Clusters in Mathematics that Influence Performance of Undergraduate Students on Engineering Mathematics

Ser Lee Loh[1*], Yan Chiew Wong[2], Rahifa Ranom[1], Irma Wani Jamaludin[1]

[1)] Centre for Robotics and Industrial Automation (CeRIA), Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia
[2)]Centre for Telecommunication Research & Innovation (CeTRI), Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia

[*]Corresponding e-mail: slloh@utem.edu.my

Keywords: Cluster of mathematics; engineering mathematics

ABSTRACT – In bachelor degree of Electrical Engineering, mathematics appears as the basic knowledge in most of the engineering courses. Students with different pre-university background achieve different performance in the program of Engineering Mathematics. This study attempts to identify the main cluster(s) in mathematics that affect the achievement of Electrical Engineering undergraduate students of Universiti Teknikal Malaysia Melaka in their Engineering Mathematics assessment. A mathematic competency test was carried out at the early of semester and the result is analyzed with the final performance in Engineering Mathematics at the end of semester. Clusters of pre-calculus and differentiation are found influence performance of Engineering Mathematics significantly.

1. INTRODUCTION

In engineering, mathematics is one of the important courses that students should dominated. With a strong foundation of mathematics, undergraduate students tend to follow through the whole program smoothly and achieved learning outcome at the end of the program as previous study [1]. In 2013, there is some evidence that poor in mathematics is part of reasons for students' dropout from engineering studies as stated in [2]. In the next year, Heublein [3] presented that the highest dropout rates for mathematics laden studies were partly caused by low motivation of students and partly by excessive demands in the first part of the study.

Students with good mathematical skills would support to enhance students' knowledge in wide range of disciplines, especially in engineering. According to Goold and Devitt in [4], mathematical knowledge is important for engineering students to develop their logical thinking. In the tertiary institution, a study by [5] found that mathematics in Level 1 is significantly influence the overall academic performance in Level 2 at the Faculty of Engineering, University of Moratuwa, Sri Lanka. Based on these researches, mathematics is indeed crucial for an engineering student to excel in his or her study. To enhance a student's mathematics performance in tertiary, a study is carried out to find out the main topic(s) in mathematics that influence students' performance of mathematics in Level 1.

2. METHODOLOGY

2.1 Participants

From the new intake, 50 students that pursuing the Bachelor of Electrical Engineering at Universiti Teknikal Malaysia Melaka are selected to sit for the mathematics competency test. These students come from different background of pre-university courses and were put in the same class attending the Engineering Mathematics under the same study environment.

2.2 Tools

Competency test is used to measure the students' ability against the mathematics solving on the 3 main clusters which are pre-calculus, differentiation and integration. The competency test questions are designed according to 3 main clusters by mathematics lecturers from different faculties in Universiti Teknikal Malaysia Melaka. The competency test contains a total number of 40 questions and students are required to work it out in 1.5 hours.

2.3 Procedures

Students sit for the competency test individually at the early of semester. During the semester, students are studying in the same class for the program of Engineering Mathematics with the same lecturer and were evaluated using summative assessments. At the end of the semester, the overall performance of students in Engineering Mathematics course were collected. Their performance in competency test and Engineering Mathematics are analyzed using data analysis package in Microsoft Excel.

3. RESULTS AND DISCUSSION

Table 1 shows the result of regression analysis.

Table 1 Regression Analysis Result

	Coeff.	Std. Error	t Stat	P-value
Intercept	62.38	2.29	27.18	8E-31
Precalculus	1.82	0.85	2.13	0.037
Differentiation	1.82	0.61	2.96	0.004
Integration	0.75	0.77	0.97	0.335

The level of significant 0.05 is used in this analysis. Based on the result, p-value of precalculus and

differentiation are 0.037 and 0.004, respectively, where both are less than level of significant 0.05. However, the p-value of integration which is 0.335 is higher than level of significant 0.05. Hence, there is enough evidence to conclude that pre-calculus and differentiation affect the final performance of undergraduate students significantly in Engineering mathematics. The higher is the scores in pre-calculus and differentiation, the better is the performance in Engineering Mathematics.

The regression equation is as follows:

$$Performace = 62.38 + 1.82 * Precalculus + 1.82 * Differentation \quad \ldots\ldots\ldots (1)$$

4. CONCLUSION

The result indicates the topics of pre-calculus and differentiation affect the performance of undergraduate students on Engineering Mathematics course in a technical university. An undergraduate engineering student with a strong foundation in pre-calculus and differentiation may score higher in Engineering Mathematics.

REFERENCES

[1] Aziz, A. A., Zaharim, A., Fuaad. N. F. A., & Mohd Nopiah Z. (2013). Student's performance on engineering mathematics: Applying rasch measurement model. *Proceedings of 12th International Conference on Information Technology Based Higher Education and Training, 2013.*

[2] Søgaad Larsen, M. (2013). Dropout phenomena at universities: What is dropout? Why does dropout occur? What can be done by the univerisities to prevent or reduce it? A systematic review. Clearinghouse – research series: 2013:15: Danish Clearinghouse for Educational Research.

[3] Heublein, U. (2014). Student drop-out from German higher education institutions. European Journal of Education, 49 (4), 497-513.

[4] Goold, E. and Devitt, F. (2012). The role of mahtematics. *Proceedings of 40th European Society of Engineering Education (SEFI), Engineering Education 2020: Meet the future*, Thessaloniki, Greece.

[5] Nanayakkra, K. A. D. S. A. and Peiris, T. S. G. (2010). Application of canonical correlation analysis to study the influence of mathematics on engineering programs: A case study. *Proceedings of Moratuwa Engineering Research Conference*, Sri Lanka, IEEE, 137-141.