

Factors Contributing to Students' Poor Performance in Engineering Mathematics

Dzaidah Hanin Nor Azlim^{1, a}, Emey Dyana Abd. Jalil^{2, b}

¹Politeknik Merlimau Melaka, Malaysia

²Politeknik Merlimau Melaka, Malaysia

^adzaidah@pmm.edu.my, ^bemeydyana@pmm.edu.my

Keywords: Factors, Engineering, Mathematics, Performance, Poor, Failure

Abstract

Performance in Engineering Mathematics 5 (BA 601) has dropped in June 2014 session in Politeknik Merlimau, Melaka comparing to the previous semesters. This study is done to investigate the factors contributing to the poor performance and to establish the strategies that can be done to improve performance in Engineering Mathematics 5 (BA 601). This study is to determine the factors that lead to poor performance in Engineering Mathematics 5 (BA 601) from students' perceptions. This study adopted descriptive survey type using frequency count and percentage for the analysis. A set of questionnaires was adopted from Favziah Nafiah and Noor Azilla Mohamed Nor (2011) for the study. The target population was among 36 students who failed in Engineering Mathematics 5, BA 601 in June 2014 session. Factors of the items in the questionnaire include : completing exercises/tutorial/assignment behavior, study method, attitude and motivation, personal problem, spiritual, and mathematics foundation. The response scales are Strongly Agree, Agree, Moderate, Disagree and Strongly Disagree. Findings indicate that weak in differentiation and integration foundation is the major factor that leads to poor performance in Engineering Mathematics 5 (BA 601) from students' perception. Improve in this factor, students will be expected to benefit from the findings because improving Engineering Mathematics 5 (BA 601) will give them opportunities to pass this course and complete their diplomas.

Introduction

Mathematics is seen as a very important as foundation of scientific and technological knowledge. Mathematics is also used as a basic entry requirement into any of the prestigious courses such as medicine, architecture and engineering among other diploma and degree programmes. In Politeknik, upon completion of mechanical and electronic engineering programme, graduates should be able to apply knowledge of mathematics, science and engineering fundamentals and also able to apply creative and critical thinking in solving problem related to assigned task. These criteria included in the Programme Learning Outcome which are needed to be completed in Engineering Mathematics courses. In reality, electrical engineering employs differential equations as the basis of power problem, control systems and machines. While in mechanical engineering uses differential equations in heat-mass transfer problems, structural engineering and stress-strain problem and etcetera. In Politeknik, Engineering Students are prepared with this advanced Differentiation and Integration knowledge in Engineering Mathematics 5 (BA 601) during the final semester. Thus studying differentiation and integration is very important for engineering background students in order to have their concept clear and help them in grasping advanced concepts efficiently.

Problem Statement

Performance in Engineering Mathematics 5 (BA 601) has dropped in June 2014 session in Politeknik Merlimau, Melaka comparing to the previous semesters, this is demonstrated on Table 1.

Table 1 : Students Failure Percentage In Engineering Mathematics 5 (BA 601) from Dec 2012 – June 2014

Session	Dec 2012	June 2013	Dec 2013	June 2014
Failure Percentage, %	8	5.1	3.35	10.5

Failure in Engineering Mathematics 5 (BA 601) has increased tremendously in June 2014 session as reflected by **Table 1**. Hence the need to investigate factors contributing to this poor performance is necessary in order to improve the performance among students.

Objectives

- Determine factors that contribute to poor performance in Engineering Mathematics 5 (BA 601).
- Establish student personal factors that effect student performance in Engineering Mathematics 5 (BA 601).
- Establish strategies that can be adopted to improve performance in Engineering Mathematics 5 (BA 601).

Literature Review

Performance in Engineering Mathematics 5 (BA 601) has dropped in June 2014 session in Politeknik Merlimau, Melaka comparing to the previous semester. From Table 1 it shows that the failure percentage among students in Engineering Mathematics 5 in Dec 2012 is 8%, in June 2013 is 5.1%, 3.35% in Dec 2013 and 10.5% in June 2014. The increment of the failure percentage might be caused by many factors from students' perception. These factors including completing exercises/tutorial/assignment behavior, study method, attitude and motivation, personal problem, spiritual, and mathematics foundation. Due to Relich and Way, 1994; Philippou, 1998; Thompson, 1992, state that belief, attitude and self efficiency are close related to academic achievement. Study by Anthony (2000), identified several factors that can affect students' success in mathematics such as lecturers' conceptions of both teaching and learning of mathematics, students' prior knowledge and previous learning. In addition, she also found other factors such as, teaching methods, curriculum design, students' learning styles and beliefs, which influenced students' achievement after their entry into the universities. According to Mokhtar Ishak and Rohani Ahmad (2001), students' mathematics achievement influenced by study style. Referring to Norhani Bakri (2005), inconsistency study method and not having initiative to make effort to find reference in library are factors that lead to poor performance in study. Favziah Nafiah and Noor Azilla Mohamed Nor (2011), no revision before attending classes, not doing mind map and not doing extra exercises are the main factors that lead to failure in Engineering Mathematics 1.

Methodology

The population of this study is consists of 36 students (7 girls and 29 boys) who have failed in Engineering Mathematics 5 (BA 601). This study adopted descriptive survey type using frequency count and percentage for the analysis. A set of questionnaires was adopted from Favziah Nafiah and Noor Azilla Mohamed Nor (2011) for the study. Factors of the items in the questionnaire include : completing exercises/tutorial/assignment behavior, study method, attitude and motivation, personal problem, spiritual, and mathematics foundation. The response scales are Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree. Each scale represents score of 5, 4, 3, 2 and 1 respectively. In this study there are 2 methods utilized to analyze the data which are 1) frequency analysis and 2) index average analysis.

1. Frequency Analysis

Frequency analysis commonly used to analyze percentage of frequency dispersion for each variables or questions that relate to this study. This method is directly related between frequency percentage and the number of respondents that answer every question in the questionnaires given. Frequency values can show the main factor or causes that was answered by each of the respondents related to reasons for failure in Engineering Mathematics 5 (BA 601). Thus each factor or causes can be ranked accordingly.

2. Average Index Analysis

Average index analysis can be used to classify each variables in the questionnaires by the respondents. It can not shows satisfactory result when frequency for each class are not obvious or clear. Thus, in order to analyze the data gathered from respondents, average index analysis is used to classify the level of importance for each factors or causes answered by respondents. Each factors that might be lead to poor performance in Engineering Mathematics 5 (BA 601) is divided into five scales. In order to analyze the data gathered, average index analysis is used to gather the level of importance of the data (MacCaffer and Majid, 1997) taken from Liew (2004), as shown in Table 2.

$$\text{Average Index} = \frac{a(1x_1 + 2x_2 + 3x_3 + 4x_4 + 5x_5)}{N}$$

x_1 = Number of respondents for Strongly Disagree

x_2 = Number of respondents for Disagree

x_3 = Number of respondents for Natural

x_4 = Number of respondents for Agree

x_5 = Number of respondents for Strongly Agree

Table 2 : Average Index

Average Index	Level of Importance or Evaluation
$0.00 \leq \text{Average Index} < 1.50$	Strongly Disagree
$1.50 \leq \text{Average Index} < 2.50$	Disagree
$2.50 \leq \text{Average Index} < 3.50$	Neutral
$3.50 \leq \text{Average Index} < 4.50$	Agree
$4.50 \leq \text{Average Index} < 5.00$	Strongly Agree

Results

The following results were obtained from the study by using Frequency Analysis and Average Index Analysis.

Table 3 : Frequency Analysis And Average Index Analysis

Scale		1	2	3	4	5	TOTAL	Average Index
		(SDA)	(DA)	(N)	(A)	(SA)		
Respondent Frequency		<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	<i>f</i>	
		%	%	%	%	%	%	
Exercise/ Tutorial / Assignment	1.1 Can not complete task within given time	6	8	13	7	2	36	2.750
		16.667	22.222	36.111	19.444	5.556	100	
	1.2 Assignment plagiarism	0	7	12	10	7	36	3.472
		0.000	19.444	33.333	27.778	19.444	100	
	1.3 No exercises on past years question	2	12	10	8	4	36	3.000
		5.556	33.333	27.778	22.222	11.111	100	
	1.4 Not doing extra exercises	1	5	9	10	11	36	3.694
		2.778	13.889	25.000	27.778	30.556	100	
Study Method	2.1 Not meeting lecturer	3	3	8	8	14	36	3.750
		8.333	8.333	22.222	22.222	38.889	100	
	2.2 No revision on lesson learned	1	5	13	12	5	36	3.417
		2.778	13.889	36.111	33.333	13.889	100	
	2.3 Self revision	1	2	13	14	6	36	3.611
		2.778	5.556	36.111	38.889	16.667	100	
	2.4 No study group	1	6	18	5	6	36	3.250
		2.778	16.667	50.000	13.889	16.667	100	
	2.5 No revision done in library	6	3	3	3	21	36	3.833
		16.667	8.333	8.333	8.333	58.333	100	
	2.6 Not focus in class	1	8	13	9	5	36	3.250

Attitude and Motivation		2.778	22.222	36.111	25.000	13.889	100	
	2.7 No questions asked in class	3	5	12	9	7	36	3.333
		8.333	13.889	33.333	25.000	19.444	100	
	2.8 Sleep late at night	2	8	7	9	10	36	3.472
		5.556	22.222	19.444	25.000	27.778	100	
	2.9 No revision before attending classes	8	8	11	8	1	36	2.611
		22.222	22.222	30.556	22.222	2.778	100	
	2.10 No notes taken during lecturers	8	8	11	8	1	36	2.611
		22.222	22.222	30.556	22.222	2.778	100	
	3.1 Always late to class	10	9	8	8	1	36	2.472
		27.778	25.000	22.222	22.222	2.778	100	
	3.2 Always absent	14	10	4	6	2	36	2.222
		38.889	27.778	11.111	16.667	5.556	100	
	3.3 Not interested with Engineering Mathematics 5 course	5	6	15	5	5	36	2.972
		13.889	16.667	41.667	13.889	13.889	100	
	3.4 Always sleepy in class	3	8	10	10	5	36	3.167
		8.333	22.222	27.778	27.778	13.889	100	
	3.5 Lazy to study	2	7	16	7	4	36	3.111
		5.556	19.444	44.444	19.444	11.111	100	
	3.6 Shy to ask lecturer in class	3	4	10	10	9	36	3.500
		8.333	11.111	27.778	27.778	25.000	100	
	3.7 Attending class just to fulfill requirement by Politeknik	6	9	11	6	4	36	2.806
		16.667	25.000	30.556	16.667	11.111	100	
	3.8 Not respecting lecturer	22	5	3	1	5	36	1.944
		61.111	13.889	8.333	2.778	13.889	100	
	3.9 Not concern on failing	28	3	0	2	3	36	1.583
		77.778	8.333	0.000	5.556	8.333	100	
	3.10 Success is not priority	19	7	4	5	1	36	1.944

		52.778	19.444	11.111	13.889	2.778	100	
	3.11 Feel nothing if unable to complete assignment given	14 38.889	6 16.667	7 19.444	4 11.111	5 13.889	36 100	2.444
	3.12 Like to day dreaming	10 27.778	10 27.778	10 27.778	5 13.889	1 2.778	36 100	2.361
	3.13 Like to hang out with friends	9 25.000	7 19.444	11 30.556	4 11.111	5 13.889	36 100	2.694
	3.14 Like to postpone task	2 5.556	9 25.000	14 38.889	5 13.889	6 16.667	36 100	3.111
Personal Problem	4.1 Financial problem	5 13.889	9 25.000	14 38.889	3 8.333	5 13.889	36 100	2.833
	4.2 Family problem	14 38.889	10 27.778	8 22.222	2 5.556	2 5.556	36 100	2.111
	4.3 Transportation problem	15 41.667	15 41.667	2 5.556	1 2.778	3 8.333	36 100	1.944
	4.4 Friends problem	10 27.778	11 30.556	11 30.556	3 8.333	1 2.778	36 100	2.278
	4.5 Boy/Girl friend problem	20 55.556	7 19.444	6 16.667	1 2.778	2 5.556	36 100	1.833
Spiritual	5.1 No faith in God and fate	31 86.111	1 2.778	2 5.556	0 0.000	2 5.556	36 100	1.361
	5.2 Not believing in reward and effort	18 50.000	6 16.667	7 19.444	4 11.111	1 2.778	36 100	2.000
	5.3 Hardly praying and not work hard	13 36.111	7 19.444	12 33.333	2 5.556	2 5.556	36 100	2.250
	5.4 Not performing prayer	14 38.889	7 19.444	9 25.000	5 13.889	1 2.778	36 100	2.222

Mathematics Foundation Knowledge	6.1 Weak in addition, subtraction, multiplication and division operation	14	11	8	2	1	36	2.028
		38.889	30.556	22.222	5.556	2.778	100	
	6.2 Weak in expansion and factorization of mathematics equation	2	3	12	5	14	36	3.722
		5.556	8.333	33.333	13.889	38.889	100	
	6.3 Weak in differentiation and integration foundation	0	1	0	15	20	36	4.500
		0.000	2.778	0.000	41.667	55.556	100	

Discussion

The highest value of average index ($3.50 \leq \text{Average Index} < 5.00$) represents respondents that are agree and strongly agree with the questions in the questionnaires given. From the Table 3 results obtained shows that the main factor that lead to failure in Engineering Mathematics 5 (BA 601) are from the following categories which are Exercise/ Tutorial / Assignment, Study Method, Attitude and Motivation and Mathematics Foundation Knowledge. From 36 sub items been investigated in the questionnaires, there are only 7 items that become main factors that contribute to failure in Engineering Mathematics 5 (BA 601) there are Not doing extra exercises, Not meeting lecturer, Self revision, No revision done in library, Shy to ask lecturer in class, Weak in expansion and factorization of mathematics equation and Weak in differentiation and integration foundation.

From the 7 items stated above, result shows that Weak in differentiation and integration foundation with highest average index of 4.5 is the main factor that causes failure in Engineering Mathematics 5 (BA 601) from student perception followed by No revision done in library 3.833 and Not meeting lecturer 3.75.

i. Weak in differentiation and integration foundation

The foundation of differentiation and integration are included in Malaysia education curriculum since secondary school level. During the study of engineering mathematics in all higher education institution, students are taught advanced concepts of differentiation and integration. In Politeknik, students are exposed to basic concepts of differentiation and integration during the second semester through Engineering Mathematics 2 (BA 201) course. These concepts have their application in the form of differential equations which find their implementation in key subjects of each and every branch of engineering where in Politeknik students are exposed during Engineering Mathematics 5 (BA 601) course. We can see that there is a long time gap between Engineering Mathematics 2 (BA 201) and Engineering Mathematics 5 courses taken by students. In order for students to pass successfully in Engineering Mathematics 5 course, students should have the differentiation and integration skills at their fingertips where they have gained during Engineering Mathematics 2 during their second semester in Politeknik. Thus, it is hard for students to remember all the differentiation and integration skills that they have left for almost a year.

ii. No revision done in library

A library can be considered as house of knowledge. Studying at the library can help many students focus better, especially if their only other option is to study in a noisy home or residence hall. Studying in a library is also handy for groups of students who want to study together. Library can facilitates their needs by providing them a section in a library called “The study/discussion room”. This section can be used as group discussion session or even as a private study room to those who want to focus on their study without any outside interference. There are some students who might need books for reference. But they can’t afford to buy books because the prices of books are very expensive. But in library they can borrow these valuable books. Library is also open to poor and rich alike. Normally there are two sections in a library. There are lending section and the reference section. Students can borrow books from the lending section and they can takedown notes from the books from the reference section. Besides there are not only books provided, but also newspapers, magazines and other reading materials that can enrich students’ knowledge. In view of the above facts it is apparent that a library is a very important place for students for their studies. But students are seen not appreciate or not realized that library could bring so much advantages to their studies.

iii. Not meeting lecturer

Sometimes students are unable to understand what they have learned during classes. It is important for students to meet their lecturer after class for any enquiries regarding to lesson learned that they don’t understand. But most of students don’t have the initiative to meet their lecturer after class due to some excuses. Some of them are shy to meet the lecturer, some of these students think that there is still a long time for them to catch up with their friends before they meet the final examination. There are also students that don’t even bother to find out more about what they don’t understand in class and refuse to meet lecturers for a discussion. These excuses finally bring so many things that they see as problem in a certain courses which eventually lead to the poor performance during final examination.

Summary

For the conclusion, the main factor that contribute to failure in Engineering Mathematics 5 from students’ perception is Mathematics Foundation Knowledge and followed by factor of Study Method. On the other hand, lecturers’ also play an important role to help and encourage these students to success. This study might be further in future by considering lecturers’ perception regarding to factors contributing to student’s poor performance in Engineering Mathematics 5 (BA 601). While some effort such as conducting an intensive class, preparing notes regarding Differentiation And Integration for students’ reference might be done to establish the strategies that can improve performance in Engineering Mathematics 5 (BA 601) in future.

References

Article:

- [1] N.Favziyah,M.N.Azilla, Faktor-faktor kegagalan: Perspektif pelajar yang mengulang kursus *Engineering Mathematics* 1.
- [2] E.L.Tang, Secondary school mathematics, gender and MUFY math performance: A Sunway campus case study.
- [3] M.Y.Yudariah, A.R. Roselainy, “*Mathematics education at Universiti Teknologi Malaysia(UTM): learning from experience.*”
- [4] K.M Zachariah, K.Komen, M.M.George, R.N.George,” *Factors contributing to students’ poor performance in Mathematics at Kenya Certificate of secondary education in Kenya: A case of baringo, Kenya*”: American International Journal of Contemporary Research.(Vol.2 No.6; June 2012)
- [5] Dr.Salman, M.F, Dr Mohammed, A.S, Dr. Ogunladea.A, Ayinla, J.O,”*Causes of Mass failure in Senior School Certificate Mathematics Examinations As Viewed by Secondary School Teachers and Students in Ondo, Nigeria*”. The Journal Of Education and Practice., Vol 3, No 8(2012).

Information :

- [1] “Study At The Library”. Retrieved July, 2015 from <http://www.wikihow.com/Study-at-the-Library>
- [2] “The Importance Of A Library”. Retrieved July, 2015 from <https://jayanath.wordpress.com/2008/07/26/the-importance-of-a-library/>
- [3] “Guaranteeing Access to Knowledge : The Role of Libraries”. Retrieved July, 2015 from http://www.wipo.int/wipo_magazine/en/2012/04/article_0004.html
- [4] “What is a real world application of polynomial factoring”. Retrieved July 2015 from <http://math.stackexchange.com/questions/83837/what-is-a-real-world-application-of-polynomial-factoring>
- [5] Research Methods 1 Handouts, Graham Hole,COGS - version 1.0, September 2000. Retrieved July, 2015 from <http://users.sussex.ac.uk/~grahamh/RM1web/sthand1.pdf>