A Comparison on Students' Entry Performance from Year 2006 to 2009 at Faculty of Engineering & Built Environment, Universiti Kebangsaan Malaysia

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Abstract

Entries to engineering courses in all universities in Malaysia expect students to have studied mathematics and physics as a pre-requisite. Consequently, it is crucial to understand the level of knowledge that a student acquired upon entry to university on that particular subjects. This understanding will help lecturers to improve students' performance by constructing a suitable first year curriculum and to ascertain whether a student would benefit from additional support. In this paper, data from Pre-Test, which was given to the first semester of first year students, at Faculty of Engineering & Built Environment (FKAB), Universiti Kebangsaan Malaysia (UKM) are used to illustrate how students' entry performance have changed since 2006. Questions on Pre-Test covered on elementary mathematical concepts such as functions and graphs, differentiation, integration, vectors and etc. The objective of this study is to identify the mathematical topics which are considered difficult by the students. The findings showed that the students were lacking in certain important topics in mathematics, which is a core subject in engineering study.

Keywords: Students' performance; Pre-Test

1. Introduction

Mathematics is a key topic supporting a large number of engineering courses and consequently, it is important for engineering students to hold a strong mathematics knowledge that can keep their motivation for reasonable progress of their engineering programs. Pyle (2001) stated that engineering as a profession requires a clear understanding of mathematics, sciences and technology and Sazhin (1998) mentioned that engineering graduate acquires not only an empirical but also abstract understanding of mathematics. Thus, it is crucial that in university level, most of programs of study require mathematics, as the ability to master mathematical skills are important indicator of potential for students' in all levels of academics endeavors (Tang et al. , 2009). Lawson (2003) found that changes in basic mathematical skills have direct effect to many mathematical skills that are essential for those undergraduate degree courses with a significant mathematical content.

In Malaysia education system, students entering university with diverse pre-university qualification and background, especially FKAB, UKM received students with Matriculation, Sijil Tinggi Persekolahan Malaysia (STPM), Asasi Sains and Diploma backgrounds into its engineering undergraduate programmes. Consequently, there is variation in the students' prior knowledge especially in mathematics. Adamson and Clifford (2002) and Todd (2001) in their study found that pre-university qualification cannot be reliably predictors of students' performance in university and this become the reason why mathematics diagnostic test and Pre-test is used widespread in university. Stephen et al. (2008) stated that mathematics diagnostic test and Pre-test not only useful for gaining information on students' prior knowledge but also the best predictors of future performance. Mathematics Pre-Test also provides a more detailed insight into which area of mathematics that the students do or don't know.

This study is a part of action research project to investigate the students' performance in mathematics engineering courses in FKAB, UKM and extension of the papers done by Zainuri et al. (2009) and Othman et al. (2009), which are presented during the congress of Kongres Pengajaran & Pembelajaran UKM 2009 at Langkawi, Kedah. Thus, this study focus on the students' entry performance from 2006 to 2009 (and onward) based on mathematics Pre-Test. The objective of this study is to identify the

mathematical topics which are considered difficult by the students.

2. Methodology

A set of mathematics Pre-Test were given to the first year students from academics session 2006/2007 to academics session 2009/2010 at Faculty of Engineering and Built Environment (FKAB), UKM during second week of each semester. Questions on the Pre-Test covered on elementary mathematical concepts such as functions and graphs, differentiation, integration, vectors and etc. A total number of 327, 296 and 232 students from academics session 2006/2007, 2008/2009 and 2009/2010, respectively, are involved in this study. Results were analyzed on the performance based on gender and topics.

3. Result and Analysis

Table 1 show the pre-test result based on students' entry performance from academics session 2006/2007 to academics session 2009/2010. Student from session 2008/2009 obtain the highest average result that is 74.44% followed by session 2009/2010 with 67.90% and 20062007 with 56.81%. In the range of 80-100, students from session 2008/2009 performed better than students from session 2006/2007 and 2009/2010 with 48.3%, 0% and 33.2% respectively (Table 1 and Figure 1). For the lowest range, that is 20-40, student from session 2008/2009 once again shows a better result where only 3% in this range as compared to session 2006/2007 and 2009/2010.

TABLE 1: *Pre-test result based on students' entry performance from academics session 2006/2007 to 2009/2010*

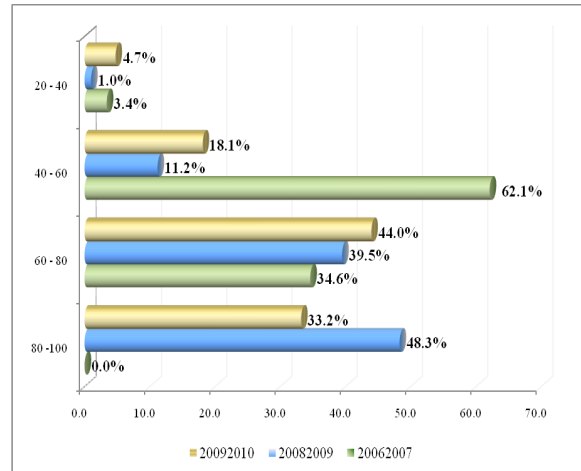| Results	20062007		20082009		20092010	
	No	%	No	%	No	%
80 -100	0	0.0	143	48.3	77	33.2
60 - 80	113	34.6	117	39.5	102	44.0
40 - 60	203	62.1	33	11.2	42	18.1
20 - 40	11	3.4	3	1.0	11	4.7
Average	**56.81**		**74.44**		**67.90**	

FIGURE 1: Pre-test result based on students' entry performance from academics session 2006/2007 to 2009/2010

The Pre-Test result is also compared across gender as shown in Table 2, *Figure 2* and *Figure 3*. Overall, male students performed better compared to female students from academics session 2006/2007 to 2009/2010. It is found that both male and female students from session 2008/2009 get the highest average result, which is 77.44% and 69.97%, respectively. Meanwhile the lowest average result is from session 2006/2007 with 57.32% and 55.97%, respectively.
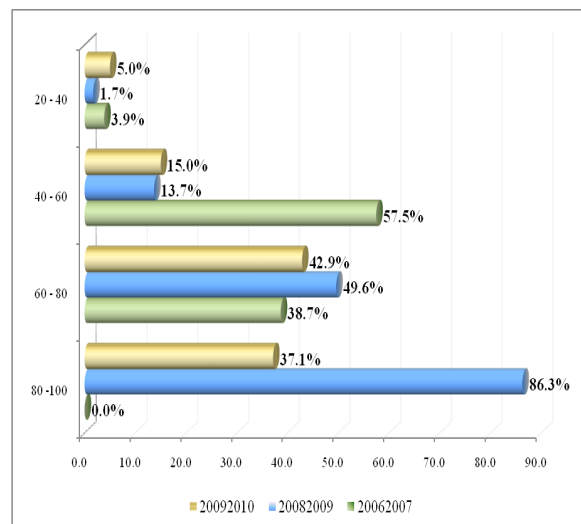

FIGURE 2: Pre-test result for male students from academics session 2006/2007 to 2009/2010

TABLE 2: *Pre-test result across gender from academics session 2006/2007 to 2009/2010*

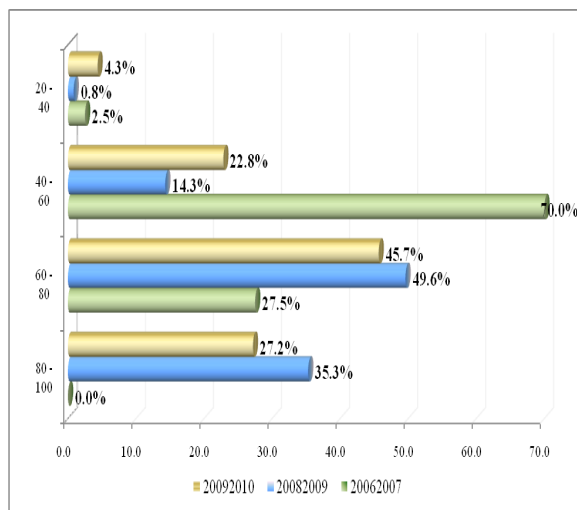| Results	20062007				20082009				20092010			
	Male	%	Female	%	Male	%	Female	%	Male	%	Female	%
80 -100	0	0.0	0	0.0	101	86.3	42	35.3	52	37.1	25	27.2
60 - 80	80	38.7	33	27.5	58	49.6	59	49.6	60	42.9	42	45.7
40 - 60	119	57.5	84	70.0	16	13.7	17	14.3	21	15.0	21	22.8
20 - 40	8	3.9	3	2.5	2	1.7	1	0.8	7	5.0	4	4.3
Average	**57.32**		**55.97**		**77.44**		**69.97**		**69.6**		**65.2**	

FIGURE 3: Pre-test result for female students from academics session 2006/2007 to 2009/2010

Table 3 and *Figure 4* shows the percentage distribution of the students who answered correctly for each topic covered in Pre-Test for academics session 2008/2009 and 2009/2010. In the session 2008/2009, students obtain the highest score on the topic of Functions and Graph that is 92.91%. Meanwhile in the session 2009/2010, the highest score is on the topic of Matrices and System of Linear Equation that is 96.12%. Students from both academics sessions performed badly in Vectors topic, which are 47.97% and 40.52% respectively.

TABLE 3: *Pre-test result based on topics academics session 2006/2007 and 2009/2010*

Topic	20082009		20092010		Topic	20082009		20092010	
	No.	%	No.	%		No.	%	No.	%
T1	192	64.86	116	50.00	T9	205	69.26	147	63.36
T2	238	80.41	176	75.86	T10	200	67.57	153	65.95
T3	270	91.22	205	88.36	T11	241	81.42	178	76.72
T4	254	85.81	185	79.74	T12	195	65.88	130	56.03
T5	269	90.88	223	96.12	T13	206	69.59	151	65.09
T6	275	92.91	202	87.07	T14	192	64.86	125	53.88
T7	183	61.82	117	50.43	T15	142	47.97	94	40.52
T8	243	82.09	160	68.97					

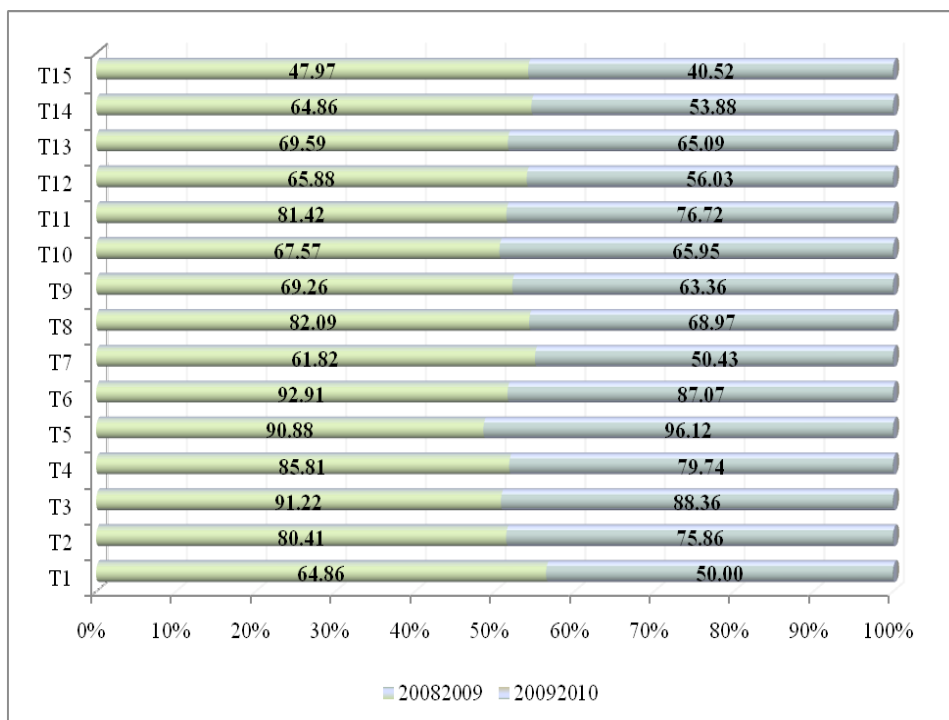*FIGURE 4*: Pre-Test result based on topics

Keys:

T1	Number System	T9	Integration	
T2	Equation	T10	Coordinate Geometry	
T3	Partial Fraction	T11	Trigonometry	
T4	Sequence and Series	T12	Application of Differentiation	
T5	Matrices and System of Linear Equation	T13	Differential Equation	
T6	Functions and Graph	T14	Numerical Method	
T7	Limits and Continuity	T15	Vectors	
T8	Differentiation			

Table 4 display the Pre-Test result across topics and genders are depicted. Male students performed better in Partial Fraction (92.7%) while female students performed better in Function and Graphs (94.1%) for academics session 2008/2009. Meanwhile in academics session 2009/2010, both gender performed better in the topic of Matrices and System of Linear Equation. Overall, both male and female students performed badly in Vectors topic for academics session 2008/2009 and 2009/2010. This can also be seen in *Figure 5* and *Figure 6*.

TABLE 4: Pre-Test result across topic and gender

| Topic	20082009				20092010			
	Male	%	Female	%	Male	%	Female	%
T1	126	71.2	66	55.5	73	52.1	43	46.7
T2	150	84.8	88	74.0	105	75.0	71	77.2
T3	**164**	**92.7**	106	89.1	123	87.9	82	89.1
T4	152	85.9	102	85.7	115	82.1	70	76.1
T5	162	91.5	107	89.9	**136**	**97.1**	**87**	**94.6**
T6	163	92.1	**112**	**94.1**	124	88.6	78	84.8
T7	119	67.2	64	53.8	72	51.4	45	48.9
T8	155	87.6	88	74.0	98	70.0	62	67.4
T9	128	72.3	77	64.7	94	67.1	53	57.6
T10	121	68.4	79	66.4	97	69.3	56	60.9
T11	150	84.8	91	76.5	108	77.1	70	76.1
T12	120	67.8	75	63.0	79	56.4	51	55.4
T13	134	75.7	72	60.5	95	67.9	56	60.9
T14	125	70.6	67	56.3	82	58.6	43	46.7
T15	**87**	**49.2**	**55**	**46.2**	**61**	**43.6**	**33**	**35.9**
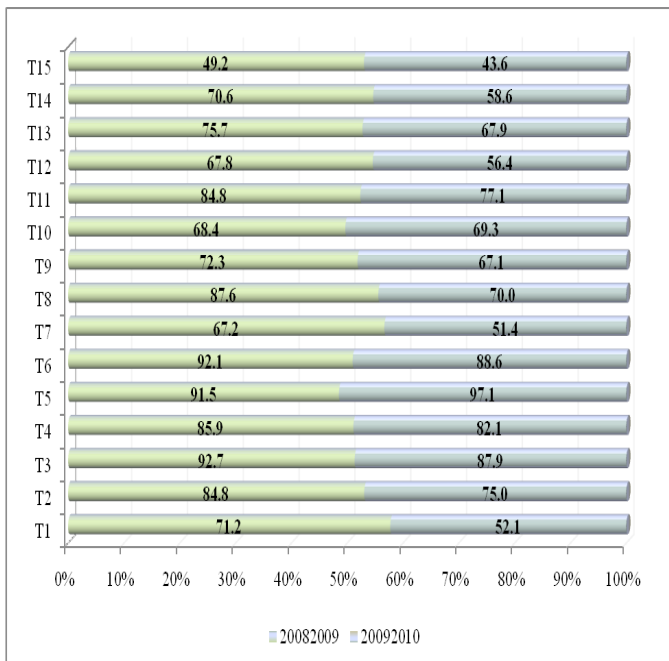
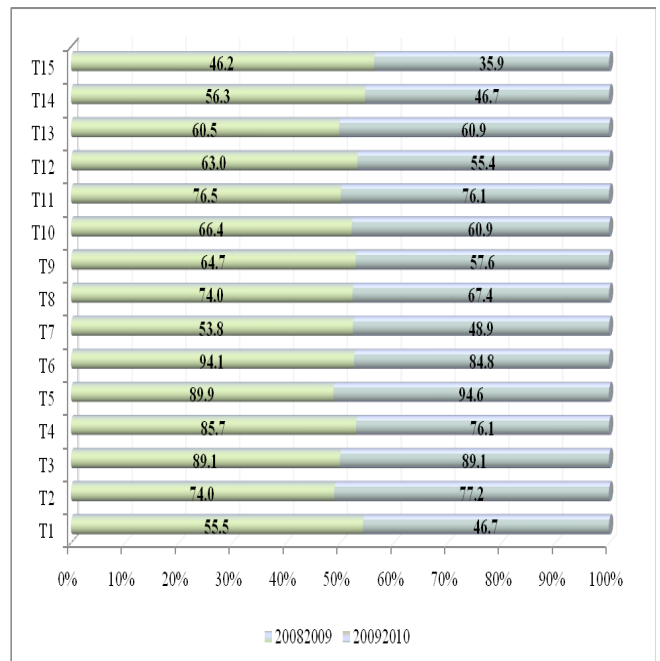FIGURE 5: Pre-Test result based on male student across topic

FIGURE 6: Pre-Test result based on female student across topic

4. Discussion and Conclusion

This study revealed that from academics session 2006/2007 to 2008/2009 there is an increase in the average results percentage, however there is a decrease for academics session 2009/2010. Overall, the intake from academics session 2008/2009 did well compared to 2006/2008 and 2009/2010 for both male and female students. Comparison between gender for academics sessions 2006/2007, 2008/2009 and 2009/2010, obviously male students' performance better in Pre-Test compared to female students.

Based on the results in this study we can agreed with the findings found by Lawson (2003), that there has been a significant decline in many mathematical skills that are regarded by higher education as essential for those undertaking degree courses with significant mathematical content, this can be observed in the comparison between academics session 2008/2009 and 2009/2010 based on mathematics topics, which shown that there were decrease in percentage of answering Pre-Test questions correctly. Furthermore, the study revealed that the students from both academics sessions and genders performed badly in the topics of Vector. This finding absolutely alarming for lecturers in FKAB, UKM since this topic is one of the main mathematical contents require in engineering courses. Therefore, with this findings and understanding, the lecturers have to take a pro-active action in order to improve students' performance by constructing a suitable first year curriculum and to ascertain whether a student would benefit from additional support.

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