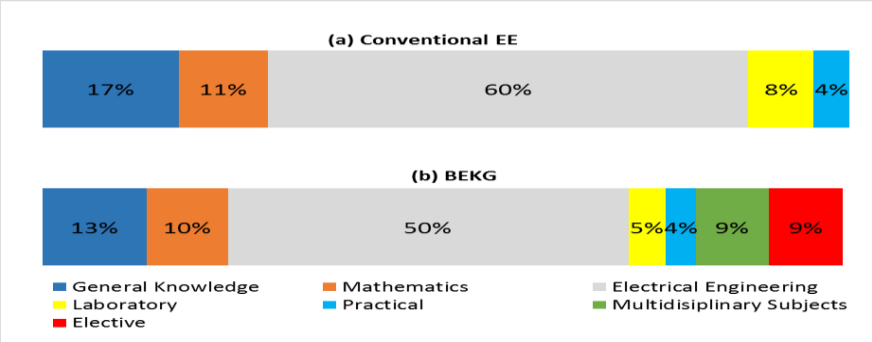

Figure 1: Summary of Electrical Engineering Curriculum Content based on total credit hours for (a) Conventional EE and (b) BEKG.

2.2 BEKG

In the BEKG programme, the student follows the curriculum structure provided by the faculty until their fifth semester of study, as illustrated in Figure 1(b). The student will select the subjects according to their interest in semester 6, 7 and 8, where faculty offered another 9% of the curriculum structure, named as an elective subject. This elective subject is selected based on three major courses offered previously in FKE, UTeM, which is BEKP, BEKC, and BEKE as tabulated in Table 1.

Table 1 List of new subjects proposed in BEKG

Categories	Subject	
Multidisciplinary	Engineering Materials; Engineering Graphic and CAD; Introduction to Mechanical Engineering; Engineering Economy and Management; Entrepreneurship Technology	
Elective	Industrial Power (BEKP)	Distribution System Design; Power System Protection; High Voltage Engineering; Renewable Energy
	Control, Instrumentation & Automation (BEKC)	Industrial Control and Automation; Intelligent Control Systems; Digital Control Systems; Industrial Robotics
	Power Electronics & Drives (BEKE)	Industrial Power Electronics Modern Electrical Drives Intelligent Motor Drives Special Machines

Generally, BEKG courses were conducted with 80% of contact hours that highlight the theoretical and 20% meeting hour, involving the practical or laboratory experiments, computer-aided learning and problem-based learning (PBL) [4]. Meanwhile, in order to fulfill the government campaign towards technology-enhanced learning, additional 10% multidiscipline subject were added, where the subjects are listed in detail in Table 1.

To date, there is no study that investigates the quality of EE programme in FKE in terms of evaluation and assessment in the students' performances. Thus, this paper provides a comparative analysis for the conventional EE and BEKG programme based on the difference in the curriculum structure. The findings in this paper provide a promising step for improving the quality of EE programme in FKE.

3. RESULTS AND DISCUSSION

3.1 Mathematics and Basic Science Subjects Performance

Mathematics and basic science subjects play a fundamental role in supporting EE education mainly because engineering problems are based on mathematical modeling, and basic science is vital frontiers of modern technology [4]. Ideally, students with a strong knowledge of these fundamental subjects should perform well in engineering subjects.

This study aims to evaluate the performance of mathematics and basic science for conventional EE and BEKG. The evaluation is done by comparing the grades obtained by students in both programmes as shown in Figures 2(a) and 2(b), respectively. Figure 2(a) shows that most of the conventional EE students scored grade C and less than 5% of students scored grade A in computer programming. Conversely, over than 10% of the BEKG students scored grade A in computer programming as depicted in Figure 2(b). For the mathematics subjects, it is found that the performance of BEKG students outperformed the conventional EE students, where the percentages of students scored grade A in mathematics for the BEKG were higher than the conventional EE. This finding proves that the performances of students based on the mathematics and basic science subject from the BEKG have better performance than the conventional EE.

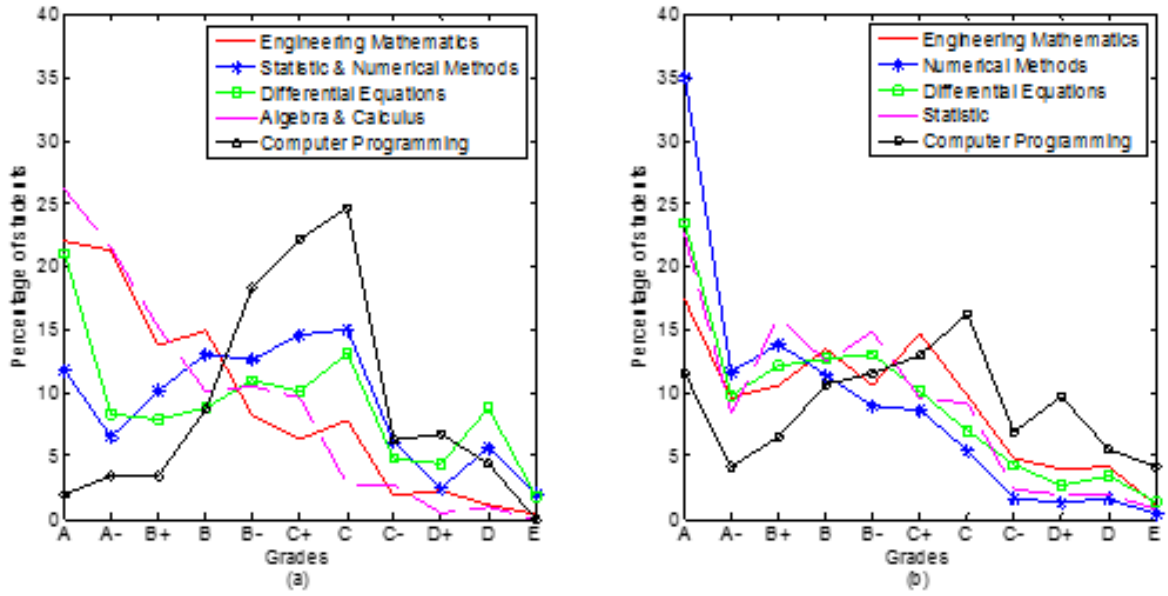

Figure 2: Mathematics and Basic Science for Cohort (a) 2013 Conventional EE and (b) 2014 BEKG

3.2 Electrical Subjects Performance

In the new curriculum of the BEKG, there are several subjects that have been improvised and upgraded from the conventional EE. To capture the effectiveness of this overall shift from the conventional EE to the BEKG, we only consider 4 electrical engineering subjects as a sample that is

shown in Figure 3. The performance based on the electrical engineering subjects in the conventional EE, i.e., Instrumentation and Measurement (Instrument), Electromagnetic Theory (EMT), Introduction to Power Engineering, and Electrical Circuit 1, are compared to the BEKG, i.e., Instrument, EMT, Power System and High Voltage, and Circuit Analysis. Firstly, for the Instrument subject, the performance of the BEKG students is better than the conventional EE, where nearly 20% of students scored grade B in the BEKG, whereas nearly 20% of students scored grade C+ in the conventional EE. Next, the performance of the Introduction to Power Engineering subject is compared to the performance of the Power System and High Voltage (HV) subject. Similarly, it is found that the performance of the BEKG students outperformed the conventional EE, where nearly 20% of the BEKG students scored grade B whereas 12% of the conventional EE students scored grade C+.

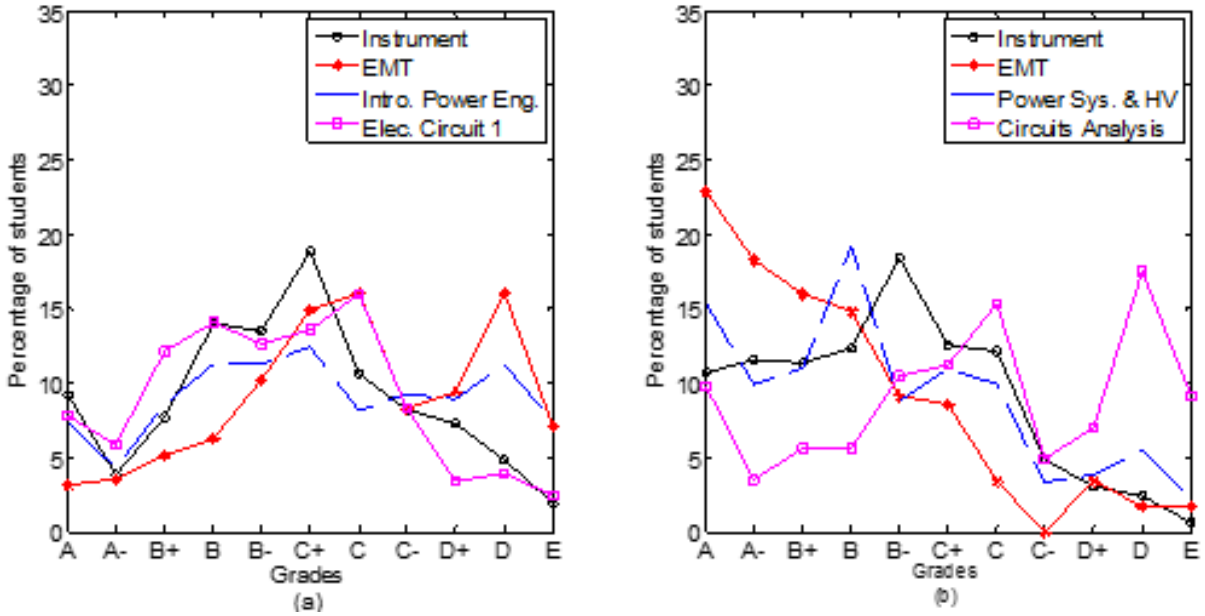

Figure 3: Selected Electrical Engineering Subjects of the (a) Conventional EE (b) BEKG

Another interesting finding is that the performance of students scored grade A in the EMT subject for the BEKG improves to more than 20% as compared to the conventional EE. This indicates that the students of BEKG have a better mathematics background compare to the conventional EE, which concurs with the observation in Section 3.1. Meanwhile, the conventional EE student obtained better performance in the Electric Circuit 1 subject as compared to the performance of the Circuit Analysis subject in the BEKG. Hence, it is advisable for any lecturer who will teach the Circuit Analysis subject to evaluate the continuous quality improvement (CQI) report for improving the performance of the students in the subject. Thus, supporting the importance of each lecturer role in the CQI of BEKG program in FKE.

3.3 Laboratory Subjects Performance

Figure 4 shows the performance of FKE's students in the laboratory subjects. Note that student of the conventional EE must attend 12 laboratory subjects in their first and second year of studies, as shown in Figure 4(a) and 4(b). Whereas in the new curriculum of the BEKG, three laboratory subjects are merged and rebranding as one subject. Hence, there is a 50% reduction in the list of laboratory subjects of BEKG as shown in Figure 4(c). Despite the rebranding of laboratory subjects for BEKG, the overall performance of the laboratory subject shows a similar trend to the conventional EE.

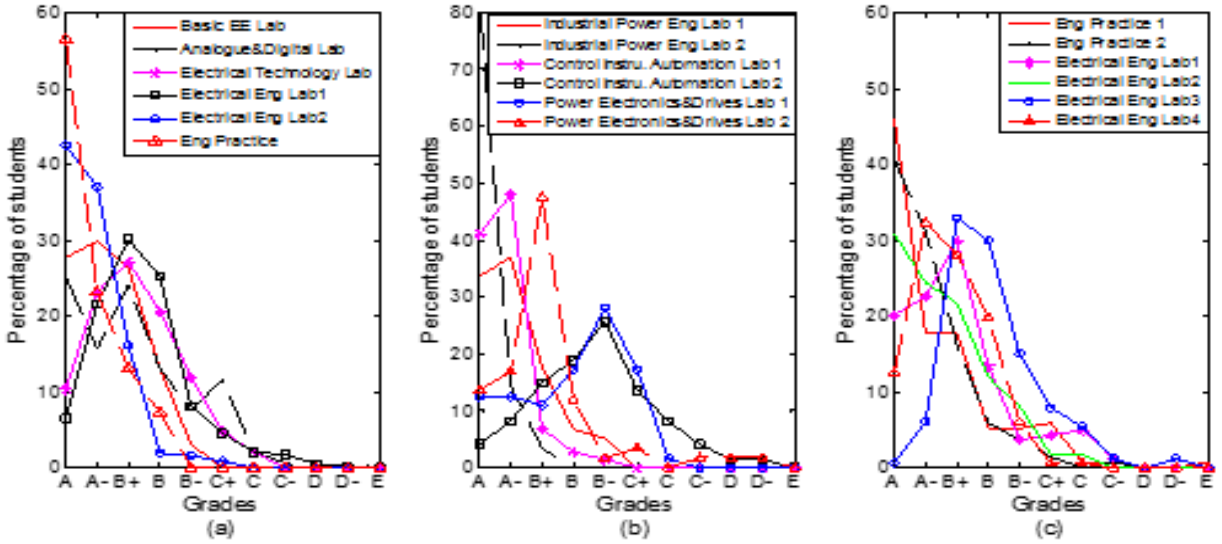

Figure 4: Laboratory subject for (a) Year 1 and 2 (b) Year 3 and 4 of the Conventional EE and (c) BEKG

4. CONCLUSION

The student performance for the conventional EE and the BEKG program in FKE have been evaluated by comparing the performance of students in mathematics and basic science, laboratory as well as electrical subjects. This study indicates that the performance of the BEKG student is better than the conventional EE in terms of evaluation and assessment through selected subjects. The future work of the authors includes evaluating the curriculum structures of the multidisciplinary and elective subjects in the BEKG program based on these results.

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