Engineering Education: Program Ranking and Student Interest

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Abstract
This article discussed about the impact of undergraduate students decision on program ranking towards their interest to study their current engineering program. The main research purposes are to investigate how students react and express their interest towards current study and to identify weather program ranking could influence students' interest to study. Survey has been conducted among 231 students at one local public university in Malaysia. It involves four different cohorts of students that include first, second, third, and fourth year students. Descriptive and ANOVA test were used to analyse the collected data. As a result, most students were ranked their current engineering program at 1 to 4 and 5 to 8 rank. The first and fourth year students' show a positive behaviour and interest towards their current program as compared to the second and third year students since they have high determination to be an engineer. The findings also show that some students are capable in simulating their engineering knowledge in any situation even they never chose to study their current engineering program.

Introduction

Tertiary or higher education is an important component in economic development. It prepares and educates students with knowledge and skill to become competent after graduation. The Organisation for Economic Co-operation and Development or OECD (2008) suggest that tertiary education must accomplish four major missions to keep on their contribution towards social and economics through the formation of human capital, the building of knowledge foundation, the dissemination and use of knowledge and the maintenance of knowledge. According to Shaffer and Wright (2010), higher education institution either university or college plays role to strengthen the country to compete with others in the new economy through research activities, provide wide range knowledge to industry, embrace the cultural, social and educational revitalization and educate people to succeed in the innovation edge.

Based on region, higher education acts in a different way due to the economic status. The research shows a strong correlation between higher education and economic development at developing and developed country (Tilak 2007). The findings proved the higher education role in enhancing the earning of individuals, reducing relative poverty, reducing infant mortality and increasing life expectancy. Therefore, Malaysia through Ministry of Higher Education (MOHE) is strengthening tertiary or higher education by giving equal opportunity for all young people to pursue diploma, bachelor, master and doctoral degree in local public university. For example, MOHE has offered 40,506 places in 2010 for those who qualified to pursue their first degree in any study field at 20 local public universities (Berita Harian 2010).

Admission policy

At the same time, MOHE used meritocracy system as student admission policy. Young (1994) defined meritocracy as a society or social system that recognizes people with reward or status for their achievement rather than because of their wealth or social status. This system determined individual's placement in a social hierarchy based on individual talent and effort (Alon & Tienda 2007). Therefore, meritocracy system evaluated person across the boundaries of religion, race, socioeconomic status, politic and geography because each students has their right to pursue tertiary education regardless of his/her background (Ministry of Higher Education 2007).

In Malaysia, the meritocracy system calculates students academic and co curriculum achievement by percentage (Ministry of Higher Education 2012). Each part has a different percentage value. The percentage for academic achievement is 90% and the balance of 10% is the percentage for students' activity in co-curriculum. The measurement of academic achievement is based on the grade points. Only four subjects with best grade point will be calculated to determine the percentage of academic achievement. Co-curriculum achievement concerned students' involvement in four components such as sport activities, uniformed club, any other clubs and national service program. Full 10% will be given to those who fulfil all four components. In university selection process, some additional criteria have been underlined such as program ranking or priority, subjects' combination, interview performance, special requirements, English test and number of places at the university for each program.

Program ranking

Program ranking is designed to assist the university committee in facilitating and selecting students according to the number of places offered by the programs and universities. In addition, each program and university has different general and

specific academic requirements. Therefore, this component becomes an early screening process to evaluate students' qualification for the applied programs and universities.

There are 193 schools, faculties, institutes and centres at public university which offer a variety of undergraduate programs (Ministry of Higher

Education 2007). Program ranking gives students opportunity to select only eight (8) programs in the Online University Application Form (OUAF) according to their priority and interest. They have to choose from the most important program to the less important program according to their preference. Figure 1. shows program ranking section in the OUAF.

Figure 1: Program ranking section in OUAF

Engineering programs are categorized under engineering and technical field. From 2002 to 2007, the number of students enrolled in engineering program as undergraduate student at public university increased every year. According to press statement from MOHE, there were eight (8) critical and competitive programs which received a lot of applications from students (Ministry of Higher Education, 2011; 2012). Some engineering programs like chemical engineering, mechanical engineering and electrical and electronic engineering are listed in that category. Only 4923 and 3683 applicants were admitted to the programs for 2010/2011 and 2011/2012 sessions (see Figure 2).

Problem Statement

Every year, more than 60 000 students filled up OUAF (Ministry of Higher Education 2010; 2011). They chose and ranked the study program based on their interest and priority in program ranking section. Coincidently, some of them may choose and ranked the same study program and cause a program overlapping. Hence, the percentage value of meritocracy has been used to compare and determine who are qualified for the program. As a result,

students with low percentage score will be terminated automatically even if they have fulfilled the program and university requirements. In addition, they will be offered a place for other program and university which is not listed in their application. This will take place when all placed in eight programs was occupied by other students with higher percentage score than them.

The rise of global war for talent give high impact on education theory, goals and principles that particularly related with some important issues of equality, opportunity, inclusion and fairness. The numbers of individuals who are highly skilled and educated are increased as well as the competition between students to get place to study at public university (Brown and Tannock, 2009). Obviously, this screening system has its own advantages and disadvantages. In recognizing students' achievement, meritocracy system has neglected some personal elements such as student motivation, attitude, interest and characteristic towards the study program. They do not identify creativity, passion, wisdom, tenacity, empathy, humor or moral worth (Pappas and Tremblay 2010). According to Bye, Poshkar and Conway (2007), extrinsic motivation such as reward

can potentially boycott genuine interest in a learning task and discourage subjective well being in the classroom while intrinsic motivation principle is to promote psychological well being through feelings of personal accomplishment and self-esteem. Seymour and Hewitt (1997) stated that interest is a strong and important element in encouraging student to study.
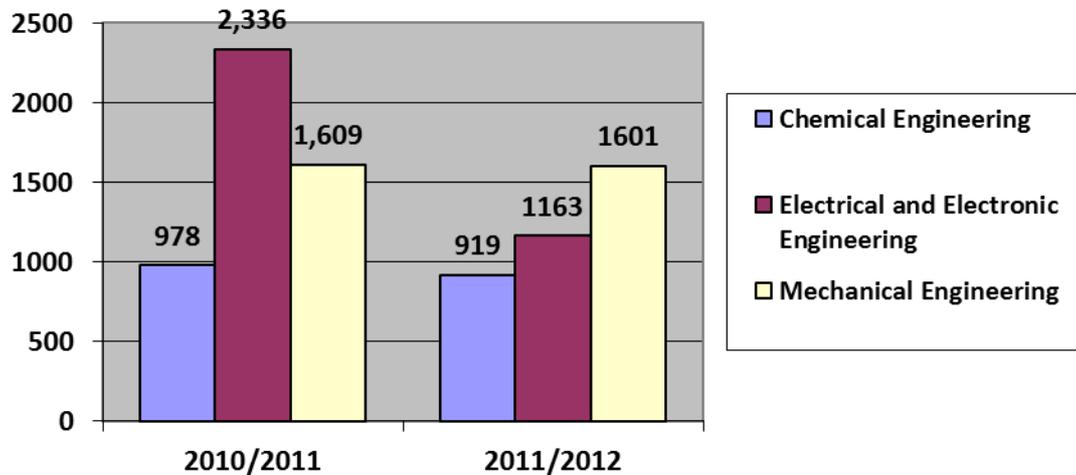
Figure 2: The number of successful candidates in engineering programs

Research Purpose

This research investigates students' interest towards their current engineering program due to their decision of program ranking, to answer the following questions: (1) How undergraduate students express their interest towards engineering study based on program ranking? (2) Does program ranking influence undergraduate students' interest to study their current engineering program?

Methodology

A total of 231 full time undergraduate students studying engineering program at one public university in Malaysia were selected randomly as a research sample. Each participant has a different cultural and educational background. 60.2% of the study participants were male, 54.5% participants were Malay and 29.0% were second and third year students. Table 1 shows the summary of participants demographic.

The researcher has designed a questionnaire for the participants. It was divided into four main parts. All parts were developed with specific purposes. Part A is to classify the participant's demographic based on gender, race, parents' education and occupation, and participant's cohort or group. In this part, the participants also need to choose the range of number that represents their current engineering program ranking in their university admission OUAF. We have divided the ranking number into three items of 1 to 4 that represent their high interest towards current program study, 5 to 8 represent their low interest

towards current program study, and not in ranking show that their current program study . Part B and Part C allowed participants to rate their perception and interest towards engineering program by using five point Likert scale. Once again, five point Likert scale has been used in Part D which request participant to choose factors that influence them in choosing university and engineering program at the public university. Overall, the constructs were develop based on the past research questionnaires that related to student's interest and perception toward engineering program at public university.

The study was conducted among the participants in the early semester. 30 minutes has been allocated for them to complete the questionnaire. Answered questionnaire was then analysed by descriptive test to divide the participants into the variable of gender, race, cohort and program ranking. Through descriptive test, cross tabulation has been used to identify the differences between two variables i.e. cohort and program ranking. Follow by one-way Analysis of Variances (ANOVA) and post hoc test, the relationship of students' interest with program rankings and students cohort were determined to identify the mean differences between three groups of participants. Therefore, the three categories of program rankings and four categories of students' cohort were placed as independent variable (IV) and eight items of students interest factors become an Dependent Variable (DV).

Table 1: Participants demographic

Background	Category	Frequency (f)	Percentage (%)
Gender	Male	139	60.2
	Female	92	39.8
Race	Malay	126	54.5
	Chinese	92	39.8
	Indian	7	3.0
	Others	5	2.2
	Unknown	1	0.4
Cohort	First year	47	20.4
	Second year	67	29.0
	Third year	67	29.0
	Fourth year	50	21.6
Program ranking	1 to 4	205	88.7
	5 to 8	18	7.8
	Not in the ranking	8	3.5

Results

Most of the participants (n=205, 88.7%) rank their current engineering program at 1 to 4. Follow by 18 (7.8%) participants placed the engineering program they are undergoing at 5 to 8, the rest of them (n=8, 3.5%) do not choose any engineering program in their OUAF. Across the variable of students' cohort, each participants decision are divided into first (Y1), second (Y2), third (Y3) and fourth (Y4) year students group. Participant of Y2 and Y3 show a record of 60 participants and above choose to rank engineering program at 1 to 4. The fraction of ranking 5 to 8 indicates seven participants of Y1, five participants of Y2, two participants of Y3 and four participants of Y4 giving a priority to other program. Next, only two participant of Y2 and three participants of Y3 and Y4 not place any engineering program in their OUAF.
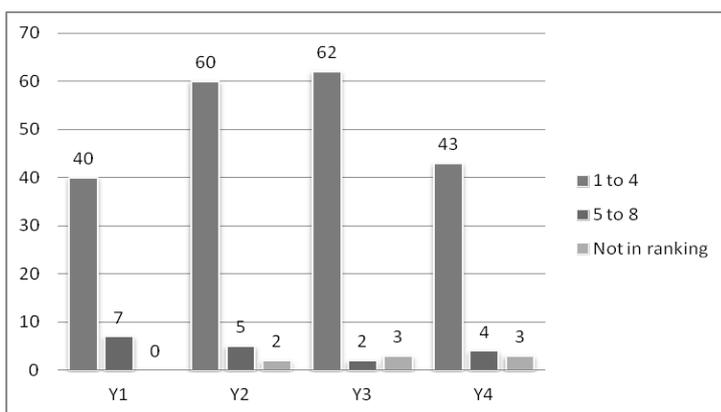
Figure 3: Engineering program ranking by students' cohort

The part of students' interest towards engineering program consists of eight (8) items. Each item represents students' action that indicates their interest towards their study. Overall, the value of reliability for this part is high and distributed at alpha=0.848. Table 2 shows all items in Part C that need to be answered by the participants.

Table 2: Items in Part C

No	Item
C1	I am interest to learn my current engineering program
C2	I want to pursue postgraduate study in engineering field
C3	I am physically and mentally prepared to study my current engineering program
C4	I work hard to master all courses in my current engineering program
C5	I am capable to apply the engineering knowledge in any situation
C6	I am committed in doing any assignment and examination
C7	I am physically and mentally prepared to be engineer after graduate
C8	I will work in engineering field after graduate

The ANOVA results indicate significant differences in students' interest towards engineering program between students' cohort and program rankings. Hence, multiple comparison procedure using Scheffe and Tukey post hoc test at significant level of 0.05 has been performed to determine which groups are significantly different from the rest. The analysis shows the results of Tukey test were more accurate compare to Scheffe test.

As a result (Look at Table A. in appendix), six (6) items record a significant mean difference between groups of students' cohort when the value of p is lower than 0.05. It involves item C3 until C8 while first two items, C1 and C2 do not show any significant difference between all groups. Table 3 represents the summary of ANOVA result for item C3, C4, C5, C6, C7 and C8. Overall, only two groups show a different significant in three aspects i.e. study preparation, courses mastery and knowledge application. In doing

preparation to study current engineering program, Y1 (M=3.70, SD=0.72) students are more prepared compare to Y3 (M=3.31, SD=0.76) students. Once again, Y1 (M=3.91, SD=0.71) students agree that they are working hard to master all the courses in their current engineering program than Y2 (M=3.51, SD=0.70) students. As expected, Y4 (M=3.68, SD=0.65) students show they are more capable to apply engineering knowledge in real world than Y2 (M=3.24, SD=0.78) students.

Table 3: The result of ANOVA test between students interest and students cohort

Item	Between groups	Sig.
C3	Y1 and Y3	0.038
C4	Y1 and Y2	0.022
C5	Y2 and Y4	0.012
C6	Y1 and Y2	0.000
	Y2 and Y4	0.001
C7	Y1 and Y2	0.004
	Y1 and Y3	0.005
	Y2 and Y4	0.005
	Y3 and Y4	0.007
C8	Y1 and Y2	0.008
	Y2 and Y4	0.020

Subsequently, three groups show significant differences in giving commitment to study engineering program and having a career as an engineer after graduation. Y1 and Y2 students together with Y2 and Y4 students show significant differences for both factors. Y1 (M=3.94, SD=0.67) and Y4 (M=3.88, SD=0.77) students are giving more commitment in their study compare to Y2 (M=3.34, SD=0.79) students. In the same position, Y1 (M=3.89, SD=0.87) and Y4 (M=3.84, SD=0.84) students have more confidents to work in engineering field while Y2 (M=3.37, SD=0.83) students are still unsure.

The result also show all groups of students cohort have a different significant for item C7 which represent student readiness to become an engineer. Y1 (M=3.98, SD=0.79) and Y4 (M= 3.96, SD=0.70) students show different mean value with Y2 (M=3.45, SD=0.82) and Y3 (M= 3.46, SD= 0.89) students. Both Y1 and Y2 students seem to have more willingness to be an engineer after they have graduated from the university.

However, only one item of Part C shows a mean different between groups of program ranking (Look at Table B. in appendix). Item C5 indicates the differences between participants who answered 1 to 4 (M=3.44, SD=0.78) and not in the ranking (M=4.13, SD=0.35). It is surprised when students who do not choose engineering program in their application become more capable to apply engineering knowledge compare to those who rank their current engineering program at 1 to 4. The high value of mean difference between these two groups indicated a significant difference.

Discussion

Based on the result of program ranking, it shows majority of undergraduate students put a priority to pursue engineering program compare to other program at public university. They also have fulfilled the general and specific requirements to be admitted by the university. That also means the students record a good mark through meritocracy system for their academic and co-curriculum achievement that allow them to pursue their current engineering program. On the other hand, there are still some participants who choose to give more priority to other program. The various programs offered by the public university giving them option to study other than engineering program. Hence, this group of students gives important information to the research findings. Technically, the data proved that they have been a victim of meritocracy system since they have to pursue current engineering program which is not in their list of interested program.

Each groups of students' cohort show a different stand or opinion in showing their interest towards their current study. Frequently, Y1 students indicated a positive result for all items in Part C compare to other groups. This condition gives the sign of a strong relationship between program ranking and students interest for Y1 group. The same behaviour was shown by Y4 students yet three of them did not choose current engineering program before. After a few years of study, they were ready, confident and willing to be an engineer in the real world.

The ANOVA result between program ranking and students' interest complete the research. It showed that student interest is not a static element and can vary due to some reasons. The total of eight students who did not rank their current engineering program proved that they can perform well in their study even though the program was not in their main choice compare to those who places their current engineering program at 1 to 4 in OUAF.

Based on the evidences, meritocracy system has affected the number of student enrolled engineering course at university. The interest factor also had influenced on students decision to choose engineering course. Therefore, the authorities should play a role to disseminate information and increase student interest in engineering field.

Conclusion

Program ranking are clearly have a significant relationship with students interest. It could be an early screening process to place the students at the right program. However, the limited number of places at local public university becomes a barrier for them to study what they like. Therefore, they have to learn

how to adapt and rise up their interest towards their current study. By this way, they will survive in their study even they did not want to be an engineer.

Acknowledgement

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APPENDIX

Table A. One-way ANOVA descriptive results on students cohort

Item	Cohort	Mean (M)	Standard Deviation (SD)
C1	First year	3.7447	0.70612
	Second year	3.3433	0.93017
	Third year	3.4179	0.80055
	Final year	3.5000	0.83910
C2	First year	3.2979	0.95359
	Second year	3.0299	0.79716
	Third year	3.0000	0.95346
	Final year	2.9200	1.06599
C3	First year	3.7021	0.71975
	Second year	3.3731	0.75550
	Third year	3.3134	0.76295
	Final year	3.3400	0.79821
C4	First year	3.9149	0.71717
	Second year	3.5075	0.70438
	Third year	3.6716	0.58745
	Final year	3.7600	0.95959
C5	First year	3.5319	0.74749
	Second year	3.2388	0.78024
	Third year	3.4925	0.84159
	Final year	3.6800	0.65278
C6	First year	3.9362	0.67258
	Second year	3.3433	0.78917
	Third year	3.6119	0.75789
	Final year	3.8800	0.77301
C7	First year	3.9787	0.79371
	Second year	3.4478	0.82174
	Third year	3.4627	0.89321
	Final year	3.9600	0.69869
C8	First year	3.8936	0.86562
	Second year	3.3731	0.83186
	Third year	3.5224	0.87660
	Final year	3.8400	0.84177

Table B. One-way ANOVA descriptive results on program ranking

Item	Program ranking	Mean (M)	Standard Deviation (SD)
C1	1-4	3.4780	0.86078
	5-8	3.3333	0.59409
	Not in ranking	3.8750	0.64087
	Total	3.4805	0.83838
C2	1-4	3.0341	0.96192
	5-8	3.0556	0.80237
	Not in ranking	3.5000	0.53452
	Total	3.0519	0.94034
C3	1-4	3.4146	0.77888
	5-8	3.3333	0.68599
	Not in ranking	3.6250	0.74402
	Total	3.4156	0.76926
C4	1-4	3.6927	0.77851
	5-8	3.6111	0.50163
	Not in ranking	3.8750	0.35355
	Total	3.6926	0.74943
C5	1-4	3.4439	0.77524
	5-8	3.4444	0.85559
	Not in ranking	4.1250	0.35355
	Total	3.4675	0.77881
C6	1-4	3.6390	0.79609
	5-8	3.6667	0.59409
	Not in ranking	4.1250	0.83452
	Total	3.6580	0.78569
C7	1-4	3.6439	0.84309
	5-8	3.7222	0.89479
	Not in ranking	4.2500	0.70711
	Total	3.6710	0.84698
C8	1-4	3.6195	0.88651
	5-8	3.5000	0.78591
	Not in ranking	4.0000	0.75593
	Total	3.6234	0.87535