

MODELLING LEADERSHIP SKILLS AND LEARNING AND INNOVATION
SKILLS MEDIATED BY ENTREPRENEURSHIP TRAITS FOR ENGINEERING
STUDENT'S ENTREPRENEURIAL MINDSET IN KLANG VALLEY

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A thesis submitted in fulfilment of the
requirements for the award of the degree of
Doctor of Philosophy in (Engineering Education)

Faculty of Engineering
Universiti Teknologi Malaysia

MARCH 2021

DEDICATION

This thesis is dedicated to my parents, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my family, who taught me that even the largest task can be accomplished if it is done one step at a time.

ACKNOWLEDGEMENT

In the name of ALLAH s.w.t., the most gracious and the merciful. All praise to Him for the strengths and blessings that He has given me to complete this thesis.

I would like to thank all of those who have contributed and played a role in supporting my journey to complete this thesis. My deepest appreciation and thanks to my supervisors, Ts. Associate Prof. Dr. Morina Abdullah and Associate Prof Dr. Norihan Abu Hassan, for their invaluable and never-ending support, advice, guidance, and encouragement through this dissertation process. Both of you have contributed immeasurably to my successful, challenging, and enjoyable journey. Your superior knowledge and experience have challenged me to refine my direction and ideas and you will always be my inspiration. The appreciation goes also to Emeritus Prof. Ir. Dato' Dr. Mohd Zainai bin Mohamad who initiated the topic of research and Dr. Normah Mulop for her guidance.

I would like to thank my husband, Hj. Izhar Abd. Kahar for all his love, support and understanding throughout this journey. Your patience, wisdom and support are invaluable, and I could not have completed this thesis without your encouragement. I must express my thanks to my two great daughters Nadira Izhar and Nadiha Izhar for their patience and understanding and who had given me the strengths to pursue my study. I owe to all of you for all the time I selfishly devoted to. I will forever appreciate the sacrifices that you had given for me to complete my dream. This thesis would not be possible without their sacrifices, encouragement.

I would like to convey my sincere thanks to the University Technology Malaysia for giving me the opportunity to pursue my study.

ABSTRACT

Studies have shown that leadership and entrepreneurial skills are important for students' success in higher education. Although many entrepreneurship education initiatives have been implemented at various education levels, very few research was done on examining the entrepreneurial mindset among undergraduate engineering students in Malaysia. Furthermore, research have shown that there is a lack of leadership skills, entrepreneurship traits, and learning and innovation skills among Malaysian undergraduate engineering students. Therefore, the purpose of this study is to develop a model for Malaysian's undergraduate engineering student's entrepreneurial mindset. The objectives of the study are: (i) To examine the level of leadership skills, learning and innovation skills, entrepreneurship traits, and entrepreneurial mindset of undergraduate engineering students; (ii) To examine the effect of leadership skills, learning and innovation skills and entrepreneurship traits on entrepreneurial mindset of undergraduate engineering students; (iii) To examine the mediating role of learning and innovation skills in the relationship between leadership skills and entrepreneurial mindset; (iv) To derive an entrepreneurial mindset model for undergraduate engineering students in Malaysia. A sample of 383 engineering students from five public universities in the Klang Valley responded through convenient sampling technique. The descriptive analysis showed that leadership skills, learning and innovation skills, entrepreneurship traits, and entrepreneurial mindset of engineering students are classified at less satisfactory level. A Structural Model analysis has revealed that leadership skills and entrepreneurship traits positively contribute towards entrepreneurial mindset. Findings also showed that entrepreneurship traits act as a part of mediator in the relationship between leadership skills and entrepreneurial mindset. Based on the results, the Entrepreneurial Engineering Mindset Model (ESEMM) has been developed to strengthen entrepreneurship education among undergraduate engineering students. The implication of the study indicated that there is a need for a dedicated model for fostering entrepreneurial mindset among undergraduate engineering students in Malaysia. In addition, comprehensive strategic intervention is needed to improve the entrepreneurial mindset among undergraduate engineering students.

ABSTRAK

Kajian menunjukkan kemahiran kepimpinan dan keusahawanan adalah penting dalam menentukan kejayaan pelajar-pelajar di institusi pendidikan tinggi. Pelbagai inisiatif pendidikan keusahawanan telah dilaksanakan di berbagai tahap pendidikan, namun tidak banyak kajian dijalankan untuk meneliti corak pemikiran keusahawanan di kalangan pelajar sarjana muda kejuruteraan di Malaysia. Selain itu, kajian menunjukkan kemahiran kepimpinan, sifat atau ciri-ciri keusahawanan dan kemahiran pembelajaran dan inovasi di kalangan pelajar kejuruteraan juga berada di tahap yang kurang memberangsangkan. Oleh itu, tujuan kajian ini dilaksanakan adalah untuk membangunkan model corak pemikiran keusahawanan bagi pelajar-pelajar sarjana muda kejuruteraan di Malaysia. Objektif-objektif kajian adalah (i) untuk mengetahui tahap kemahiran kepimpinan, kemahiran pembelajaran dan inovasi, sifat atau ciri-ciri keusahawanan dan corak pemikiran keusahawanan pelajar-pelajar sarjana muda kejuruteraan; (ii) untuk meneliti kesan kemahiran kepimpinan, kemahiran pembelajaran dan inovasi dan sifat atau ciri-ciri keusahawanan ke atas corak pemikiran keusahawanan pelajar-pelajar sarjana muda kejuruteraan; (iii) untuk meneliti peranan kemahiran pembelajaran dan inovasi sebagai mediator dalam hubungan di antara kemahiran kepimpinan dan corak pemikiran keusahawanan; (iv) untuk menghasilkan model corak pemikiran keusahawanan untuk pelajar-pelajar sarjana muda kejuruteraan di Malaysia. Seramai 383 responden di kalangan pelajar-pelajar sarjana muda kejuruteraan dari lima buah universiti awam di Lembah Kelang telah menjawab soalan-soalan kaji selidik melalui kaedah pensampelan mudah. Analisis deskriptif menunjukkan kemahiran kepimpinan, kemahiran belajar dan inovasi, sifat atau ciri-ciri keusahawanan dan corak pemikiran keusahawanan berada pada tahap kurang memuaskan. Analisa *Structural Equation Modelling* telah berjaya membuktikan kemahiran kepimpinan dan sifat atau ciri-ciri keusahawanan memberi kesan ke atas corak pemikiran keusahawanan. Dapatan kajian turut mendapati bahawa sifat atau ciri-ciri keusahawanan bertindak sebagai sebahagian *mediator* kepada hubungan di antara kemahiran kepimpinan dan corak pemikiran keusahawanan. Berdasarkan keputusan kajian, Model Minda Keusahawanan Pelajar Kejuruteraan (MMKPK) dibangunkan bagi meningkatkan kualiti latihan keusahawanan di kalangan pelajar sarjana muda kejuruteraan. Implikasi dari kajian mengesahkan keperluan model yang boleh mendorong pelajar ke arah corak pemikiran keusahawanan terutama di kalangan pelajar sarjana muda kejuruteraan diwujudkan. Tambahan pula, intervensi strategik yang menyeluruh diperlukan untuk meningkatkan tahap corak pemikiran keusahawanan di kalangan pelajar-pelajar sarjana muda kejuruteraan.

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LIST OF ABBREVIATIONS

BEM	-	Board of Engineers Malaysia
CR	-	Composite Reliability
CV	-	Convergent Validity
DV	-	Discriminant Validity
EAC	-	Engineering Accreditation Councils
EC	-	European Commission
EFA	-	Exploratory Factor Analysis
EM	-	Entrepreneurship Mindset
ET	-	Entrepreneurial Traits
HEI	-	Higher Education Institution
KEEN	-	Kern Entrepreneurial Engineering Network
KMO	-	Kaiser Meyer Olkin Test
LS	-	Leadership Skill
LIS	-	Learning and innovation skills
LPI	-	Leadership Potential Indicator
MEB	-	Malaysian Education Blueprint
MEF	-	Malaysian Employers Federation
MOHE	-	Ministry of Higher Education
MOOC	-	Massive Open Online Courses
MQA	-	Malaysian Qualifications Agency
NAE	-	National Academy of Engineering
NGO	-	Non-Governmental Organization
NSF	-	National Science Foundations
OECD	-	Organisation for Economic Cooperation
PLS	-	Partial Least Square
RO	-	Research Objective
RQ	-	Research Question
SPSS	-	Statistical Packages for Social Science, IBM
STEM	-	Science, Technology Engineering and Mathematics
WEF	-	World Economic Forum

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Entrepreneurship education has generated considerable interest in recent decades, with the existence of small and medium-sized businesses, job creation, innovation, and wealth generation. Since the first entrepreneurship course at Harvard Business School was delivered in 1947, entrepreneurship education (EE) programs and courses in higher education have grown rapidly and globally (Nabi, Liñán, Fayolle, Krueger & Walmsley, 2017). The relevance of entrepreneurship education (EE) to foster entrepreneurship culture and activity is widely recognized throughout the world (Sousa, Carmo, Gonçalves, Cruz & Martins, 2019). There is a global consensus that traditionally, formal education is inadequate to prepare students to adapt the changing market conditions, creating and enhancing innovations or even self-employment. However, as attitude and cultural references take shape, the education system especially entrepreneurship education has been considered as being one of the key instruments that contribute successfully addressing entrepreneurial attitudes and skills. In this context, it can be said that the engineering students need an entrepreneurial education for the development of attitude together with the technical skills possessed (Mariana, 2015). To date, entrepreneurship education teaches engineering students in all disciplines, the knowledge, tools, and attitudes that are required to identify opportunities and bring them to life.

In addition to technical competencies, professional skills such as communication, teamwork and leadership skills have been identified to be important in the development of well-rounded engineering students who will be drivers of innovation in a changing global society (Cox, Cekic & Adams, 2010a; Rottmann, Sacks & Reeve, 2015). According to Reed, Aiello, Barton, Gould, McCain and

Richardson (2016), engineering students need to develop strong grounding in their respective disciplines and leadership skills that will prepare them to be influential in their professions. An example a study by Wan Muda, Ab Halim and Libunao (2017) proved that it is important for civil engineers to have leadership skills to ensure the quality of workmanship at construction sites whereby in the past, engineers are frequently overlooked for senior management positions (Sanjeev Kumar & Hsiao, 2007).

The demands for sustainable development require a redefined and innovative engineering talent and leadership. The economic trend and changes of the economy and workforce needs led to the potential value of entrepreneurship education to engineering students. This explains why engineers increasingly need technical competency and professional skills that differ from what worked in the past (Aaltio & Wang, 2015; Apelian, 2013). As a result, many engineering schools offering entrepreneurship education to their students. Historically, entrepreneurship education was primarily offered to business school students, but over the past 20 years it has spread to all academic disciplines including recognizing the need for such programs in engineering education (Duval-Couetil, Reed-Rhoads & Haghghi, 2012; Huang-Saad & Celis, 2017).

Entrepreneurial activity has played a dominant role in the U.S. economy for decades. It enhances the quality of the U.S. lives, changes the way people work, the way they communicate and the way they live (Brooks, Green, Hubbard, Jain, Katehi, McLendon, Plummer, Roomkin & Newton, 2007). In the context of U.S. engineering education, courses and programs that deliver entrepreneurial skills, knowledge, and experiences to students are very diverse in terms of target audience and key objectives. Some approaches target engineering students specifically and are embedded within the engineering curriculum, while others target students in multiple majors and/or are offered campus wide. Some focus more generally on generating awareness of entrepreneurship and/or creating an entrepreneurial mindset, while others focus on developing innovative products and technologies and/or new business models and ventures. With this initiatives, many industries in the U.S. are now motivating students in campus such as the Kauffman Foundation, Coleman Foundation, Venturewell,

Lemelson Foundation, National Science Foundation, National Center for Engineering Pathways to Innovation (Epicenter) and many more (Duval-Couetil, Shartrand & Reed, 2016).

European countries also realized how entrepreneurship can bring benefits to their economy and bringing entrepreneurship education to the society is one of the steps to boost up their economy (Badariah, Abdul & Mariana, 2016). Entrepreneurship is an important European Union objective for education and lifelong learning policies. The development of the entrepreneurial capacity of European citizens and organisations has been one of the key policy objectives for the EU and Member States for many years. The European Commission first referred to the importance of entrepreneurship education in 2003, in the European Green Paper on Entrepreneurship in Europe. By 2006, the European Commission had identified a ‘sense of initiative and entrepreneurship’ as one of the eight key competences necessary for all members of a knowledge-based society. The 2008 Small Business Act for Europe, the 2012 Communication on Rethinking Education, the 2013 Entrepreneurship Action Plan 2020, and more recently the New Skills Agenda for Europe, have kept the need to promote entrepreneurship education and entrepreneurial learning under the spotlight. This has led to a wealth of initiatives across Europe (Bacigalupo, Kampylis, Punie & Van den Brande, 2016c).

1.2 Background of the Study

This section further discussed the need to instill entrepreneurial mindset awareness and competences among university engineering graduates. The entrepreneurship education initiatives undertaken by engineering faculties around the world and Malaysia are provided as evidence of the growing demand for entrepreneurial mindset among the graduates. The section proceeds with a discussion of the state of entrepreneurship education within the Malaysian engineering education, and the need to nurture Malaysian graduate engineers who are compassionate about entrepreneurship.

Engineers has been working within ever increasing complexity and changing conditions. The role of engineers is becoming significantly challenging because of the globalization of industry, international competition, rapid growth of population and global environment. Technological innovation and commercialization continue to drive economic growth. Several studies have reported that that the demand for sustainable development requires redefined and innovative engineering talent and other soft skills (Andalibi, 2019; Cristina, 2016; Schäfer & Richards, 2007). Even though engineering faculties aim to prepare students to be professional engineers, they are heavily influenced with the conventional academic traditions that do not support the profession's needs (Sheppard, Macatangay, Colby & Sullivan, 2009).

Engineers are crucial in helping Malaysia to achieve developed nation. Based on the Institution of Engineers Malaysia (IEM) record, the engineer to population ratio for developed nations is 1:100. Malaysia with a population of 32 million, the number of engineers should be 300,000 (Chin, 2019). Based on the Education Ministry's statistics from 1997 to 2017, the average number of engineers produced per year by local institutions of higher learning is about 16,000. The cumulative total of all engineers produced from 1997 to 2017 is estimated to be about 341,109. It appears that the number of engineers produced are enough for Malaysia but there are only 128,000 professional and graduate engineers registered with the Board of Engineers Malaysia (BEM). Various reasons identified that contributed to the low number of registered engineers were because their jobs do not require them to make submission to the authorities, some left the profession or mismatch between the graduates and the employer's expectations (Chin, 2019).

Entrepreneurship education needs to be well organized so that engineering students will gain the optimum entrepreneurial mindset and other generic skills that can be used upon graduation (EC, 2012b). The appropriate understanding of entrepreneurial mindset is also beneficial to students and other stakeholders to produce entrepreneurial engineers (EC, 2015a; Leitch & Harrison, 1999; Secundo, Romano, Passiante & Del Vecchio, 2013). Hence, entrepreneurship education needs serious attention from the stakeholders; students, universities, and the education ministry (EC, 2015b; Hahn, Minola, Van Gils & Huybrechts, 2017; Henry, Hill & Leitch, 2005).

These stakeholders have an important role to increase the possibility of graduates being able to be innovative, entrepreneurially driven and producing marketable products (EC, 2015c).

Studies indicated an agreement among researchers that there is no definition of entrepreneurship that is considered as a universally accepted definition (Brown, 2000; Henry et al., 2005). There are different schools of thoughts, each with its own definition. According to Low and McMillan (1988), entrepreneurship is the creation of new enterprises. To Bruyat and Julien (2000), entrepreneurship is seen as a change process, that results in the creation of new values and entrepreneur as business founder. Theorist, Schumpeter (1911) sees an entrepreneur as an individual who introduces new products and new services, or creates new forms of organization, or exploits new raw materials. It is necessary to destroy the economic order in existence to benefit from the new structure. Hamilton and Harper (1994) define an entrepreneur as a person who takes certain level of risks to capitalize on an invention. On the other hand, Thompson (1999) views an entrepreneur as someone who can identify unexploited business opportunities. There exists a mismatch in understanding the definition of entrepreneurship. In general all universities in Malaysia include entrepreneurship education with the objective to impart skills needed to set up businesses (Rahim, Kadir, Abidin, Junid, Kamaruddin, Lajin, Buyong & Bakri, 2015). It is also a platform to develop new entrepreneurs among universities' graduates.

Realizing the importance of producing a highly competence engineers of the future, the Ministry of Higher Education (MOHE) has put a considerable pressure to the universities to produce engineers who are competitive to be in the market. It is essential for the universities in Malaysia to produce engineers with strong analytical skills, creativity, communication skills and leadership skills. The Education Ministry in the Malaysia Education Blueprint 2015-2025 urged the institutions of higher learning (IHL) to produce graduates with entrepreneurial skills, who create jobs rather than those who are just looking for job. The role of the learning institutions to promote entrepreneurship education has received attention across several disciplines in recent years. Unfortunately, little research is done on monitoring the progress of the programmes. That is they should take the opportunity to be innovative that is to be

creative and critical thinking; social awareness and persevere and finally curiosity to be able to create new products with the technical knowledge obtained (Secundo et al., 2013).

To date, universities in Malaysia offer entrepreneurship courses at most universities. Table 1.1 shows the Entrepreneurship courses offered to year 2 to year 4 based on the university's course structures at various universities in the Klang Valley.

Table 1.1 Entrepreneurship Courses for Engineering Students

University	Entrepreneurship Course/Modules	Credit Hour	Year/Semester
Universiti Malaya (UM)	Basic Entrepreneurship Culture: 2 credit hours as university course and compulsory to all students. Year2 semester 1	2	Year 2 Semester 1
Universiti Teknologi Malaysia (UTM)	Introduction to Entrepreneurship: 2 credit hours in Year 2, semester 2	2	Year 2
Universiti Kebangsaan Malaysia (UKM)	Entrepreneurship and Innovation Base: 2 credit hours in Year 2, semester 2 as a compulsory course	2	Year 2 Semester 2
Universiti Putra Malaysia	Asas Keusahawanan: 3 credit hours, Year 3	3	Year 3
University Islam Antarabangsa (UIAM)	Engineering Economics and Management: 3 credit hours, Year 3, semester 6 as pre-requisite	3	Year 3 Semester 6
	Technology Entrepreneurship: 2 credit hours, Year 4, semester 7	2	Year 4 Semester 7
Universiti Teknologi MARA (UiTM)	Technology Entrepreneurship: 3 credit hours, Year 4, semester 7	3	Year 4 Semester 7

Sources: Engineering Faculty Handbooks UM, UTM, UKM, UPM, UiTM

To complement technical engineering skills, universities acknowledging the need to prepare engineering students with other soft skills such as leadership skills. Most universities in Malaysia place leadership skills in the Programme Outcomes (PO), this shows that leadership skills are important for all students to acquire. Many researchers study on the gap between the graduates and employer (Azmi, Hashim & Yusoff, 2018b; Makhbul & Yussof, 2017). A skills gap analysis was conducted by Mohd Kamaruzaman, Hamid, Mutalib and Rasul (2019) to measure the mean average difference between the perception and importance of skills perceived by the engineering graduates from engineering educators' perspectives.

Leaders should not be self-centered and project-stereotype rather they are motivated by the well-being of the subordinates, organizations and society (Toor & Ofori, 2006). Leaders should be able to help build relationships and support one another to accomplish and achieve success (Murphy & Ensher, 2008). Leaders should be able to have various skills such as assessing risk, initiative, resourceful making decisions and many more (Ahn, Cox, London, Cekic & Zhu, 2014). In today's competitive global market and changing work environment, engineering programmes are challenged to come up with innovative ways to meet the Engineering Accreditation Council (EAC) Standard. Often, the discussion to develop various soft skills among the students including leadership skills are through workshops and universities' activities and the lecturers are the catalyst in encouraging students to engage in the activities (Esa, Padil, Selamat & Idris, 2015).

There are discussions on relationship between leadership skills and innovation skills. According to Hussain, Talib and Shah (2014a) there is a significant strong relationship between the leadership and the innovation. Denti and Hemlin (2012) viewed innovation as an outcome of individual or team efforts joined to produce new products, process, and services that potentially attractive to a market. This clearly indicate that there is a relationship between leadership skills and innovation (Kesting, Ulhøi, Song & Niu, 2015). Leadership plays a decisive role of a leaders in enhancing organizational creativity and innovation (Mumford, Scott, Gaddis & Strange, 2002). Somech concludes that corporate leaders are the key drivers, who either promote or inhibit innovation management in the organization as cited in (Kesting et al., 2015, p. 22). Hussain et al. (2014a) reported that there is significant impact of transformational leadership on both process and product innovation. In addition, transformational leadership plays an important role in determining innovation.

1.3 **Problem Statement**

Ideally, entrepreneurship education is created with the intention to equip universities' students with the necessary skills required to be marketable in the employment or to be an entrepreneur. The engineering graduates are expected to

become professional engineers in their disciplines for example electrical and electronics, mechanical and chemical with the capacity to create technology and solving future problems not only relevant to the profession but also to society at large. According to Byers, Seelig, Sheppard and Weilerstein (2013), if a country wants to have a sustained economic growth, it is important to educate engineering students to be entrepreneurial engineers, that is engineers with entrepreneurial mindset. The engineering students specifically are at their advantage to be an entrepreneur because of the technical knowledge acquired during their studies. Engineers are literally to shape the future by developing breakthrough technologies that solve global problems and enhance the quality of life (Andalibi, 2019; Byers et al., 2013).

The uncertain economic conditions, technological gap, funding difficulties are some of the challenges a leader of an organization must deal with (Wan Muda et al., 2017). It is noted that leadership skills are crucial in all organizations. These competencies have been identified as important for engineering undergraduates to meet the changing needs of the twenty-first century (Ismail, Hamzah & Fatah, 2019). A leader should not only be a good manager but also have genuine and authentic passion to be able to lead projects. Industries and organizations of all sizes need leadership that could provide directions to succeed in its strategic environment. Farr and Brazil (2009) explained that it is a struggle to develop program contents to include soft skills such as leadership skills and academicians do not know how to cultivate leadership. Questions have been raised about leadership ability of an engineering graduates at workplace (Husain, Mokhtar, Ahmad & Mustapha, 2010; MOHE, 2017; Rasul, Abd. Rauf & Mansor, 2013; Zaharim, Yusoff, Omar, Mohamed & Muhamad, 2009a).

Relatively, many studies in Malaysia examined that engineering students acquired low level of soft skills such as leadership skills, communication and entrepreneurship skills (Ghazalan, Ab Halim, Hamidon, Hariri, Sallehuddin, Bahrol, Zakaria & Roddin, 2019; Ismail et al., 2019). Mohd Kamaruzaman et al. (2019) found that the students viewed leadership skills and communication as less important than any other skills. Along with good academic results, however, there is increasing concern over lacking non-technical skills among the engineering graduates specifically

leadership skills. Many studies showed that the industries prefer graduates who possessed both excellent academic as well as non-technical skills (Farr et al., 2009; Mohd Kamaruzaman et al., 2019; Sanjeev Kumar et al., 2007). Despite good academic results possessed, employers hesitate to assign managerial position or task to fresh engineering graduates because lack leadership skills (Mohd Kamaruzaman et al., 2019). Azmi, Kamin, Noordin and Nasir (2018a) concluded that most Malaysian graduates lack leadership skills, teamwork skills, critical thinking and problem skills, communication skills and resource skills which are the most important non-technical skills that demanded by employers. As a result, it is difficult for the graduates to meet the job requirements and professional expectations and are forced to work at clerical level (OECD, 2019a).

While the universities have already put in place a number of important actions aimed at narrowing the skill gap, more needs to be done in light of the many worrying signs of a widening the entrepreneurial mindset and the effect may have in the future.

1.4 **Research Objectives**

The purpose of this research is to develop a model for engineering students' entrepreneurial mindset. Hence, the set objectives for this study are:

1. To examine the level of leadership skills, learning and innovation skills, entrepreneurship traits and entrepreneurial mindset among engineering students.
2. To examine the effect of leadership skills, learning and innovation skills, entrepreneurship traits on entrepreneurial mindset of engineering students.
3. To examine the mediating role of learning and innovation skills in the relationship between leadership skills and entrepreneurial mindset.
4. To derive an entrepreneurial mindset model for engineering students in Malaysia.

1.5 **Research Questions**

Based on the formulated research objectives, the following are the research questions derived:

1. What is the level of leadership skills, learning and innovation skills, entrepreneurship skills and entrepreneurial mindset among engineering students?
2. What is the effect of leadership skills, learning and innovation skills and entrepreneurship traits on entrepreneurial mindset of engineering students?
3. Do learning and innovation skills mediate the relationship between leadership skills and entrepreneurial mindset?
4. What is the entrepreneurial mindset model for engineering students?

Table 1.2 list the summary of the research objectives and research questions.

Table 1.2 Summary of Research Objectives and Research Questions

Research Objective 1	To examine the level of leadership skills, learning and innovation skills, entrepreneurship traits and entrepreneurial mindset of engineering students.
Research Question 1a	What is the level of leadership skills of engineering students?
Research Question 1b	What is the level of learning and innovation skills of engineering students?
Research Question 1c	What is the level of entrepreneurship traits of engineering students?
Research Question 1d	What is the level of entrepreneurial mindset of engineering students?
Research Objective 2	To examine the effect of leadership skills, learning and innovation skills and entrepreneurship traits on entrepreneurial mindset of engineering students.
Research Question 2a	What is the effect of student's leadership skills on their entrepreneurial mindset?
Research Question 2b	What is the effect of student's leadership skills on their learning and innovation skills?
Research Question 2c	What is the effect of student's leadership skills on their entrepreneurship traits?
Research Question 2d	What is the effect of student's entrepreneurship traits on their entrepreneurial mindset?
Research Question 2e	What is the effect of student's entrepreneurship traits on learning and innovation skills?
Research Question 2f	What is the effect of student's learning and innovation skills on their entrepreneurial mindset?
Research Objective 3	To examine the mediating role of learning and innovation skills in the relationship between leadership skills and entrepreneurial mindset.
Research Question 3a	Do learning and innovation skills mediate the relationship between leadership skills and entrepreneurial mindset?
Research Question 3b	Do learning and innovation skills mediate the relationship between entrepreneurship traits and entrepreneurial mindset?
Research Question 3c	Do entrepreneurship traits mediate the relationship between leadership skills and entrepreneurial mindset?
Research Objective 4	To derive an entrepreneurial mindset model for engineering students in Malaysia.
	What is the entrepreneurial mindset model for engineering students?

1.6 Research Hypothesis

There are nine hypotheses being developed for the study. The list of hypotheses, based on their corresponding research questions and research objectives, are presented in Table 1.3.

Table 1.3 Hypothesis of the study

Hypothesis	Statement	Corresponding Research Question	Corresponding Research Objectives
Hypothesis 1	Leadership skills has a positive and significant influence on entrepreneurial mindset	2a	2
Hypothesis 2	Leadership skills has a positive and significant influence on learning and innovation skills	2b	2
Hypothesis 3	Leadership skills has a positive and significant influence on entrepreneurship traits	2c	2
Hypothesis 4	Entrepreneurship traits has a positive and significant influence on entrepreneurial mindset	2d	2
Hypothesis 5	Entrepreneurship traits has a positive and significant influence on learning and innovation skills	2e	2
Hypothesis 6	Learning and innovation skills (LIS) has a positive and significant influence on entrepreneurial mindset	2f	2
Hypothesis 7	Learning and innovation skills (LIS) mediate the relationship between leadership skills and entrepreneurial mindset	3a	3
Hypothesis 8	Learning and innovation skills (LIS) mediate the relationship between entrepreneurship traits and entrepreneurial mindset	3b	3
Hypothesis 9	Entrepreneurship traits mediate the relationship between leadership skills and entrepreneurial mindset	3c	3

1.7 Significance of the Study

This study aims to develop a model for measuring engineering student's entrepreneurial mindset by integrating leadership skills, learning and innovation skills,

entrepreneurship traits for the constructs. Currently there is limited research on engineering student's entrepreneurial mindset especially those focusing on relation and the effect of leadership skills, learning and innovation skills, entrepreneurial mindset for entrepreneurial mindset among the engineering students in various universities in the Klang Valley. The noteworthy contribution of the present study thus is divided into two perspectives, one from the practical point of view.

1.7.1 Practical Significance of the Study

In relation to the practical contributions of the study, the assessments on the level of leadership skills, learning and innovation skills, entrepreneurship traits and entrepreneurial mindset will provide important indicators to gauge the climate of entrepreneurial mindset among engineering students. The findings indicate area for improvement to strengthen the entrepreneurship education in Malaysian universities. The indicator will be useful in developing entrepreneurial minded graduate engineers.

Secondly, the findings will provide the basis for strategic planning in formulating, revising, updating the entrepreneurship education content, assessment, evaluation, programme monitoring and benchmarking to enhance engineering student's entrepreneurial mindset. In this context, the findings will help the universities to formulate greater strategy for fostering engineering student's entrepreneurship education and to improve the current performance through continuous learning process. In addition, the ministry, the educators, the researchers will benefit from this research by adopting the findings as the foundation for spearheading entrepreneurial minded engineer model in this country.

Thirdly, the assessment on the mediator in this case the learning and innovation skills and entrepreneurship traits are the variable that is assumed to cause the dependent variable in this case the entrepreneurial mindset. The mediator effect is to assist the engineering faculty in determining entrepreneurial minded engineers. The information will assist the stakeholders to focus and prioritise their resources, strategy and policy toward the most important criteria which need special attention.

1.7.2 Theoretical Significance of the Study

A review of literature revealed various frameworks on measuring entrepreneurial mindset such as KEEN Framework (Keen, 2017) and EntreComp Framework (Bacigalupo, Kampylis, Punie & Van den Brande, 2016b). Application of these theories in the model established comprehensive perspectives for understanding entrepreneurial mindset. However, the literature concerning the engineering student's entrepreneurial mindset in relation to leadership skills, learning and innovation skills and entrepreneurship traits is scarce. Thus, the effect of these variables towards entrepreneurial mindset among engineering students would be addressed in this study.

Theoretically, by measuring the entrepreneurial mindset of engineering students in Malaysia, this study will contribute toward the increase of literature on entrepreneurial mindset and other professional skills. Considering previous works on measuring engineering student's entrepreneurial mindset that have focused on developed countries, this study will contribute to the pool of knowledge by providing empirical evidence on engineering students entrepreneurial mindset in a developing country.

1.8 Scope and Limitation of the Study

The Malaysian Higher Learning Institutions comprised of 20 public and 495 private universities (KPT, 2017). Engineering programmes are offered in most public universities. All engineering programmes are accredited by Engineering Accreditation Council (EAC), a body delegated by Board of Engineers (BEM). For this research, the focus are the undergraduate engineering students from the five selected public universities in Klang Valley such as Universiti Malaya, Universiti Teknologi Malaysia, Universiti Kebangsaan Malaysia, Universiti Putra Malaysia and Universiti Teknologi MARA. These engineering students have taken entrepreneurship programmes at their universities. Entrepreneurship programmes were offered both within the curricula and as extra-curricular activities, providing students with a variety of ways to access entrepreneurship education following the course structures created

for year 3 or 4 depending on the universities. Criteria of selection among engineering students to participate in this research is not limited to grades obtained, students' interest, gender, and socio economics status. Time constraints is the limitation of the research as the students are busy with their classes and challenging to gather them at the same time.

The selection of five universities in Klang Valley as the scope of study is based on the justification that it is a good start, and this could be a role model to be replicated at other public universities outside Klang Valley. Other public universities outside Klang Valley and private universities are not included in this research as the scope is too wide. The approach is consistent with previous research (Al Mamun, Ibrahim, Yusoff & Fazal, 2018; Rahim et al., 2015; Yusoff, Zainol & Bin Ibrahim, 2015) on measuring entrepreneurship education which also excludes both criteria from the study based on different setting and nature of entrepreneurship education.

1.9 Operational Definitions of Key Terms

Listed below are some terms that are used in this research work.

Entrepreneurship: entrepreneurship is the ability to turn ideas into action. It involves creativity, innovation and risk-taking, as well as the ability to plan and to manage projects to achieve objectives. The individual is aware of the context of his/her work and to seize opportunities that arise. It is the foundation for acquiring more specific skills and knowledge needed by those establishing or contributing to social or commercial activity.

Entrepreneurship Education: As (Gibb, 2008) stated, entrepreneurship education is about learning for entrepreneurship, learning about entrepreneurship and learning through entrepreneurship. Therefore, entrepreneurship education should be considered both as a method of learning as well as a content of learning. In this study, entrepreneurship education is taken to cover all educational activities (EC, 2015b) *“that seek to prepare people to be responsible, enterprising individuals who have the*

skills, knowledge and attitudes needed to prepare them to achieve the goals they set for themselves to live a fulfilled life.” According to (EC, 2016) entrepreneurship education is about learners developing the skills and mind-set to be able to turn creative ideas into entrepreneurial action. This is a key competence for all learners, supporting personal development, active citizenship, social inclusion, and employability. It is relevant across the lifelong learning process, in all disciplines of learning and to all forms of education and training (formal, non-formal and informal) which contribute to an entrepreneurial spirit or behaviour, with or without a commercial objective.

Entrepreneurial mindset: According to (Kriewall & Mekemson, 2010) an entrepreneurially mindset engineer (who is an engineer instilled with the Entrepreneurial Mindset) places product benefits before design features and leverages technology to fill unmet customer needs. The purpose of entrepreneurial engineering is to design value-added products and processes that create demand through innovation, resulting in positive cash flow, revenue, and regenerative profits for the enterprise producing the product.

Leadership Skills: is the art of motivating a group or team of people to work toward a common goal based on the needs of the organization or university. According to (Kotter, 1996) leadership is about coping with change and setting a direction and a vision, aligning and motivating employees to achieve their vision.

Learning and innovation skills: The skills that separate students who are prepared for increasingly complex life and work environments in the 21st century and those who are not. A focus on creativity, critical thinking, communication, and collaboration is essential to prepare students for the future (OECD, 2009; WEF, 2016).

Entrepreneurship Traits: The personality characteristics associated with motivation to become entrepreneurs (Amiri & Marimaei, 2012).

1.10 Organisation of the Thesis

This thesis comprises seven chapters, each chapter presents different parts of the research and has relevant explanations or discussions on the part of the research highlighted. The following paragraphs provides the general information on each chapter available in this thesis.

Chapter 1: Introduction: This chapter describes an overview of the project background starting with the description of the study, the objective of the study, the scope of study and the significance of this study.

Chapter 2: Literature Review: This chapter provides readers with the researcher's knowledge on the study and the topic areas with all the relevant points discussed and explained in the subsections available. The chapter provides the explanation on the issues identified regarding this study and the previous research works. This chapter can be regarded as the proof of the researcher's knowledge and understanding on the topic studied based on previous works.

Chapter 3: Research Methodology: This chapter provides the explanations on the research methodology employed for this study. The methodology employed is based on the objectives set for this study. The details of the methodology that includes the research approach, the data collection and data analysis and the research design will be presented in this chapter.

Chapter 4: Results and Discussions: This chapter presents the analysis of data. All the tests conducted on the key variables are presented and discussed in this study. The statistical tests are conducted to achieve all the set objectives as well as to test the hypotheses formed. Among the tests presented and discussed in this chapter are reliability test, EPA, CFA and SEM. The results of all the mentioned tests will also be presented and discussed in this chapter.

Chapter 5: Conclusion and Recommendations: This chapter offers the discussions on the findings and based on the findings, the conclusion will be formed

and presented as well in this chapter. This chapter will also offer the explanation on the limitation of the study and the potential future research work.

to overcome several issues and challenges faced in the economic sectors such as human capital, technology and innovation believed that hampered the efforts towards sustained growth related to human capital. All these initiatives reflect the Malaysian government's awareness on the importance of entrepreneurial activities and the significance of adopting entrepreneurship to boost employment and economic development (Shamsudin, Al Mamun, Nawi, Nasir & Zakaria, 2016).

At the same time, the National Entrepreneurship Framework 2018 aimed to generate new job opportunities and capabilities in engineering sectors as well as other areas. Entrepreneurial education in Malaysia starts as early as the primary school level. It continues in the lower secondary level through the subject of integrated living skills. The effort to promote an entrepreneurship culture is continued in the upper secondary level where students are given the opportunity to take an elective subject which is related to entrepreneurship (Mohamed, Rezai, Nasir Shamsudin & Mu'az Mahmud, 2012).

2.2.1 Government and Stakeholders' Initiatives

In ensuring entrepreneurship agenda is well received and understood, various initiatives and efforts contributed by various institutions and agencies. Amongst the higher learning institutions are University Malaya, University Putra Malaysia, Universiti Sains Malaysia, Universiti Kebangsaan Malaysia, and Universiti Teknologi Malaysia. Among others are setting up support centers, clubs etc. in all the universities to carry out entrepreneurship activities and are monitored and advised by coordinators as shown in Table 2.1 (page 22). As one of the initiatives, University Malaya initiated Entrepreneurship Program Investment Grant Scheme to develop and nurture innovative and competitive entrepreneur. University Putra Malaysia started with Centre of Entrepreneurial Development and Graduate Marketability. Universiti Sains Malaysia initiated USM Entrepreneur Club. Universiti Kebangsaan Malaysia started the Centre for Entrepreneurship and SME Development (CESMED). Finally, Universiti Teknologi Malaysia initiated UTM Technology Entrepreneurship Center – UTMTEC, Innovation and Commercialization Centre and Pusat Inovasi Mahasiswa dan Keusahawanan

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Appendix A List of Experts Referred for Content Validity.

Name and Position	Comment
Professor Madya Dr. Morina bte Abdullah Fakulti Teknologi & Informatik Razak UTM Razak School of Engineering and Advanced Technology Universiti Teknologi Malaysia Jalan Sultan Yahya Petra Received: 11.9.2017	The questionnaire is suitable for purpose of collecting data on engineering students' skills in Malaysia
Dr Noor Hamizah Hussain Senior Lecturer UTM Razak School of Engineering and Advanced Technology University Technology Malaysia Received: 11.9.2017	The suitability of the items is subject to the amendment on number of questions, demographic information, clarity of instruction, suitability of some question, availability of data, and structure of question.
Dr Norihan Abu Hassan Senior Assistant Professor Center for Communication, Teaching and Learning Universiti Teknologi BruneiPublic Received: 11.9.2017	Each item prepared is suitable for data collection

Appendix B Research Questionnaire

Section A: DEMOGRAPHIC

Please provide information on your background

1	Age	1. _____ years old
2	Gender	1. <input type="checkbox"/> Male 2. <input type="checkbox"/> Female
3	Nationality	1. <input type="checkbox"/> Malaysian 2. <input type="checkbox"/> Non-Malaysian
4	University Name	1. _____
5	Level of Education	1. <input type="checkbox"/> Diploma 2. <input type="checkbox"/> Bachelor's Degree
6	Program of study	1. <input type="checkbox"/> Electrical and Electronic Engineering 2. <input type="checkbox"/> Mechanical Engineering 3. <input type="checkbox"/> Chemical Engineering 4. <input type="checkbox"/> Civil Engineering 5. <input type="checkbox"/> Others
7	Current year of study	1. <input type="checkbox"/> 3 rd year 2. <input type="checkbox"/> 4 th year
8	Education Funding	1. <input type="checkbox"/> Scholarship 3. <input type="checkbox"/> Student Loan 2. <input type="checkbox"/> Sponsorship 4. <input type="checkbox"/> Self-financing
9	Father's working status	1. <input type="checkbox"/> Self-employed/Owned Business 2. <input type="checkbox"/> Government Employee 3. <input type="checkbox"/> Private sector employee 4. <input type="checkbox"/> Retired/Pensioner 5. <input type="checkbox"/> Others: (please state)
10	Mother's working status	1. <input type="checkbox"/> Self-employed/Owned Business 2. <input type="checkbox"/> Government Employee 3. <input type="checkbox"/> Private sector employee 4. <input type="checkbox"/> Retired/Pensioner 5. <input type="checkbox"/> Others: (please state)

Section B – Leadership Skills

Please circle the number that best indicate the degree to which you believe the following:

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

LS1	I belief I can take risks in any situations	1	2	3	4	5
LS2	I have high tolerance of risks	1	2	3	4	5
LS3	I belief I can make things better to improve situations	1	2	3	4	5
LS4	I belief I can produce creative ideas and solutions	1	2	3	4	5
LS5	I belief I can adapt quickly to changes	1	2	3	4	5
LS6	I belief I can respond flexibly to people and situations	1	2	3	4	5
LS7	I belief I can analyze situations carefully	1	2	3	4	5
LS8	I belief I can make rational judgments	1	2	3	4	5
LS9	I belief I can make logical decisions	1	2	3	4	5
LS10	I belief I can make decision quickly	1	2	3	4	5
LS11	I belief I have confidence	1	2	3	4	5
LS12	I belief I can work independently	1	2	3	4	5
LS13	I can plan and organize resources efficiently	1	2	3	4	5
LS14	I always plan how deadlines are going to be met	1	2	3	4	5
LS15	I prioritize tasks assign to me	1	2	3	4	5
LS16	I always pay close attention to quality	1	2	3	4	5
LS17	I like to get the detail right	1	2	3	4	5
LS18	I have high standards	1	2	3	4	5
LS19	I am a person who get things right the first time	1	2	3	4	5
LS20	I can express my views clearly	1	2	3	4	5
LS21	I prefer to involve people in plans and decisions	1	2	3	4	5
LS22	I prefer to develop strong working relationships	1	2	3	4	5
LS23	I can make an impact with presentations	1	2	3	4	5
LS24	I am strong team player	1	2	3	4	5
LS25	I can work effectively with other people	1	2	3	4	5
LS26	I am self-motivated	1	2	3	4	5
LS27	I am prepared to do whatever it takes	1	2	3	4	5
LS28	I belief I can exploit opportunities for self-development	1	2	3	4	5
LS29	I am sensitive to people's needs	1	2	3	4	5
LS30	I like to build rapport quickly	1	2	3	4	5
LS31	I enjoy being in charge	1	2	3	4	5
LS32	I like to take the lead	1	2	3	4	5

Section C – Learning and innovation skills

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

IS1	I can make use of information to solve problems	1	2	3	4	5
IS2	I can seek relevant sources of information to solve problems	1	2	3	4	5
IS3	I can come up with unique solutions or alternatives	1	2	3	4	5
IS4	I can think rationally in whatever I do	1	2	3	4	5
IS5	I am creative to recognize opportunity	1	2	3	4	5
IS6	I always seek for new ways to carry out tasks	1	2	3	4	5
IS7	I am not concern for how difficult things might be	1	2	3	4	5
IS8	I communicate my points clearly to others	1	2	3	4	5
IS9	I listen to other people's opinions	1	2	3	4	5
IS10	I always pay close attention to what the other person is saying	1	2	3	4	5
IS11	I always ask for clarification	1	2	3	4	5
IS12	I always rephrase the sentence to ensure understanding	1	2	3	4	5
IS13	I always say what I want clearly and directly (Clarity)	1	2	3	4	5
IS14	I always think about what I want to say before I say it (Concise)	1	2	3	4	5
IS15	I can pull out differences to make one solution work for multiple problems	1	2	3	4	5
IS16	I follow step by step to solve problems	1	2	3	4	5
IS17	I can work effectively in a team	1	2	3	4	5
IS18	I am reliable when working in a team	1	2	3	4	5
IS19	I can work collaboratively with different types of people at every level	1	2	3	4	5

Section D – Entrepreneurship Traits

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

ET1	I believe I have a positive attitude	1	2	3	4	5
ET2	I believe I am a self-starter	1	2	3	4	5
ET3	I am curious about changes happening around the world	1	2	3	4	5
ET4	I am determined to succeed at something and keep trying until I get it right	1	2	3	4	5
ET5	I have high determination that pushes me to keep going and keep trying through times	1	2	3	4	5
ET6	I can adjust myself to different conditions	1	2	3	4	5
ET7	I can make changes to respond to a new environment	1	2	3	4	5
ET8	I am aware of the differences and similarities between people from other countries	1	2	3	4	5
ET9	I know about cultural Entrepreneurial Traits, history, values, beliefs and behaviors of other ethnic or groups	1	2	3	4	5
ET10	I am aware of other cultural attitudes	1	2	3	4	5
ET11	I respect and value other cultures	1	2	3	4	5
ET12	I like to explore various solutions to problems	1	2	3	4	5
ET13	I like to seek new knowledge	1	2	3	4	5
ET14	I always get things done	1	2	3	4	5

Section E – Entrepreneurship Mindset

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

EM1	I like to seek new knowledge	1	2	3	4	5
EM2	I am curious about changes happening around the world	1	2	3	4	5
EM3	I like to explore various solutions to problems	1	2	3	4	5
EM4	I can identify unexpected opportunities to create value	1	2	3	4	5
EM5	I believe I can create extraordinary value for others (create solutions and deliver value)	1	2	3	4	5
EM6	Doing work which contributes to society is very important to me	1	2	3	4	5
EM7	I want to improve people's lives	1	2	3	4	5
EM8	I am motivated to use my ideas and energy for the public good	1	2	3	4	5
EM9	I would rather work in an organization with a social mission	1	2	3	4	5
EM10	I am good in engineering theory	1	2	3	4	5
EM11	I am good at the art and science of engineering	1	2	3	4	5