STUDENT ACHIEVEMENT AT PRE-UNIVERSITY LEVEL: DOES IT INFLUENCE THE ACHIEVEMENT AT THE UNIVERSITY?

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Abstract

At the Faculty of Engineering and Built Environment (FKAB), Universiti Kebangsaan Malaysia (UKM), a poor level of Mathematics achievement among the first-year students enrolling in the engineering course is a cause for concern to the faculty. Thus, the aim of this study is to analyse the correlation and association between students' achievement in the subject of Mathematics during the pre-university level and in their first year at the UKM. As many as 181 first year students for the 2012/2013 session are involved in this study. Students' Mathematics results in the pre-university and their Vector Calculus result in the first semester of their first year were compared. Their educational background was also recorded and grouped. The study shows that there is a weak correlation and association between Mathematics results of the pre-university students with their Vector Calculus results in the first semester.

Keywords: Pre-university, Vector Calculus, Engineering Mathematics.

1. Introduction

Mathematics is an important aspect that offers great contribution to the field of engineering and is also an important requirement in engineering programs. In the engineering field, Mathematics and scientific theories have a lot of applications in daily life. The fields of Algebra and analysis also Discreet Mathematics are a bigger part of the main core in the field of Mathematics. Pyle [1] in his study states that the field of engineering is a career that which necessitates

understanding in Mathematics, science and technology. Engineering graduates not only require practical skills, but also good Mathematical understanding [2]. Thus, it is very important for engineering students to have a strong basic Mathematical knowledge.

In this vein, most of the study programs at the university level place a considerable importance on Mathematics where the ability to master Mathematical skills has become a significant indicator as to know the potential of the students in all academic levels [3]. Lawson [4] states that the change in the basic knowledge of Mathematics will give a direct impact to important Mathematical skills for undergraduate courses containing a more significant mathematical content. In a separate Lawson's study [5] and also in Stephen et al. [6] both studies suggest that students' ability in mastering some of the basic topics in Mathematics is deteriorating. International literature also reports on several unsatisfactory achievements in the field of Mathematics [7-10]. Students' level of ability in Mathematics at the university level can also reflect on the basic knowledge in the subject that they obtain from their pre-university learning process. Thus, the shift of students from the pre-university level to the university level is very important to ensure that they are all prepared to face high-level Mathematics and Science at the university. Nevertheless, the work of Adamson and Clifford [11] including Todd [12] point to the fact that students' achievement at the university cannot be necessarily be able to be predicted based on their achievement at the preceding stage (pre-university).

The education system in Malaysia has opened doors for the students with certain qualifications to seize the opportunity to further their studies at degree level, and in every pre-university program, these students are equipped with different backgrounds and teaching approaches. For the Faculty of Engineering and Built Environment (FKAB), UKM, most students registering for engineering programs have pre-university qualifications from the Matriculation, Sijil Tinggi Pengajian Malaysia (STPM), Science Foundation and Diploma.

The objective of this study is to investigate the correlation and association between students' achievement in the subject of Mathematics in their pre-university level and during their first year at the UKM. This study also discusses specifically the students' achievement according to their pre-university background.

2. Methodology

2.1. Respondents and instruments

In this work, respondents involved comprise of 181 first year students from the Faculty of Engineering and Built Environment (FKAB), UKM for the academic session 2012/2013. The instrument adopted is the data of students' Mathematics results from the pre-university level and the results of Vector Calculus subject sat by the same students during their first year at the UKM.

2.2. Data collection and analysis

A set of survey questions was given to the students to gather some information on their pre-university background also their Mathematics results at the pre-

university stage. The Vector Calculus results were obtained from lecturers teaching the subject. These two sets of data were then analysed using the Statistical Package for Social Sciences (SPSS) version 22. Pearson's Standard Analysis was adopted to see the correlation and association between the two data. The analysis outcome will explain students' achievement based on their pre-university background.

3. Results and Analysis

This study involves 181 first year students as respondents comprising various pre-university backgrounds. 114 respondents completed their Matriculation, 33 respondents from Fundamental Science Study Centre, 19 respondents completed their STPM and 15 respondents were diploma graduates.

The grades for Mathematics results of the students at their pre-university level and first semester at the university, for the Vector Calculus course were calculated by average and compared with one another. The results shown in Fig. 1 suggest that the average grade for Vector Calculus is lower than the average grade for Mathematics at the pre-university level. Students' achievement based on their pre-university background can also be seen in this figure. Their pre-university Mathematics results show that Diploma-based students noted the highest grade average which was 3.89 whereas students from Fundamental Science 1 had the lowest average grade which was 3.18. However, students' average grades in Vector Calculus taken in their first semester in their first year illustrate different results. Results have shown that students who completed their STPM recorded the highest average grade in the subject of Vector Calculus; 3.69. Fascinatingly, STPM students' average grades during the pre-university period; 3.77 and the first semester at the university; 3.69 did not show any significant difference. The lowest average grade in Vector Calculus was noted from the Matriculation students which was 2.35 which also demonstrates a significant reduction in the average grade from the grades they obtained at the pre-university level.
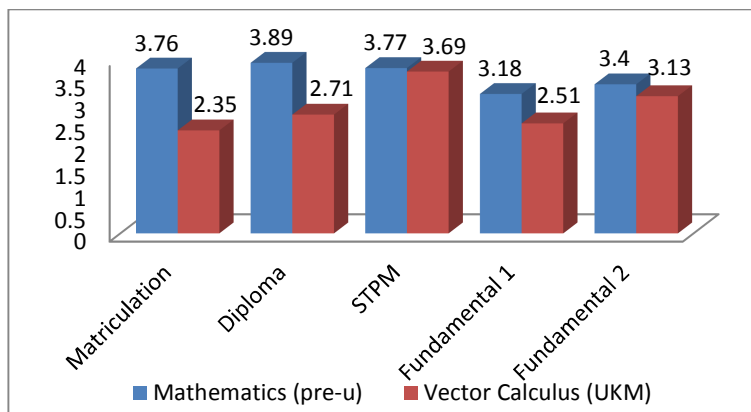

Fig. 1. The average grades of FKAB students for Vector Calculus course at the university vs average grades of Mathematics at the pre-university based on students' pre-university institutions.

The students' average grades during their pre-university level and when they were in the first year at the UKM were compared and the correlation between the two data was analysed to study the relationship of student achievement at the pre-university level and during their first year at the UKM. The scope of this analysis is made narrower by classifying student achievement based on their pre-university background.

3.1. Matriculation

In Malaysia, the Matriculation program is a program established by several public institutions under Ministry of Education Malaysia. This program has been developed since 30 years ago to equip the students before they further their studies in the degree level in the fields of science, technology and accounting at the local, or other universities abroad. After completing one or two years studying at this level, they need to choose university to further their studies at the degree level. The total number of Malaysian study institutions offering this Matriculation program is 17 institutions and 114 FKAB students have undergone this program and chosen UKM as their place of study for the degree level in the field of engineering.

Table 1 show a Pearson Correlation (r) for the grade point average between students' Mathematics grades in Matriculation and their grades in Vector Calculus in their first year at the FKAB, UKM. Although there exists positive relation among them, however this correlation is not significant. This correlation implies that students who obtain excellent results during their pre-university years are not necessarily equally excellent for Vector Calculus.

Table 1. Pearson Correlation for the grade point average between students' Mathematics grades in Matriculation and their grades in Vector Calculus in their first year at the FKAB, UKM (Matriculation).

Course		Mathematics (Matri)	Vector Calculus (U)
Mathematics (Matri)	**Pearson Correlation**	1	.418*
	Sig. (1-tailed)		.000
	N	114	114
Vector Calculus (U)	**Pearson Correlation**	.418*	1
	Sig. (1-tailed)	.000	
	N	114	114

*Correlation is significant at 0.05 level (1-tailed)

3.2. Higher Certificate of Education Malaysia (STPM)

Higher Certificate of Education Malaysia (STPM) is an examination sat by all Form Six students in Malaysia. The STPM program is one of the main pre-university systems other than the Matriculation programs in Malaysia. STPM examination is formulated and handled by Malaysian Examination Council, which is also responsible in running MUET (Malaysian University English Test), a leading qualification

required before students can apply an entry to degree courses. 19 students from FKAB completed their STPM before selecting UKM to further their studies in the field of engineering. For most of the students, the level of difficulty of the subject of Vector Calculus has become one of the reasons why most results of the students for this subject are lower than their pre-university results. However, most STPM students are still able to maintain their achievement consistently, and even some of the STPM-oriented students had achieved better results after enrolling in UKM.

Table 2 also shows the same results as previously, whereby there is a positive relationship and yet there is no remarkable correlation between students' STPM Mathematics grades and Vector Calculus grades. Thus, it also suggests that students who obtain excellent results in their STPM are not necessarily equally excellent for Vector Calculus.

Table 2. Pearson Correlation for the grade point average between students' Mathematics grades in STPM and their grades in Vector Calculus in their first year at the FKAB, UKM (STPM).

Course		Mathematics (STPM)	Vector Calculus (U)
Mathematics (STPM)	**Pearson Correlation**	1	.409*
	Sig. (1-tailed)		.041
	N	19	19
Vector Calculus (U)	**Pearson Correlation**	.409*	1
	Sig. (1-tailed)	.041	
	N	19	19

*Correlation is significant at 0.05 level (1-tailed)

3.3. Diploma

Diploma programs take a shorter period to be completed as compared to degree programs. Most diploma programs in Malaysia take one or two years to complete. Normally, when a student has obtained his diploma related to his/her degree courses, he/she will be exempted from taking certain subjects in their first year at the university level. In this study, 15 students from FKAB had a diploma qualification in the field of engineering before they choose to continue to the degree courses in the same field according to their diploma qualification.

Table 3 has established the same result whereby there is a positive relationship but without any significant correlation between students' Mathematics grades at the diploma level and Vector Calculus grades when they were in the first year at the degree level. This correlation shows that students who score well during diploma level do not necessarily obtain the same level of excellence for Vector Calculus.

3.4. Fundamental Science Study Center

Other than the large three pre-university systems as explained earlier, there are also several universities which offer matriculation programs at their respective Study

Centre. 28 students from FKAB had graduated from the program Fundamental Science 1 and 5 students graduated from Fundamental Science 2 before being offered to continue their studies in the engineering field in UKM. Based on the analysis, most students from Fundamental Science 2 are still able to maintain their achievement by obtaining grade point average of at least 3.00 but this is not the case for students from Fundamental Science 1.

Table 3. The Pearson Correlation for the grade point average between Mathematics grades at the Diploma level and Vector Calculus grades in their first year at the degree level at the FKAB, UKM (Diploma).

Course		Mathematics (Diploma)	Vector Calculus (U)
Mathematics (Diploma)	**Pearson Correlation**	1	.073*
	Sig. (1-tailed)		.398
	N	15	15
Vector Calculus (U)	**Pearson Correlation**	.073*	1
	Sig. (1-tailed)	.398	
	N	15	15

*Correlation is significant at 0.05 level (1-tailed)

From Table 4, it is found that there is a positive change in the relationship but there is no remarkable correlation between the Mathematics grades of the students back when they were in Fundamental Science 1 and the Vector Calculus grade where they were in Year 1 in FKAB, but the average grade for Fundamental Science 2 students shows a higher correlation value than the grade for their Fundamental Science 1 counterparts between their Mathematics grades then with their grades in Vector Calculus. However, this correlation also shows that students' achievement at the Foundation level and university level are not determined by one another.

3.5. Level of difficulty of vector calculus for students

Questionnaires were distributed to students to identify whether or not Mathematics syllabus they learned during the pre-university years had aided their understanding of Vector Calculus better in their first year at UKM. 53% stated that the Mathematics subject they learned during the pre-university years only helps them slightly in understanding Vector Calculus and most of these respondents are from the Matriculation programs.

The level of difficulty of Vector Calculus for first year students has also been identified. 50% of the students stated that the subject of Vector Calculus is tough for them, especially for diploma students and the additional 20% of the students stressed that Vector Calculus is even too difficult for them. This indicates that engineering students face some challenges and difficulties in learning Vector

Calculus and feel that their pre-university Mathematics does not help them to understand the course better.

Table 4. Pearson Correlation for the grade point average between Mathematics grades of the students at the Foundation level and Vector Calculus grade of students in their first year at the FKAB, UKM (Foundation).

Course		Mathematics (Foundation)	Vector Calculus (U)
Mathematics (Foundation 1)	**Pearson Correlation**	1	.112*
	Sig. (1-tailed)		.570
	N	29	29
Vector Calculus (U)	**Pearson Correlation**	.112*	1
	Sig. (1-tailed)	.570	
	N	29	29
Mathematics (Foundation 2)	**Pearson Correlation**	1	.512*
	Sig. (1-tailed)		.378
	N	5	5
Vector Calculus (U)	**Pearson Correlation**	.512*	1
	Sig. (1-tailed)	.378	
	N	5	5

*Correlation is significant at 0.05 level (1-tailed)

4. Conclusion

The aim of this research is to study the correlation of student achievement at their pre-university level and during their first year at the UKM in Mathematics. Our study shows that there is a positive, but no remarkably strong relationship between their grade point average in Mathematics at the pre-university and in their Vector Calculus results at UKM. This result is harmonious with that of Adamson and Clifford [11] and Todd [12] which state that students' university achievement cannot be gauged accurately from their achievement in the pre-university years. This implies that their achievement in their pre-university stage does not directly influence their achievement in the university.

The study result demonstrates that some groups of students need to be given attention especially the diploma-based students as the correlation of their grade point average back in their pre-university stage and during their first year in UKM is very weak although their achievement in the diploma years was far better than other groups of students. These matriculation students also require sufficient amount of attention as they come in higher number as compared to other pre-university students. This matter will further leave an impact to the quality of engineering students in UKM. Normally, at the pre-university stage, students are exposed to basic knowledge necessary in every topic of Mathematics such as topic introduction and basic formula that will be used to

solve Mathematical problems at their pre-university level. As they reach the university level, students need to understand theories of Mathematics before they learn how to apply the theories in solving Mathematical problems. In summary, students learn Mathematics in greater detail at the university level as compared to what they learned back in their pre-university years. Thus, in the effort to enhance basic knowledge in Mathematics before they further study to higher mathematical syllabus at the university level, Malaysian Education Ministry (KPM) should revise the teaching and learning method also the syllabus used in the subject of Mathematics in the Matriculation, STPM, Foundation Studies Centre and Diploma.

Acknowledgment

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