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THE DEVELOPMENT OF VOCATIONAL INTELLIGENCE INVENTORY

RAHAYU AHAMAD BAHTIAR

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RAHAYU AHAMAD BAHTIAR

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

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DEDICATION

This thesis is dedicated to,

My beloved husband,
who always be there in times of ease and hardship:
Asrul Afendi bin Mohd Said

Both my parents,
whom I love very much and has done a lot:
Haji Ahamad Bahtiar bin Mohd Dan & Hajah Siti Inshah binti Mansor

Both my parents in law,
whom I respect very much:
Haji Mohd Said bin Yunos & Minah binti Haji Mohamed

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My brothers and sisters

My dearest friends and colleagues

And all the lecturers

Your sacrifices, help, support, kindness, and deeds are very much appreciated. May Allah bless you always. This success belongs to us together.

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My fellow friends, colleagues, and those who had directly or indirectly contributed, and shared ideas that helped me complete my thesis, I express my finest gratitude. Finally, I hope that this research will be used as guidance for future researchers.

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ABSTRACT

This study was designed to develop a new inventory to measure vocational intelligence of Malaysian adolescents. The Design and Development Research (DDR) model was adopted as a main research design in this study and three phases were involved. Phase one was the need analysis phase - involving the modified Delphi study and focus group discussion where the importance of identifying students' vocational intelligence and their attributes were identified. Six attributes of vocational intelligence were identified - background, interest, personality, ability, skill, and creativity. Phase two was the design and development phase where an inventory to determine students' vocational intelligence, named MyVQ, was developed using the attributes found in phase one. The verification and evaluation of MyVQ were carried out in phase three - the implementation and evaluation phase. The Cronbach's alpha values of each section of the instrument demonstrated that all items in each section have acceptable internal consistency. MyVQ was tested to 400 Year-Six students in five zones of peninsular Malaysia, selected using stratified random sampling. Three different types of primary schools were selected from each zone. MyVQ scores were analysed descriptively according to attributes and total scores as well as to obtain norms for Malaysian adolescents. Using MyVQ, the samples can be categorized into four different levels of vocational intelligence: gifted (2.3%), high (18.5%), moderate (69.5%) and low (9.8%). Students who were in the gifted and high levels (20.8%) are proposed to choose Technical and Vocational Education and Training (TVET) educational pathways. Hence, MyVQ is a valid and reliable new instrument to measure vocational intelligence that could be used to map vocational intelligence among adolescents. In implication, MyVQ can be used as a diagnostic and screening tool to place students in appropriate educational and training institutions in order to produce future quality human resources to achieve sustainable economic development.

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PEMBANGUNAN INVENTORI KECERDASAN VOKASIONAL

ABSTRAK

Kajian ini telah direka bentuk untuk membina satu inventori baharu bagi mengukur kecerdasan vokasional pelajar Malaysia. Model Penyelidikan Reka Bentuk dan Pembangunan (DDR) digunakan sebagai reka bentuk utama kajian dan melibatkan tiga fasa. Dalam fasa satu iaitu fasa analisis keperluan, kajian Delphi yang diubah suai dan perbincangan kumpulan fokus digunakan untuk mengenal pasti kepentingan kecerdasan vokasional pelajar serta atribut mereka. Enam atribut kecerdasan vokasional pelajar telah dikenal pasti – latar belakang, minat, personaliti, kebolehan, kemahiran dan kreativiti. Dalam fasa kedua iaitu fasa reka bentuk dan pembangunan, instrumen untuk mengenal pasti kecerdasan vokasional pelajar yang dinamakan MyVQ telah dibangunkan menggunakan atribut daripada fasa satu. Pengesahan dan penilaian MyVQ dijalankan semasa fasa tiga iaitu fasa pelaksanaan dan penilaian. Nilai Cronbach alpha untuk setiap bahagian dalam instrumen tersebut pula menunjukkan kesemua item dalam setiap bahagian mempunyai tahap ketekalan dalaman yang boleh diterima. MyVQ telah diuji kepada 400 pelajar tahun enam yang berada di lima zon semenanjung Malaysia di mana pelajar telah dipilih menggunakan kaedah pensampelan rawak berstrata. Tiga jenis sekolah rendah dipilih dari setiap zon. Skor MyVQ telah dianalisis secara deskriptif mengikut atribut dan skor komposit. Skor komposit MyVQ digunakan untuk mendapatkan norma bagi pelajar Malaysia. Berdasarkan hasil kajian ini, pelajar dapat dikategorikan kepada empat tahap kecerdasan vokasional yang berbeza: *gifted* (2.3%), tinggi (18.5%), sederhana (69.5%) dan rendah (9.8%). Pelajar yang berada di tahap *gifted* dan tinggi (20.8%) dicadangkan untuk memilih aliran pendidikan dan latihan teknikal dan vokasional. Oleh itu, MyVQ merupakan satu instrumen baharu yang sah dan boleh dipercayai serta boleh digunakan untuk pemetaan kecerdasan vokasional dalam kalangan pelajar. Implikasinya, MyVQ boleh digunakan sebagai alat pengujian diagnostik dan tapisan untuk penempatan pelajar ke institusi pengajian dan latihan yang sesuai bagi memastikan sumber manusia yang berkualiti dapat dihasilkan di masa hadapan dalam memacu ke arah pembangunan ekonomi yang mampan.

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LIST OF ABBREVIATIONS

DDR	Design and Developmental Research
EQ	Emotional Intelligence Quotient
ETP	Economic Transformation Programme
HOTS	Higher Order thinking Skills
IQ	Intelligence Quotient
KSSR	Primary School Standard Curriculum
MIDAS	Multiple Intelligences Development Assessment Scales
MyVQ	Vocational Intelligence Inventory
SDG	Sustainable Development Goals
SDS	Self-Directed Search
SJKC	Chinese Primary School
SJKT	Tamil Primary School
SK	National Primary School
SQ	Spiritual Intelligence Quotient
TTCT	Torrance Test of Creative Thinking
TVET	Technical and Vocational Education and Training
UNESCO	United Nations Educational, Scientific and Cultural Organization
VQ	Vocational Intelligence Quotient

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CHAPTER 1

INTRODUCTION

This chapter explains the fundamental elements of this research. This research evolved around the technical and vocational education and training (TVET), and intelligence. As such, a brief look into the TVET in Malaysia and other countries, and some theories of intelligence were discussed in the background of the research. The chapter continued with the problem statement where the issues brought into the emergence of this research were discussed. The other topics discussed in this chapter were the conceptual framework, research purpose, research importance and the research limitation. The operational definitions of important terms used in the research were defined at the end of this chapter.

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1.1 Research Background

TVET could contribute great benefits to a country. Apart from contributing to the economic development of a country (Ramlee, 1999; Ramlee & Abu, 2000; Ramlee & Greenan, 2002; Ramlee *et al.*, 2010; Ramlee, 2013) by providing the skilled workforce, TVET also has the potential to bridge the gap between the poor and the rich, offering the opportunities to raise the education attainment level (Lamb, 2011), and becomes the drive for innovation (Attwell*, et al.*, 2008). As such, many countries in the world as well as the United Nations Educational, Scientific and Cultural Organization (UNESCO) are focusing and promoting TVET.

Beginning from 2015, the United Nations (UN) has adopted the Sustainable Development Goals (SDGs) to transform the world by 2030. UNESCO is actively involved in the implementation of SDGs and one of UNESCO contribution is through education that was recognized as the essential factor of success for all 17 SDGs. TVET is one of the targets for equal access for all women and men, where eventually could lead to the increase in the number of youth and adults with relevant skills for employment, decent jobs and entrepreneurship (UNESCO, 2016). TVET could assist individuals to have better work and life and hence help to reduce poverty and increase income (UNESCO, 2016). Furthermore, when individuals have better work and life, the Millennium Development Goals (MDG), goal #1, to eradicate extreme poverty and hunger may also be achieved (United Nations, 2015).

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Realizing the importance of TVET, Malaysia also is not lagging behind by ensuring that TVET in the country is in line with other countries. Various initiatives planned and carried out by the Malaysia government in transforming Malaysia into a high-income nation by the year 2020. Skilled human capital, the product of TVET, is essential in achieving Malaysia as high-income country. It is stated in the Economic Transformation Programme (ETP) that the target is to lift Malaysia's gross national income (GNI) per capita from USD6,700 or RM23,700 in 2009 to more than USD15,000 or RM48,000 in 2020, in order to increase the country to the level of other high-income countries (*Economic Transformation Programme: A Roadmap for Malaysia*, 2010). In the initiatives of the ETP which projected to create a significant growth in the jobs market mainly in the middle-income category, there will be a better match between the skills developed and the labour market demand. Therefore, the country will need more well-trained and competent individuals with matching vocational and technical training.

The year 2050, about 30 years from now would be a very challenging world. The economic challenges and rapid changes of technology may contribute to a very different world. Thus, children and youth, the future citizen who will shape the future Malaysia need to be prepared. The National Transformation by 2050 (TN50) was introduced and aims for Malaysia to be among the top countries in the world economics, well-being of the citizen and innovation. TVET may assist Malaysia in shaping these upcoming generations and increasing the number of skilled workers who will eventually contribute to the economic development of the country. As the world as well as Malaysia moving towards the era of Industry Revolution 4.0 (IR4), the digitisation and automation of the manufacturing sector, these skilled workers need to be refreshed

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and retrained in order to stay competitive and relevant. TVET is one of the ways that plays important role.

1.1.1 The Roles of Technical and Vocational Education and Training in Malaysia

In order to ensure the well-trained and competent individuals received the proper and matching TVET, the fundamental theory of vocational from 'Father of the Vocational Guidance' is referred. Parsons (1909) in his trait and factor theory of career development or also known as the trait and factor theory of occupational choice, who is also known as 'Father of the Vocational Guidance' asserted that ideal career choice are based on matching personal traits (aptitude, abilities, resources and personality) with the job factors (wages, environment, and etc.) to produce the best conditions of vocational success. In other words, an individual will work at his best when his personal traits matched with the job requirements and environment. This condition is also supported by Holland (1997) in his theory of careers and vocational choice where he represented six types of personality (realistic, investigative, artistic, social, enterprising, and conventional). A person with realistic personality is good in working with his hands and body, with tools, machines, and things, practical, mechanically inclined, and a physical person. This type of personality very much suits the personality of TVET students.

The Malaysian government is investing a large amount of money in education in Malaysia to increase the quantity and quality of TVET in order to increase the level of qualifications (*Economic Transformation Programme: A Roadmap for Malaysia*,

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2010). Raising the skills of Malaysians to increase employability is also one of the approaches in the Tenth Malaysia Plan (Chapter Five, Tenth Malaysia Plan). These show the importance of TVET as seen by the efforts of the Malaysian government. TVET enrolment must be increased to achieve the plan. Although the plan requires the collaboration of various sectors, education plays very important part.

Education for all is the policy of the Malaysia education system. All levels of students must be taken into considerations without neglecting the underperformers. Formal TVET was introduced in the system in 1906 to provide opportunity for the underperformers who are unable to perform excellently in normal academic stream. The TVET consists hands-on activities with the objectives of producing students who are proficient in certain vocational fields especially in relation to their future occupation (Ministry of Education, 2003). In other words, TVET enables the underperformers to gain essential knowledge and skills for employability and to survive in their future challenging life.

The Malaysian government is investing not only money, but also time and energy in the development of the vocational subjects in the education system. The introduction of the *Mata Pelajaran Vokasional (MPV)* or Vocational Subjects (VS) at the public secondary schools as an addition to the vocational schools shows the government initiatives in increasing the participation of students in vocational fields. Students who are not able to continue their study in vocational schools after form three (at the age of 15) due to limited places will have the opportunity to continue their study in form four (at the age of 16) and form five (at the age of 17) in the vocational stream but in the public schools. The students will have the VS as an elective subject apart

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from their compulsory subjects. A total of 22 VS have been introduced in stages since 2002. The VS syllabus consists hands-on activities, in line with the objectives of producing students who are proficient in certain vocational fields especially in relation to their future occupation thus enable them to pursue stable career, being an entrepreneur or even further training to a higher level (Ministry of Education, 2003).

In Malaysia, the growth of the industries and higher demand of skilled workers has increased the awareness of the need to transform TVET. TVET needs to be more relevant and responsive to the industrial needs (Pillai & Ridzwan, 1994). TVET system was transformed starting from the year 2013. The transformation included the upgrading of the vocational schools into vocational colleges and the opportunity for the form one students to start taking basic vocational subjects. This means the students will be able to enrol into vocational stream earlier, as early as the age of 13, the first year of their secondary school instead of at the age of 16 or form four, the fourth year of their secondary school.

Beginning from 2013, the vocational schools have been transformed into vocational colleges (VC). This is one of the agenda in the Malaysia Vocational Education Transformation Plan (Ministry of Education, 2011). Students who graduated from VC not only complete their secondary school education but also have the opportunity to obtain diploma in their preferred vocational fields (Vocational College Diploma). Subsequently, they will have the opportunity either to pursue for higher education or to venture into suitable jobs. Hence, students are expected that they will be able to raise their education attainment and skills to fulfil one of the focuses in the

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Malaysia Education Blueprint (Higher Education) 2015-2025 that is to increase the quality of the TVET graduates (Ministry of Education Malaysia, 2015).

1.1.2 Technical and Vocational Education and Training in Other Countries

The issues in TVET have been discussed and debated widely in the developed countries. These countries had been focusing on the TVET with the collaboration of various industrial sectors for achieving the same purpose, skilled workers that meet the market demands that will further contribute to other benefits.

In Germany, a developed and highly-industrialized country, about 70 percent of the youth received TVET. The dual system practiced by the TVET in Germany is the significant factor for the success of this high participation. In the dual system, the government, private sectors and the trade union collaborate and operate with a sense of partnership (Pillai and Ridzwan, 1994). The youngsters who attended the dual system work as apprentices where they combined on-job-training in industry or business with part-time and compulsory attendance at vocational schools (Deissinger, 2007). Despite the rapid emergence of new technologies, the aptitude, attitude and commitment of the instructors are more important in the vocational training in Germany than the new technologies itself (Pillai & Ridzwan, 1994).

In Japan, the investment in human resources, which considered as their most precious capital, is important to maintain the country economic well-being. Their nature of TVET inhibits the development of creative thinking rather than promotes it. In

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Australia, more work forces now hold qualifications and women participation in the workforce have increased (Smith, 2008). TVET also found to have positive effect on transition into work for early school leavers in Australia (Woods, 2008).

The enrolment of students into TVET in Malaysia and several other countries is compared to see the scenario of TVET. Table 1.1 shows the secondary education students' enrolment in TVET for several countries (UNESCO, 2011). Malaysia shows the lowest percentage, only seven percent of students' enrolment in TVET as compared to the total students' enrolment in secondary education. There exists the urge to increase the participation in TVET for Malaysia in order to compete with other countries in the world in line with the growth of industries and higher demand of skilled workers globally.

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The TVET transformation plan in Malaysia is in fact was introduced at the perfect time. Through the TVET transformation, TVET in Malaysia may offers alternative educational routes for students who are interested especially for the underperformers' students. The TVET transformation also enables TVET educational institutions in Malaysia to provide skilled and knowledgeable workforce for the country. Furthermore, TVET enrolment and the number of students dropped out also can be decreased (Ministry of Education, 2006).

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Table 1.1

Enrolment of students in Technical and Vocational Education and Training (TVET) programme

Country	Total enrolment in secondary education	Enrolment in TVET programmes	%
Belgium	810,000	340,200	42.0
Australia	2,255,000	721,000	32.0
China	100,392,000	20,078,400	20.0
Germany	7,741,000	1,548,200	20.0
Indonesia	19,521,000	3,123,360	16.0
United Kingdom	5,356,000	696,280	13.0
Japan	7,300,000	876,000	12.0
Republic of Korea	3,986,000	478,320	12.0
Singapore	232,000	27,840	12.0
Malaysia	2,537,000	177,590	7.0

Adopted from *UNESCO, 2011*.

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1.1.3 Technical and Vocational Education and Training Assessment

The formative and summative assessments are essential in the education system. It is a systematic process that is very important in effective teaching. Various techniques are used to assess students' learning for measuring their achievement (Linn & Miller, 2005). In TVET, the assessment will include the subject knowledge, practical skills, personal qualities and attributes, values and attitudes, interpersonal skills, problem

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solving, setting targets and the evaluation of individual's work (Ecclestone, 1996). Since TVET is often associated with practical learning through hands-on activities, the learning outcome is referred as 'applied'. The other type of learning, usually referred as theoretical, the learning outcome is referred as 'abstract' where knowledge is merely recalled rather than applied to practice (Ecclestone, 1996).

The theoretical learning or sometimes called as academic program involves assessment of knowledge where individual's ability to recall facts and relevant principles are tested. Bloom's taxonomy of cognitive objectives is widely applied. Bloom (1956) in Ecclestone (1996) described a hierarchy of cognitive skills; knowledge, comprehension, application, analysis, synthesis and evaluation. TVET also involves assessing individual's knowledge or cognitive skills but the importance are the appropriate methods used in collecting and assessing evidence as well as making judgments.

1.1.4 Multiple Intelligence Theory

In 1983, Howard Gardner introduced to the world the theory of multiple intelligences where intelligence was viewed incorporation of range of abilities or talents. There were nine types of intelligence; linguistic intelligence, musical intelligence, logical-mathematical intelligence, visual-spatial intelligence, bodily-kinaesthetic intelligence, naturalist intelligence, interpersonal intelligence, intrapersonal intelligence, and existential intelligence (Gardner, 1983). Gardner (1983) defined intelligence as the ability to solve problems, or to create products, which was valued within one or more

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cultural settings. A person may have high level of several types of intelligences but maybe weak in some of them. Depending on the different intelligent profile and education of a person, the person will suit to different positions in the various working field and conditions. As no single job relies on a single intelligence, an individual may have a combination of several intelligences; high in one type of intelligence and low in others or multi-faceted level in their intelligence profile.

The application of the multiple intelligence theory in TVET offers the opportunity for an individual to see himself successful in multiple ways. Individuals who received TVET vastly comes from the students who were non-academic oriented person. As TVET involves many practical and hands-on activities, TVET was closely related to the bodily-kinaesthetic type of intelligence. A person with bodily-kinaesthetic intelligence has the ability to express himself by manipulating his body and hands purposely, and handle objects skilfully (Gardner, 1983). These characteristics involved the fine motor movements of one's finger and hands, and exploit gross motor movements of the body.

1.1.5 The Importance of Bodily-Kinaesthetic and Visual-Spatial Intelligence

Rabiah (2008) found that students who enrolled for the vocational subjects in the public school of Malaysia had high level of readiness, skills in using tools and machines though moderate level of knowledge in vocational subjects. The vocational subjects' students showed the characteristics of a high bodily-kinaesthetic intelligence person.

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Furthermore, the visual-spatial intelligence was also important for TVET students (Maizam*, et al.*, 2002; Kell & Lubinski, 2013; Wahyudi, 2015). Individuals with visual-spatial intelligence were talented in identifying and visualizing shape, space, colour and lines including representing ideas visually and graphically. They were also creative and highly imaginative. TVET students also need to be artistic to design and draw for subjects such as fashion design, food craft, technical drawing, and wood craft. Hence, TVET students should also possess the visual-spatial intelligence.

Nokelainen et al. (2012) studied on the characteristics and experiences of competitors and experts in WorldSkills London 2011 and used Gardner's multiple intelligences theory as part of the study. The competitors' average self-evaluation on the nine types of intelligences showed highest rating for the bodily-kinaesthetic intelligence and followed by the visual-spatial inelligence. As for the gold, silver or bronze medalist, the interpersonal intelligence was found high as well. Thus, these two types of inteligences, the bodily-kinaesthetic and visual-spatial intelligence are important for TVET students.

1.2 Statement of the Problem

TVET is sometimes being undervalued in the educational field despite its vast contributions towards a country resulted to TVET being viewed as education for the low ability individuals (Billet, 2011; Ramlee, 2017). An inherent problem with *Pendidikan Asas Vokasional* (PAV), the basic vocational education program in Malaysia secondary schools, is that only those students with failing grades in UPSR

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were admitted to PAV. This reinforced the negative image of vocational education as second-class education. In other words, only those who fail or weak in academic subjects were admitted to PAV. In contrast with vocational system in Germany, an advanced country, excellent students with high vocational talent were admitted to vocational schools.

Asian countries such as Hong Kong, Republic of Korea, Taiwan, and Singapore, also known as the "four tigers", had propelled themselves to developed nation status within relatively short period of time (Page, 1994). They succeeded by prioritizing precisely, deliberately, and purposefully on focus sectors as well as concentrating on developing, up-skilling and delivering the right talents to drive growth in those sectors.

A significant gap in contemporary research is that studies on identifying students with vocational intelligence in Malaysia were scarcely found (Mitchell, 1985; Conoley & Kramer, 1989; Kramer & Conoley, 1992; Conoley & Impara, 1995; Impara & Plake, 1998; Plake & Impara, 2001; Plake*, et al.*, 2003; Spies & Plake, 2005; Geisinger*, et al.*, 2007; Spies*, et al.*, 2010). Majority of the research focused on either IQ or EQ of Malaysian. Some research focused on the factors influencing students' vocational choice (Tsakanika, 1994; Achter*, et al.*, 1999; Baker Jr., 2004; Halijah, 2004; Momberg, 2004; Bromet, 2005; Mndebele & Xaba, 2006; Proyer, 2006; Kent, 2008) and the current scenario of the TVET students (Rabiah, 2008). Some other research focused on the vocational for higher education or for job purposes but this research focused on the younger generation. Thus, it was critical this fundamental study to be carried out to map the Malaysia adolescents in terms of their vocational intelligence. Dewey (1916) had highlighted this issue decades ago on the importance of suitable

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career in one's life where individuals may work with the right aptitude, minimum friction and maximum satisfaction.

Moreover, despite the importance of TVET and existence of the highly vocational talented students, there was still lack of proper instrument to select students with high vocational talent. There are many tests in print exist for measuring various aspects of life such as aptitude, interest, achievement, intelligence, vocations, and etc. One of the sources of information for the available test in print was the Mental Measurements Yearbook by Buros Institute of Mental Measurements (Mitchell, 1985; Conoley & Kramer, 1989; Kramer & Conoley, 1992; Conoley & Impara, 1995; Impara & Plake, 1998; Plake & Impara, 2001; Plake*, et al.*, 2003; Spies & Plake, 2005; Geisinger*, et al.*, 2007; Spies*, et al.*, 2010). This was the commonly used source for reviewing the existing available instruments. Although various instruments found to be measuring vocational interest, mechanical ability or dexterity, there is no instrument for measuring the vocational intelligence as intended by this study, instrument that could be used to identify the vocational intelligence of students.

The government focus continued with the transformation of TVET which was implemented in 2013, aiming to strengthen the TVET and support the national economic transformation agenda in churning out skilled and trained manpower. An issue raised, whether the students were streamlined into TVET based on their academic results only, and whether the students were the correct candidate for the TVET course they enrolled. The decision to streamline these students would be better if a method of assessing the students' vocational intelligence exist. In other words, despite of all the needs and importance of TVET, there was no formal assessment made to identify the

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vocational intelligence of students in Malaysia, thus assisting in the selection of the vocational students. If there exist a formal method on how to assess the vocational intelligence of the students, the results could be used to streamline the students accordingly. Hence, the decision or choices would be more reliable.

The rapid growing of economy especially in industrial sector required skill workforce in order to compete with the challenging world. It was important to match skills with jobs to balance the labour market and this can be achieved through TVET in the apprenticeship system (Woods, 2012; Ramlee, 2017). Cainarca and Sgobbi (2012) found education and skill mismatches could be solved by further investment in the education and training. As such, in line with the increasing government focus on TVET, Malaysia targeted an increase of 10% to 20% participation of students in the vocational and technical field by 2015 (Ministry of Education, 2011). The implementation of vocational subjects in the public school will be expanded and enhanced for human resource development (Ministry of Education, 2006). However, Schmidt (2010) found that companies may select only the fittest person as employee and the remaining stays unemployed when the choice of potential employee is piling up. Hence, it was crucial to ensure the students who enrol into TVET were the correct candidates to ensure they have higher opportunity to perform well because they would be the one with high vocational intelligence.

The next issue was students with high vocational intelligence unable to be recognized in school. A student may have high ability or high intelligence in a certain domain and low in another domain. As such, their performances in school vary. Some students who cannot perform well in school academic may be less-academically

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inclined students and may have high TVET inclination. They cannot perform well due to the school environment does not provide the opportunity for them to show their ability (Chiam & Abdullah, 1997; Clark & Shore, 2004). These students may resort to deviant behaviour when their needs are unmet. Appropriate stimulations needed to be given to these students to prevent them from seeking alternative activities to fulfil their needs. Therefore, TVET was a possible choice for them. Apart from rebuild confidence and improve employability, Lim (2010) found that TVET programmes were able to recapture students' enthusiasm towards education as the courses were their special interest.

Students who enrolled into TVET were likely those who performed moderately or did not performed in their examination results. Students in the non-academic oriented category or the underperformer are those who might be the potential TVET students. Some may have the TVET inclination and some may not. Even those who do not enrol for TVET might have TVET inclination but did not realize of their situation. It would be good if there was an assessment to test on the students' TVET inclination before they choose their further education program to prevent mismatch between their personal attributes with the courses they enrolled. It was found by Polesel (2010) that students with low socio-economic status are more likely to enter TVET and suggested the need for an integrated approach for TVET admission to quality pathways for students of all background. As such, this study attempted to develop an inventory to test on the TVET inclination, i.e. measuring their vocational intelligence.

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In the public schools today, the current practices for students' enrolment to the TVET were school-based and the decision was made by the Ministry of Education for the Technical and Vocational Schools. The decision was made by taking into consideration mainly on the students' form three examination results since the TVET in Malaysia only offered starting from form four. There were some studies carried out to identify the factors influencing the decision made by the TVET students. Several factors that influence the students in choosing the vocational stream are career opportunities, schools administration, interest and parents (Asnul Dahar & Zulkifli, 2010). Halijah (2004) found in her research that teachers and the community influenced the students' choice the most compared to the school administration and parents.

As stated in Chapter Five of 10th Malaysia Plan, 22% of Malaysian students in 2009 started working directly after high school may be more technically inclined ("Tenth Malaysia Plan," 2011-2015). If only these groups of students have been offered the opportunity to improve their skills in the TVET fields they were inclined earlier in their school life. However, in the early stage of their school life, there was no such identification process of their TVET inclination. It would be an opportunity for this group of students if they could receive TVET earlier. They would have the appropriate knowledge and skills prior to their working life. It would be an advantage of the education system if this group of students could be identified earlier. In other words, the vocational intelligence of a student should be identified earlier.

Generally, TVET will prepare the students for working life (Ecclestone, 1996; Ivan*, et al.*, 2008) and it was found that TVET plays major role in the economic development of Malaysia (Ramlee, 1999). Furthermore, an individual will work at his

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best when his personal traits matched with the job and environment (Parsons, 1909; Holland, 1997). Thus, a person will be satisfied with his job. In the study by Ramlee (2009) on the job satisfaction among vocational teachers in Malaysia, it was found that the teachers' job satisfaction were moderate. It is a question whether these teachers had chosen a correct vocation. If their vocational intelligence was assessed earlier the results might lead them to a better decision in their choice of vocation.

As an addition, Xavier and Zafar (2012) proposed four research agenda from their examination of Malaysia's new economic model (NEM); (1) creating a competitive investment environment, (2) creating a quality workforce, (3) transforming government, and (4) narrowing income disparity. This research was focusing on the second proposed research area, creating a quality workforce through quality selection of TVET students who eventually will be the future workforce.

Education plays a very important role in producing knowledgeable and skilful generation in various fields. The education that is being given to the students must be able to mould them in becoming good citizen as well as fulfilling the nation's needs. As such, earlier detection of the vocationally intelligence students by using the vocational intelligence inventory was hoped to be the guidance for future selection of education path for students.

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1.3 Conceptual Framework

The conceptual framework of this research was as in Figure 1.1. The initial stage of the conceptual framework focused on the identification of vocational intelligence attributes. As the research on vocational intelligence is scarcely found, the initial attributes identified were based on literature review and based on experts' perceptions in the later stage. The conceptual framework for this research was derived from the integration of three theories - Trait and Factor Theory (Parsons, 1909), Multiple Intelligence theory (Gardner, 1983), and Holland Occupational Choice or Holland Codes (Holland, 1997).

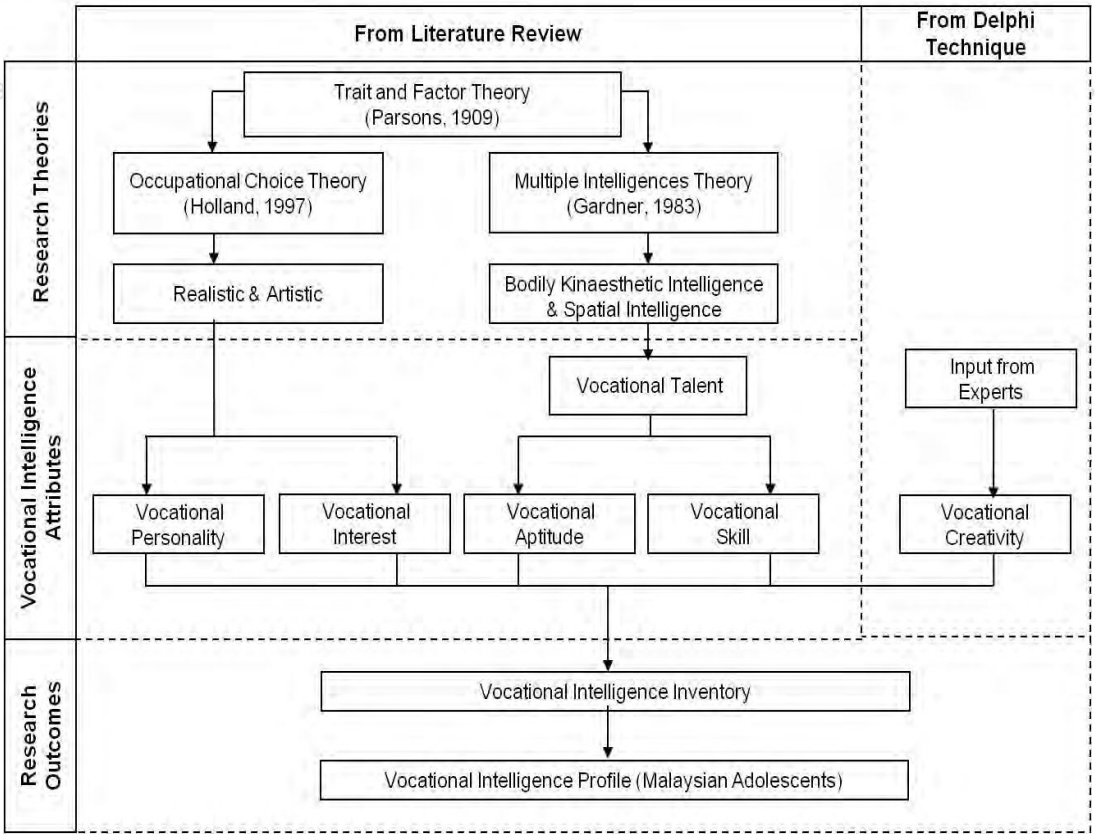

Figure 1.1. Vocational Intelligence Conceptual Framework

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Parson (1909) suggested the concept of talent matching. Parson (1909) suggested that matching personal traits (aptitude, abilities, resources, and personality) with the job factor (wages, environment, etc) are the important factors for the best conditions of vocational success. In TVET, and any other field of education, the final outcome expected will always be the success of the students. As such, the trait and factor theory was included to support the research to attain the best condition of for success.

TVET involves largely on practical, physical and hands on activities. As in Malaysia education system, academic subjects were also included in TVET but at lower percentage compared to vocational subjects. Thus, students who enrol to TVET need to have high vocational intelligence, good control of body movements and better if equipped with good skills in handling objects such as tools or machine. This requirement was closely related to one of the multiple intelligences introduced by Gardner (1983), bodily-kinaesthetic intelligence, and one of the personality types in the Holland Codes, realistic. Green (2010) also matched the realistic personality from the Holland (1997) with the bodily-kinaesthetic intelligence from the Gardner (1983) MI theory.

In addition, Maizam, Black and Gray (2002) study showed the importance of visual-spatial ability in TVET students. Kell and Lubinski (2013) agreed the visual-spatial ability as a neglected talent in TVET. Green (2010) also matched the visual-spatial intelligence from Gardner (1983) MI theory with artistic personality from Holland (1997). Hence, Gardner (1983) visual-spatial intelligence artistic personality from Holland (1997) were included in the framework.

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Therefore, both the multiple intelligence theory and the Holland Occupational Choice Theory were used as the basis of the research. Ackerman and Heggestad (1997), Momberg (2004) and Clutter (2010) support the existence of relationship between personality, vocational interest and intelligence. Five overlapping attributes gained from the integration of the three theories - talent, aptitude, skill, interest and personality were used for the next stage of the research, identifying the attributes of vocational intelligence through the analysis of expert panels' perceptions. These five attributes acted as tentative attributes before obtaining the final attributes from the analysis of experts' perceptions. Another attribute emerged from the expert panels' perceptions, creativity. All the six attributes were included in the vocational intelligence inventory developed and used to obtain the Malaysian students' vocational intelligence profile.

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1.4 Research Purpose

This purpose of this research was to identify vocational intelligence among Malaysian adolescents. Specifically, the objectives of this research were as listed in section 1.4.1.

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1.4.1 Research Objectives

The research objectives (RO) were:

RO1: To determine the importance of assessment for identifying students' vocational intelligence.

RO2: To identify the attributes of vocational intelligence through the analysis of previous research and specialist perceptions.

RO3: To develop the vocational intelligence inventory.

RO4: To identify the vocational intelligence of Year-Six students using the inventory developed.

RO5: To determine the vocational intelligence profile of Year-Six students.

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1.4.2 Research Questions

There are several questions that need to be answered in this research. The research questions (RQ) were:

RQ1: What are the importance of assessment for identifying students' vocational intelligence?

RQ2: What are the attributes of vocational intelligence?

RQ3: How can we assess the students' vocational intelligence?

RQ4: What are the reliability and validity of the instrument?

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RQ5: What is the vocational intelligence scores of the Year-Six students from primary schools in Peninsular Malaysia?

RQ6: What is the vocational intelligence profile among Year-Six students?

1.5 Significance of the Study

The non-traditional students could become productive and successful if given the opportunity to pursue the career routes that aligns their interests with ability in some special area (Nelson, 2008). Thus, if the students' vocational intelligence able to be identified at earlier stage in their educational life, students would be able decide the educational path they prefer that align with their interest and ability for the career they intend to pursue, and hence being successful. This research focused on developing an inventory to identify the vocational intelligence of a student. The inventory may assist the students in identifying their possible strengths and weaknesses. As such, the students may understand themselves better (Melamed & Jackson, 1995) and hence making better decision regarding their education path.

The instrument was also hoped to benefit academically and practically. From the academic perspective, this research hoped to show the current scenario of vocational education. The result was hoped to give ways of improving the current situation in terms of students' enrolment and preferences as well as administrative decision. Thus, this research could be used as one of the guidelines specifically for the schools to streamlined form one students accordingly and not only based on the students' UPSR results but also taking into consideration students' personality, interest, ability, skills

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and creativity. As such, the decision made for the students' placement will be better. Furthermore, the research may increase a person education opportunities and options for example by considering TVET or any TVET related programs as an option.

From a practical perspective, this research was hoped to be the basis of future application for everybody in assessing themselves or others in terms of their vocational intelligence. Nowadays, it was possible for us to measure our IQ level. Hence, the vocational intelligence inventory developed could be used in future to assess the vocational intelligence. The result could be used by institutions, parents, teachers, students or maybe individuals for various purposes such as planning for future education and training, development of career and etc.

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Generally, the most significant contribution of this study was the substantial baseline data on vocational intelligence of Malaysian adolescents – the initiation of a new Vocational Intelligence Theory (VQ).

1.6 Limitations of the Study

There were several limitations of this research. Firstly, the research was limited to year six students only. The instrument developed was distributed among the year six students in Peninsular Malaysia primary schools who were 12 years old. As TVET in Malaysia begin from Form One or for students who are 13 years old, the test would be best taken by the 12 years old students.

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Secondly, this research was carried out in Peninsular Malaysia only, and did not include the East Malaysia (Sabah and Sarawak). In future, the research could be further carried out in the East Malaysia to identify the vocational intelligences of East Malaysia students. Thirdly, the research design was cross-sectional rather than longitudinal. Further research on the same cohort of students followed across year level may contribute to more findings on their intelligence over time.

1.7 Operational Definitions

The scope of this research depended on several terms to be defined and explained operationally. The operational definitions of terms used in this study were vocational education and training, vocational personality, vocational interest, vocational aptitude, vocational skill, vocational creativity, vocational talent, and vocational intelligence.

1.7.1 Technical and Vocational Education and Training (TVET)

Education in any specialized field is considered TVET (Evans & Herr, 1971). TVET is defined as the educational program that prepare for employment with practical job training (Ecclestone, 1996). In this research, TVET referred to the vocational education and training offered by the educational institutions such as schools, colleges, universities or any other public and private institutions.

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1.7.2 Vocational Personality

Personality refers to the external and visible characteristics of a person that other people can see. Personality also can be referred to as the unique, relatively enduring internal and external aspects of a person's character that influence behaviour in different situations (Schultz & Schultz, 2009). Thus, in the context of this research, vocational personality can be referred to individual's traits or characteristics revealed for a vocationally inclined person.

1.7.3 Vocational Interest

Covey and Colosimo (2009) define interest as something that gives satisfactions to a person and the feeling comes from inside the person without external interference. Vocational interest can be defined as preference towards specific occupational field that will give satisfactions to the person.

1.7.4 Vocational Aptitude

Aptitude refers to how quickly or easily you will able to learn in the future (Carter, 2007) or inborn potential (Cohen & Swerdlik, 2009). Linn and Miller (2005) defines aptitude as the ability to learn new tasks. Ability is defined as inherited, enduring and stable trait of individual that support various kinds of motor and cognitive activities or skills (Schmidt, 1991). The natural ability that someone is born with is referred to as

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talent (Eysenck & Keane, 2005). This research focused on the spatial aptitude and motor coordination of the students. Thus, for this research, vocational aptitude can be defined as the ability or talent to do and learn specific vocation related tasks as well as understand and identify the geometric forms and patterns, and their meanings.

1.7.5 Vocational Skill

Vocational skill is learned or acquired abilities, or the acquisition of practical competencies necessary to accomplish specific tasks (Palmer, 2007). The research focused on the motor skills of the students from task perspective, based on the way the tasks were organized as suggested by Schmidt and Wrisberg (2008). Therefore, the vocational skill can be defined as the learned and acquired practical competency to accomplish tasks given.

1.7.6 Vocational Creativity

Creativity can be defined as the application of knowledge and skills for achieving goals using new methods (Pope, 2005). Creativity is being imaginative, inventive and generating new ideas (Fisher, 1996). As for this research, vocational creativity was referred to the application of knowledge and skills in accomplishing the practical task given based on the fluency, novel idea, expressiveness, manipulation, impression and usability of the products.

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1.7.7 Vocational Talent

Talent can be referred to as the skills that someone has naturally to do something, the natural ability that someone is born with or a capacity for achievement (Eysenck & Keane, 2005). The vocational talent in this research was referred to the natural capacity of someone to perform in specific occupational field.

1.7.8 Vocational Intelligence

Cohen, et al. (2009) defines intelligence as the multifaceted capacity that displayed in different ways. Humphreys (1985) described intelligence as an innate capacity or learning potential. Intelligence is the level of ability that a person actually shows in behaviour, cleverness, the efficiency and complexity of perceptions, learning, thinking and problem solving (Vernon, 1979). Gardner (1983) defines intelligence as the ability to solve problems, or to create products. Vocational intelligence is referred to innate capacity of a person in the vocational domain or the capacity of individual to perform or complete tasks mainly using kinaesthetic agility. A person with high vocational intelligence has the vocational personality, vocational interest, vocational aptitude, vocational skill, and vocational creativity. The concept of vocational intelligence will be discussed further in Section 2.6.

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1.7.9 Adolescent

Adolescent is defined as individual aged 10-19 (APA, 2002; UNICEF, 2011). Children between the ages of 10 and 14 are considered as early adolescence and late adolescence for who are between the ages of 15 and 19 (UNICEF, 2011). The adolescents referred in this research will be in the early adolescence, 12 years old.

1.8 Summary

This chapter highlighted the main idea of this research. The importance of TVET in Malaysia and other countries for producing the skilled workers will contribute to the economic growth of the country as explained in the research background reinforces the need of this study. The need to increase the enrolment of TVET students in Malaysia that is relatively low as compared to other developing countries is crucial added with the negative image of TVET as second-class education. Students with high vocational talent also unable to be recognized in school. Moreover, lack of proper instrument to select the appropriate TVET students or students with high vocational talent contributed to the emergence of this research. A significant gap in contemporary research is that studies on identifying students with vocational talent in Malaysia were also scarcely found.

The conceptual framework for this research was derived from the integration of three theories; Trait and Factor Theory (Parsons, 1909), Multiple Intelligence theory (Gardner, 1983), and Holland Occupational Choice or Holland Codes (Holland, 1997).

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Six attributes were included in the vocational intelligence inventory developed for identifying vocational talents among Malaysian adolescents and used to obtain the Malaysian adolescents' vocational intelligence profile. This research is hoped to show the current scenario of vocational education and give ways of improving the current situation in terms of students' enrolment and preferences as well as administrative decision. Furthermore, the research may increase a person education opportunities and options by considering TVET or any TVET related programs as an option. This research was also hoped to be the basis of future application for everybody in assessing themselves or others in terms of their vocational intelligence. Hence, the vocational intelligence inventory developed could be used in future to assess the vocational intelligence and used by various sectors such as educational institutions, parents, teachers, students or maybe individuals for various purposes such as planning for future education and training, development of career and etc. The main contribution was the initiation of a new theory, the Vocational Intelligence Theory (VQ).

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