

Criteria and Priorities of Secondary School Students in Choosing Their Educational Pathway: A Selection Process by Analytic Hierarchy Process

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Abstract

Malaysia has been striving to become a high-income country and paving the road to rise to rank top 20 nations in the world in terms of economics, social and innovation by 2050. However, the participation of secondary school students in technical and vocational education and training (TVET) has been low throughout the years, even with the rise of awareness on the importance of TVET in producing skilled workers towards sustainable economic growth. Therefore, this paper determines the criteria and priority that secondary school students consider in choosing their educational pathways. This study administered a pair-wise comparison survey to 80 secondary school students through Malaysia. Their responses were analyzed using by a multi-criteria decision-making method, i.e. the Analytical Hierarchy Process (AHP). Three main criteria which were identified were 'Internal Factors', 'External Factors' and 'Social Influence Factors' and each had five sub-criteria. The results found that 'Aptitude', 'Career', 'Parent', 'Courses' and 'Financial Aid' sub-criteria are the top five priorities in choosing the educational pathways. Therefore, in alignment with Industrial Revolution 4.0, stakeholders especially parents should be able to give early identification of technical and vocational aptitude of their children with the help of teachers while encouraging them to go into TVET. At the same time, parents and teachers ought to provide accurate information and advice on TVET-related careers, courses, and financial aid should be made available for students who are interested in TVET-related fields. Prioritizing on these criteria will ensure a high enrolment of TVET students and will hopefully lead to more skilled Malaysian workers in the future.

Keywords - TVET, secondary school students, decision making, priorities Analytic Hierarchy Process, AHP

Introduction

Skilled workers form the backbone of a developed country. They are needed to build, expand and eventually sustain the economic growth. Market globalization has accelerated the distribution of technology and innovation rates, thus resulting in the

emergence of new occupations replacing outdated jobs. Soon, the skills and competencies required in a trade will be of high standards because of the rising knowledge content of production processes and services (OECD, 2010).

Hence, Technical and Vocational Education and Training (TVET) initiation in Malaysia is expected to be an educational framework that can address various economic, social and environmental issues by producing skilled workers with the required skills and competencies for employment and entrepreneurship. TVET is defined as “the study of general education, technologies and related sciences as well as the acquisition of practical skills, attitudes, understanding, knowledge relating to occupations in various sectors of economic and social life” (UNESCO-UNEVOC, 1999). TVET is also advocated as the educational subsystem that is expected to prosper alongside conventional education.

Under the 11th Malaysian Plan, 1.5 million new jobs are expected to be created, 60 per cent of which, require TVET-focused skills by 2020 (Economic Planning Unit, 2016). In line with this development plan, RM4.9 billion is being allocated for the implementation of TVET Malaysia Masterplan in the newly announced Malaysian National Budget Projection for 2018. However, the current TVET institutions are far from being able to supply Malaysia with sufficient skilled workers in the future. Ministry of Human Resources stated that only 28 per cent or 3.4 million people out of the 14.8 million are skilled workers in Malaysia. For Malaysia to attain the developed nation status by 2020, the skilled workforce has to increase to 35 per cent or 5.3 million people (News Straits Times, 2017).

The latest statistics published in the Malaysian Education Blueprint 2013-2025 by Ministry of Education Malaysia (MOE) in 2017 indicates upper secondary TVET enrolment in 2016 stands at only 6.2 per cent. The vast disparity in enrolment rates between TVET schools and regular secondary schools highlight the fact that there exists insufficient attention to skilled-based education in Malaysia compared to other developed nations with high TVET development indices such as Germany and Denmark (Boston Consulting Group, 2012).

The TVET tertiary level is similar to the TVET secondary level, but with a slightly better outlook. Figure 1 shows the total combined enrolment at Polytechnics and Community Colleges which accounts for less than 15 per cent of the entire tertiary education enrolment throughout the last 13 years (MOE, 2016; Cheong & Lee, 2016). Additionally, the TVET tertiary level enrolment shows less than 9 per

cent increment in the last nine years. The only substantial increase in enrolment occurred from 2003 to 2009, with an increment of more than 60 per cent. Despite the allocated budget of RM4.6 billion in 2016 to implement the TVET Malaysia Masterplan to increase the skilled workforce, specifically with TVET-related skills, the statistics on TVET enrolment shows otherwise.

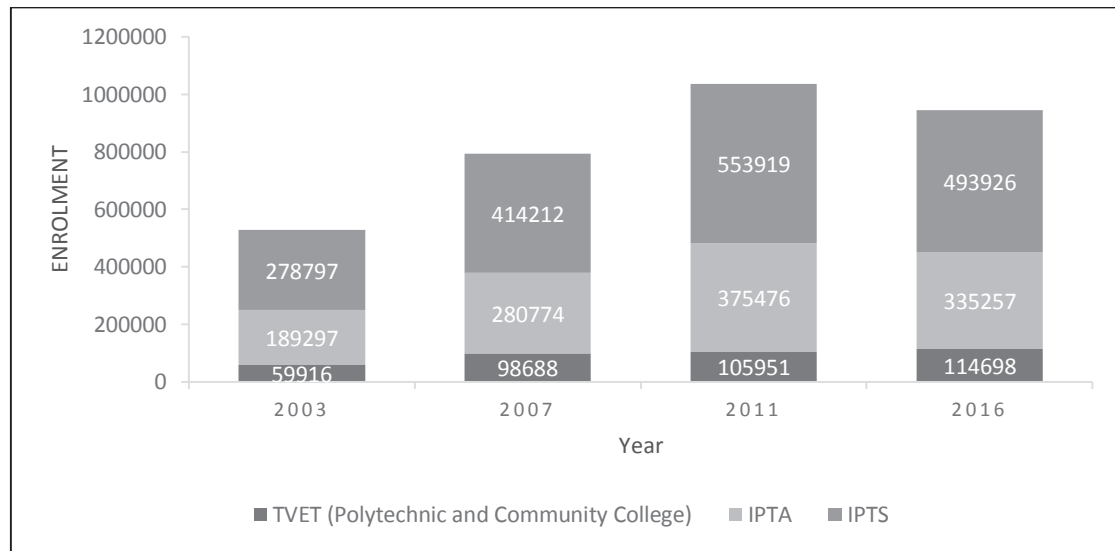


Figure 1: Enrolment at Tertiary Level in Malaysia as of 30th June 2016

Unless appropriate countermeasures are taken, it will be difficult for Malaysia to achieve the milestone of producing skilled workers and being able to achieve its long-term goal as a developed country. In this light, the purpose of this paper is to determine how secondary school students choose their educational pathway, the factors considered in choosing an educational pathway and how parents and students decide on various educational pathways.

Literature Review

2.1 Theoretical Underpinning

Rational choice theory, also known as choice theory or rational action theory, is a framework for understanding social and economic behaviour. The basic concept of rational choice theory is that aggregate social behaviour results from the behaviour of individual actors, each of whom is making individual decisions. Determinants of the individual choices also form the focus of rational choice theory. The rational choice theory then assumes that an individual has preferences among the available

choice alternatives that allow them to state which option they prefer. These preferences are assumed to be complete and transitive (Hedström and Stern, 2008).

The rational choice theory has also been used and empirically tested in research on educational decision-making topics. Chapman (1981) and Moogan, Baron, and Harris (1999) applied rational choice theory in their study of students' decision-making behaviour of post-secondary education. Breen and Goldthorpe (1997) researched educational differentials with rational choice theory as its basis and found that children and their families act in a (subjectively) rational way. However, Maringe and Carter (2007) argue that all decision-making is not rational and is not based on careful information processing, as proved by consumer behaviour theory.

Even though the rational choice theory has limitations in predicting human behaviour accurately, research on children of similar abilities but dissimilar class backgrounds are observed to make different educational choices. This has been proven with studies that develop theoretical models to provide detailed reasons for this phenomenon (Goldthorpe, 1996, 1998; Erikson and Jonsson, 1996; Breen and Goldthorpe, 1997; Morgan, 2005). The rational choice theory will be the underlying theory for determining the criteria and priorities of students in choosing an educational pathway.

2.2 Review of Past Studies

Many studies have been done on students and educational pathways. For example, Mehboob, Shah, and Bhutto (2012) determined three main factors and sub-factors that influence a student's decision in entering tertiary education in Pakistan. These include Internal Factors (Aspiration, Aptitude, and Career), External Factors (Cost, Courses, Location, Reputation, Promotion and Facilities) and Social Factors (Parents, Friends and Teacher). The study shows mixed results as all the factors listed for testing were found to be important in the selection of institutes, with career and facilities as the most significant sub-factors.

In another study in Lithuania, Eidimtas and Juceviciene (2014) conducted a study on how school-leavers made decisions about higher education. The study used analysis of scientific literature which uncovered four factors that were further categorized into twelve subfactors: educational factors (in the family: style of education; at school: recommendations of teachers and career counsellors),

information factors (open days, exhibitions, the mass media), economic factors (study fees, career prospects), other factors (geographical location, ratings, personal skills and demography). However, the results showed the idiosyncrasies of school-leavers' decision-making by emphasizing on influencing factors.

In Indonesia, Kusumawati, Yanamandram, and Perera (2010) determined that cost, reputation, proximity, job prospects, and parents were important criteria applied by students in the selection of universities. In Malaysia, a study found that academic quality, facilities, campus surroundings, and personal characteristics are the significant factors which influence the college choice decisions of undergraduate students (Sidin, Hussin, S. & Soon, T., 2003). Intrinsic motivators such as pursuing a new interest, seeking additional knowledge, improving social skills, gaining friends and achieving one's potential also influence students' school choice (Timarong, Temaungil & Sukrad 2002).

A study by Goodman, Hurwitz, Smith, and Fox (2015) found that if the younger siblings are similar to their older siblings in terms of academic skill, age, and gender, they are more likely to follow the college choices of their older siblings. However, Chen (2016) examined that there are no effects of siblings on an individual's choice of college major. Previous studies on the effect of the extended family toward children's education by Jaeger (2012) found that extended family (i.e. aunt, uncle, and grandparent) influence students' educational success, supported with interactions between the immediate family and the extended family. However, Jaeger found that the extended family has little effect in contributing to children's educational success, which aligned with a previous study by Warren and Houser (1997). On a related note, past research by Morton (2000) that focuses on the education of deaf children found that grandparents are a significant support pillar for other members of their grandchild's family.

One study that specifically focused on students and TVET was by Wahab et al. (2015) where the researchers determined the students' intention to study at technical and vocational education and training higher learning institutions (TVET). The researchers found that cost of education, degree content, and structure, physical aspect, facilities and resources, the value of education and information to be significant criteria in determining the intention to study at TVET for first-year undergraduate students in Universiti Kuala Lumpur (UniKL). The study uses

Pearson’s correlation as a method to test the strength of the association between the proposed variables.

2.3 AHP and Selection Criteria

Research in Malaysia that explores how secondary school students make decisions in choosing their educational pathway is scarce and currently, there are only a few that have used the Analytical Hierarchy Process (AHP) as a multi-criterion in decision-making method (MCDM). AHP is one of the Multi-Criteria decision-making methods described by Saaty (2012) to derive ratio scales from paired comparisons. In making judgments about the priority of the criteria, there are three steps in AHP that the researcher must follow (Brunelli, 2015). In step 1, the respondents are asked to perform pair-wise comparisons among the criteria. The scale is from 1 to 9, and its definition is described as in Table 1.

Table 1: Saaty’s Pairwise Comparison Scale

Intensity of Importance	Definition
1	Equal importance
2	Weak
3	Moderate importance
4	Moderate plus
5	Strong importance
6	Strong plus
7	Very strong or demonstrated importance
8	Very, very strong
9	Extreme importance

Source: Saaty (2012)

If there are m criteria to be evaluated, then the respondent has to make $\frac{m(m-2)}{2}$ comparisons. For example, 10 pairs of criteria will be compared if the number of criteria is 5. Suppose criterion 1 is compared with criterion 2. If criterion 1 is ‘strong importance’ compared to criterion 2, then $m_{12} = 5$, and $m_{21} = \frac{1}{5}$. All the pair-wise comparisons collected from each respondent are transferred into matrix form, M, where $m_{jk} = \frac{1}{m_{kj}}, k > j$ such as in Figure 2.

$$M = \begin{bmatrix} 1 & m_{12} & \dots & m_{1n} \\ m_{21} & 1 & \dots & m_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ m_{n1} & m_{n2} & \dots & 1 \end{bmatrix}$$

Figure 2: Matrix M

One of the major drawbacks of AHP is that the number of pair-wise comparisons increases exponentially as the number of criteria increases.

In Step 2, the degree of consistency is then measured by the Consistency Index (CI). Perfect consistency implies a value of zero, but as individuals' judgments are often inconsistent, it is difficult to comply. Therefore, inconsistency up to a certain degree is acceptable in computing pair-wise judgments. The CI for M is calculated as:

$$CI = \frac{\lambda_{max} - n}{n - 1} \tag{1}$$

where λ_{max} is the maximum Eigenvector of matrix M. If the consistency ratio, $CR = \frac{CI}{RI} < 0.10$, then the degree of consistency is acceptable, where the random index, RI values are given in Table 2 (Taylor III, 2004).

Table 2: Random Index, RI, Values

Number of criteria, (n)	Random index (RI)
2	0.00
3	0.58
4	0.90
5	1.12
6	1.24
7	1.32
8	1.41

Source: Saaty (2012)

In step 3, the weight for criterion $j, j = 1, 2, \dots, n$, for each respondent's evaluation is calculated by using the following formula:

$$w_j = \frac{1}{n} \sum_{k=1}^n \frac{m_{jk}}{\sum_{i=1}^n m_{ik}} \tag{2}$$

This process is repeated for every criterion considered. Next, the rule for aggregation of judgments in a comparison matrix is to combine the judgments using the geometric mean if a study involves more than one respondent. Ranking of the

criteria can then be determined with the weight values. The higher the weight of a criterion the higher its ranking when compared with other criteria. (Saaty & Peniwati, 2007; Saaty & Alexander, 2013). If ' p ' respondents were involved in the assessment, the final weight for criteria j is obtained as a geometric mean, that is, by taking the p th root of the product of all p weights of that criterion, as follows:

$$w_j = \sqrt[p]{w_{j(1)} \times \dots \times w_{j(p)}} \quad (3)$$

Methodology

Quota sampling is used by segmenting secondary school students by their states and federal territories in Malaysia, This is to ensure each region in Malaysia is well represented in this study. Snowball sampling is also used as the researcher faced difficulty in finding students in a few particular states and federal territories. The sample included all public secondary students from Form 1 to Form 5 who are currently studying in public secondary school during the time the questionnaires were distributed. The questionnaires were created using Google Form and distributed online. Before answering the questionnaire, the respondents were explained on how to answer the pairwise comparison questionnaire for each criterion involved in this study. Demographic profile of the respondents is as shown in Table 3.

Table 3: Respondents Background

	Percentage	Number
Gender		
Male	30.0	24
Female	70.0	56
Ethnicity		
Malay	88.8	71
Chinese	-	-
Indian	1.3	1
Sabah/Sarawak Bumiputra	10.0	8
Other	-	-
State of Residence		
Johor	11.3	9
Kedah	7.5	6
Kelantan	6.3	5
Kuala Lumpur	3.8	3
Labuan	-	-
Melaka	5.0	4
Negeri Sembilan	3.8	3

Pahang	5.0	4
Perak	8.8	7
Perlis	1.3	1
Pulau Pinang	5.0	4
Putrajaya	1.3	1
Sabah	7.5	6
Sarawak	11.3	9
Selangor	17.5	14
Terengganu	5.0	4
<i>Student's Form</i>		
Form 1	1.3	1
Form 2	5.0	4
Form 3	10.0	8
Form 4	5.0	4
Form 5	78.8	63
<i>Education Stream</i>		
Academic Stream (Science/Art)	78.8	63
TVET Stream	6.3	5
Religious Stream	2.5	2
Other	12.5	10

To ensure that the sample size of respondents represent the Malaysian scenario, the distribution of respondents were based on the ratio of secondary school students' enrolment at secondary level at government and government-aided schools in Malaysia (MOE, 2017). Female students formed the majority of respondents with 70 per cent compared to male students. More than 80 per cent of the respondents were from Malay ethnicity, while the remaining were Indians, Sabah, and Sarawak Bumiputra students.

Students from the northern region were the highest at 22.5 per cent (18), central region 22.5 per cent (18), southern region 20 per cent (16), East Malaysia 18.7 per cent (15), and east coast region 16.3 per cent (13). The majority (79%) of the students who answered the questionnaire were in Form 5 and were studying in the academic stream (science/art). Meanwhile, the minority of the students are in Form 1 and studying in a religious stream, with 1.3 per cent (1) and 2.5 per cent (2) respectively.

Three main criteria were identified in this study, which is Internal Factors (IF), External Factors (EF) and Social Influence Factors (SIF) with 15 'covering criteria', which is the lowest of criteria/sub-criteria. Definition for the criteria used in are as followed: Internal factors are defined as deciding on choosing educational pathways

due to personal circumstances such as aspiration for a future profession, career prospect, aptitude or the ability to be in a future line of work, knowledge-seeking tendency and social skill self-improvement.

External factors are defined as deciding on choosing an educational pathway due to outside influence, in which this study explored the importance of educational institutions' features for a selection of students' educational pathway. External factors include the availability of courses offered by educational institutions and financial aid that are available in educational institutions. Social factors are defined as deciding on choosing an educational pathway under the influence of others in the social circle. In this study, external factors include family, teachers, and friends. The 15 criteria are as shown in Table 3.

Table 3: Educational Pathway Selection Criteria

Internal Factor (IF)	External Factor (EF)	Social Influence Factor (SIF)
Aptitude	Courses	Parent
Career	Financial Aids	Teachers
Aspiration	Costs	Siblings
Seeking New Knowledge	Facilities	Friends
Improving Social Skill	Reputation	Extended Family

Source: Timarong et al. (2002); Mahbob et al. (2012); Jaeger et al. (2012); Goodman et al. (2015)

Results and Discussion

80 secondary school students in Malaysia were involved in the study which was subdivided into 5 regions, namely Northern, Central, Southern, East Coast, and East Malaysia. Two-third of the respondents were females, the majority are from the Malay ethnicity, more than 70 per cent of them were in Form Five ('O'levels) and the science stream. When asked whether they want to study or work in TVET-related fields in the future, more than 60 per cent answered 'No'.

After the criteria had been identified, each respondent was asked to compare the importance of each criterion to another criterion, and the evaluation was transformed into a matrix as in Figure 1. Then the weights of the criteria were calculated using equation (1). All 80 judgments were aggregated by using the geometric mean approach, as in equation (3). Table 4 and Table 5 summarises the final weights, consistency ratio and rankings of the three main criteria and each of the five sub-criteria.

Table 4: Weights, Consistency Ratio and Ranking of Main Criteria

Criteria	Priorities	Rank
Internal factors (IF)	0.53044	1
External Factors (EF)	0.26592	2
Social Influence Factors (SIF)	0.20364	3

Consistency Ratio (C.R.): 0.03678

Table 4 shows the main criteria and priority consideration in choosing the educational pathway by students. The main criteria group were compared regarding their importance concerning the goal. The consistency ratio (CR) is 0.037; therefore the results are accepted. From table 4, it can be seen that Internal Factors ranked the most important by students, followed by External Factors and Social Influence Factors. The priority value of Internal Factors constitutes more than half of the main criteria compared to External Factors and Social Influence Factors, both of which are at 26.5 per cent and 20.3 per cent respectively. The results indicate that to students, Internal factors take more priority when deciding on choosing their educational pathway compared to External Factors and Social Influence Factors.

Tables 5 show the priorities of the coverage criteria and represent the rankings of the sub-criteria of IF, EF and SIF respectively. The (CR) of IF, EF and SIF are 0.057, 0.047 and 0.042 respectively; therefore the results are accepted. This paper firstly looks into the ranking by cluster for sub-criteria in each criterion. For the sub-criteria of IF, Aptitude was chosen as the most importance sub-criteria with 37 per cent priority value, followed by Career, Aspiration, Seeking New Knowledge and Improving Social Skill at 24 per cent, 15 per cent, 13 per cent, and 10 per cent respectively. From the results, it can be understood that students perceived their aptitude for studying to be the most important internal factor when deciding to choose an educational pathway.

For the sub-criteria of EF, Courses was selected by the respondents to be the most significant (35%), followed by Financial Aids (32%), Costs (15%), Facilities (10%) and Reputation (9%). From the results, it can be noted that students perceived courses offered by institutional education to be the most significant external factor when deciding to choose their educational pathway.

Table 5: Weights, Limiting Priority and Ranking of Sub-Criteria

Criteria	Local Priority	Rank by Cluster	Global Priority	Overall Rank
<i>Internal factors (IF)</i>				
CR:0.05733				
Aptitude	0.37226	1	0.19746	1
Career	0.24236	2	0.12856	2
Aspiration	0.15464	3	0.08203	6
Seeking New	0.13184	4	0.06993	7
Knowledge				
Improving Social Skill	0.09889	5	0.05246	8
<i>External Factors (EF)</i>				
CR: 0.04693				
Courses	0.35082	1	0.09329	4
Financial Aids	0.32138	2	0.08546	5
Costs	0.14865	3	0.03953	10
Facilities	0.09796	4	0.02605	12
Reputation	0.08119	5	0.02159	14
<i>Social Influence Factors (SIF)</i>				
CR: 0.04175				
Parents	0.46161	1	0.09400	3
Teachers	0.20167	2	0.04107	9
Siblings	0.16580	3	0.03376	11
Friends	0.11026	4	0.02245	13
Extended Family	0.06065	5	0.01235	15

For the sub-criteria of SIF, 'Parents' is the most important criteria at 46 per cent, followed by Teachers at 20 per cent, Siblings at 17 per cent, Friends at 11 per cent and Extended Family was the least important criteria in choosing educational pathway at 6 per cent. From the results, it can be seen that students perceived support from parents to be the most significant social influence factor when deciding to choose an educational pathway.

Using AHP, the study successfully ranked fifteen covering criteria of secondary school students in selecting educational pathway. The overall results show that students' aptitude for studying, students' career prospects, support from parents, courses and financial aids offered by educational institutions as the five criteria that secondary school students considered as top priorities when choosing their educational pathway.

Conclusion

To adopt choice strategies and attract new students, TVET institutions should capitalize on the criteria that secondary school students have prioritized to further increase the institutions' enrolment rates. For example, based on the findings, TVET institutions are able to attract potential students by scouting students with high aptitude towards technical skills, lay down a well-structured career plan for their potential candidates, give awareness to parent on the importance of trade skills in the job market, construct a comprehensive financial assistance for potential students that qualify and promote vocational and technical courses that are attractive and competitive for the current job market.

The major limitation of this study was that the researcher only focused on a small number of secondary school students throughout Malaysia. The participation of a large number of secondary school students may be proposed for future studies.

This paper only explores the selection process until the second level of the AHP hierarchy, which is the sub-criteria in choosing the educational pathway. The selection process can be expanded by adding alternatives such as type of educational institutions into the AHP hierarchy so that the secondary students can evaluate the alternatives against the criteria that are chosen. By adding pairwise comparing the alternatives concerning criteria, we will be able to see the type of educational institutions that secondary school student prioritize when choosing their educational pathway.

In conclusion, the selection of educational pathway of a secondary school student is very much influenced by internal, external and social influence factors especially in term of students' aptitude, career prospects, support from parents, courses and financial aids offered by educational institutions. Thus, moving forward in increasing the enrolment of TVET in Malaysia, parents should be able to give early identification of technical and vocational aptitude of their children with the help of teachers, while encouraging them to go into TVET stream. At the same time, parents and teachers ought to provide accurate information and advice on TVET-related careers, courses, financial aids that are available for students who are interested in TVET-related field. Prioritizing on these criteria will ensure a high enrolment of TVET students and will hopefully lead to more skilled Malaysian workers in the future.

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