

# Entrepreneurial Self-Efficacy and Entrepreneurial Intention Among Engineering Undergraduates: What Matters the Most in Entrepreneurship Education?

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**Abstract-** Engineering is a premier career choice among students in higher education institutions but there is a growing number of engineering graduates in unemployment and underemployment. Due to that, entrepreneurship education has been introduced to engineering students with the hope that this could improve their entrepreneurial self-efficacy and subsequently leading to greater intention to become self-employed. This descriptive study involved a total of 292 engineering undergraduates selected via purposive sampling from four higher education institutions in Malaysia. Using adapted measurement scales from past studies, the interrelationships among entrepreneurship education, entrepreneurial self-efficacy and entrepreneurial intention were investigated. Based on a structural equation modeling with partial least square, data were analyzed quantitatively to test the direct and indirect relationships among these variables. Findings indicated that entrepreneurship curriculum and university support contribute significantly and positively to enhance entrepreneurial self-efficacy and entrepreneurial intention but not teaching methodologies. Further to that, entrepreneurial self-efficacy mediated the relationships of entrepreneurship curriculum and university support with entrepreneurial intention but not teaching methodologies. The overall structural model yielded 38.2% and 69.8% of predictive accuracy to explain entrepreneurial self-efficacy and entrepreneurial intention respectively. In comparison, entrepreneurship curriculum has a greater effect size compared to university roles while teaching methodologies had negligible effect size to explain entrepreneurial self-efficacy and entrepreneurial intention. The study also concluded that entrepreneurial self-efficacy has a large effect size on entrepreneurial intention. Hence, these findings implied the need to focus on the adequacy and relevance of entrepreneurship curriculum and encourage greater intervention from the university in promoting entrepreneurial intention among students. Additionally, there is a dire necessity of improving teaching methodologies to improve students' engagement in entrepreneurship learning activities. Future studies should explore in greater detail about students' preference for learning entrepreneurship effectively and other aspects of entrepreneurship education.

**Keywords:-** *Entrepreneurial self-efficacy, entrepreneurial intention, entrepreneurship education, engineering undergraduates, entrepreneurship curriculum, teaching methodologies, university support.*

## I. INTRODUCTION

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), engineering contributes significantly to ensure the fulfillment of basic human needs by improving the quality of life and the creation of opportunities for sustainable growth at the local, national, regional and global level. Engineering is concerned with knowledge and the practice of solving problems. Through the application of scientific knowledge, technical methods, design and management principles, engineering solves daily problems in various aspects of life. These include securing food and water, communication and transportation, innovation and creation of new products and services, surviving disasters and addressing public health challenges [1]. The relevance of engineering in sustaining lives and contributing to the development of the country is indeed undeniable, and engineering course itself is among the popular courses besides social sciences, business and laws, manufacturing and construction, science, mathematics and computing taken by students at the tertiary level [2]. Hence, young people are encouraged to take up engineering as a vocation and profession.

Digital transformation and disruptive technologies alongside with globalization are providing extensive opportunities in terms of employment yet at the same time, bringing greater risks, uncertainties and competition [3,4,5]. As the world moves into the Fourth Industrial Revolution or IR4.0, with advancement in artificial intelligence, big data and Internet of Things, the field of engineering has also been profoundly affected [1]. Ortiz, Fitzpatrick and Bryne [6] stated that engineers are expected to work in an even more complex and uncertain environment than before whereby the need to integrate technical knowledge and transferable skills and values become even critically demanded. Further to that, graduates in Malaysia are also facing the issues of unemployment and underemployment. As mentioned in Jamaludin et al. [2], the national unemployment rate indicated a quite consistent unemployment rate at 3.3% in recent years but at a closer scrutiny, the proportion of unemployment among people with tertiary education has increased from only 15% in 2000 to 35% in 2017. The recent COVID-19 pandemic has worsened the unemployment rate as it reached 5.3% in May 2020 [7].

The key issue causing unemployment among graduates is mainly due to the imbalance between supply

and demand. Jamaludin et al. [2] reported that there is an increasing number of student enrolment in tertiary education in recent years as evident from the total of 581,668 enrolments at university in 2015 as compared to 552,702 enrolments in 2019. On average, Malaysian higher education institutions are producing about 290,000 graduates annually ([8, 9]. At the same time, the

Department of Statistics Malaysia and Bank Negara Malaysia reported that millions of job vacancies are indeed offered every year but from 2006 to 2017, 65% of these vacancies are low-skilled vacancies, 26% are medium-skilled vacancies while only 9% are high-skilled vacancies [2]. Figure 1 illustrates the comparison of vacancy rate among these levels of skills.

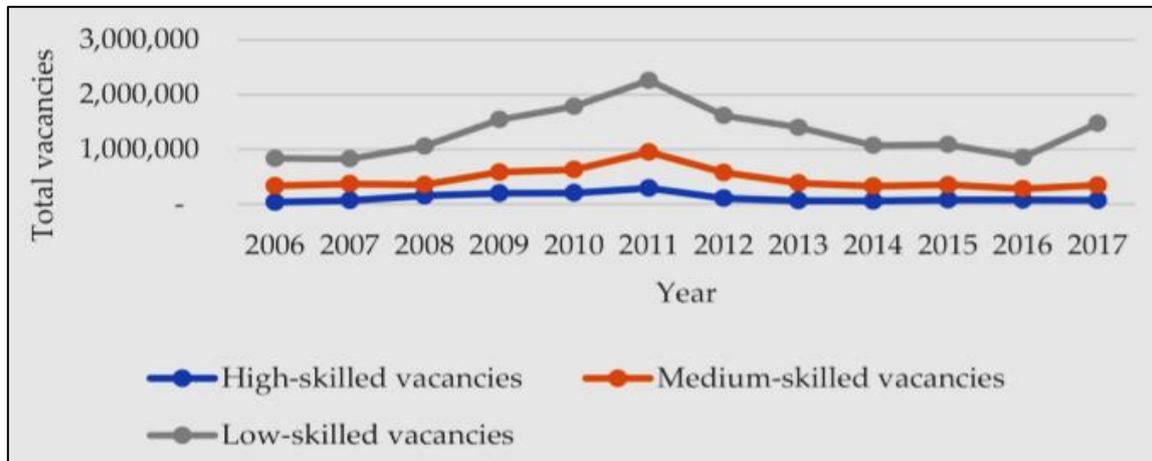


Fig. 1: Distribution of Job Vacancies (2006-2017)

Source: [2]

Engineering graduates enter the job market mainly for the high-skilled vacancies. The low availability of job vacancies at this skill level as compared to other levels implies that there is greater competition for job placement among freshly graduated engineers. Husin et al. [3] added that the competition becomes even stiffer as students who have just graduated have to compete with those graduated long ago but are still unemployed due to various reasons. The disparity of supply and demand in the job market is further aggravated with unemployment issues as employers dictate their demand for graduates to have certain knowledge, skills and attitudes or soft-skills as well as work experience [2,3, 6]. Saleh and Lamsali[10] stated that graduates must acquire employability skills such as teamwork skills, communication, problem solving and decision making besides strong academic achievement to secure employment in the job market.

As a means of reducing the unemployment rates among graduates, entrepreneurship education is considered as one of the strategies to equip students with entrepreneurial skills and encouraging them to become self-employed rather than competing for jobs in public and private organizations. Developing countries including Malaysia are also pushing more students to be involved in entrepreneurship and consider self-employment as their career choice. Entrepreneurship is instrumental in addressing unemployment as it generates occupational opportunities, stimulate regional development, enhance economic growth and encourage innovation [11]. Hence, in Malaysia, entrepreneurship education is offered as a compulsory course for undergraduates in almost all fields of study including engineering course. The provision of entrepreneurship education is expected to improve

students' entrepreneurial self-efficacy and subsequently leads to greater intention for entrepreneurial activities including the willingness to become self-employed and starting their own start-up companies [12, 13]. The importance of entrepreneurship in higher education institutions and its contribution to improve employability and encouraging entrepreneurial endeavors among graduates have caught the attention in the research field [11, 12, 13, 14, 15, 16]. However, Aadland and Aaboen [17] stated that there are various educational designs for introducing entrepreneurship in the educational context. Simatupang et al. [13] confirmed the interrelationships of entrepreneurial education, entrepreneurial self-efficacy and entrepreneurial intention. Yet, the questions remain which aspect of entrepreneurial education contribute to improve students' entrepreneurial self-efficacy and leading to greater intention to become an entrepreneur. Hence, this study focuses on investigating which matters the most to ensure entrepreneurial self-efficacy and entrepreneurial intention. Three aspects of entrepreneurship education are compared which include entrepreneurship curriculum, teaching methodologies and university support in promoting entrepreneurship and inculcating an entrepreneurial culture among engineering undergraduates. In this study, engineering undergraduates are targeted as they are also facing an upsurge of challenges in seeking employment due to the stiff competition for high-skilled vacancies in Malaysia [2]. Further to that, there is a need to have more engineers who are entrepreneurial as the IR 4.0 creates greater demand for skillful engineers, particularly those with transferable skills [6].

## II. LITERATURE REVIEW

### A. Entrepreneurial Intention

Entrepreneurial intention is described as a process of seeking knowledge that is necessary for business creation [18]. Intent on its own can be explained based on the viewpoint of motivation [19] and goal-related behavior [20]. It is also a cognitive process [21] that is purposeful and leading to action [22]. Hence, entrepreneurial intention bespoken of motivational factors and willingness towards entrepreneurial behaviors [23]. Karimi et al. [24] added that entrepreneurial intention also implies a state of mind that is open towards self-employment. Ruiz et al. [25] stated that readiness for entrepreneurship reflects the ability of the individual in observing and analyzing the environment in a manner that he/she will be able to channel high creativity and productive potentials into achievement.

### B. Underlying Theories of Entrepreneurial Intention

There are many models often used in research to examine entrepreneurial intention through a theoretical lens. Among the most common ones are the Theory of Planned Behavior [26] and the Shapero's Entrepreneurial Event [27]. In the Theory of Planned Behavior (TPB), intention is determined as the consequence of influence from attitude, subjective norms and perceived behavioral control [28]. Attitude reflects the disposition of the

individual to respond in a favorable or unfavorable manner towards an object or event [29], as in this case, attitude towards entrepreneurship. Subjective norms on the other hand, is the perception of the individual that most people who are important to this individual should or should not perform the particular behavior or intention [30]. Meanwhile, perceived behavioral control is the confidence of the individual about his or her capabilities of performing the behavior and having control over such behavior [29]. In this regard, perceived behavioral control is similar to Bandura's Self-Efficacy Theory (SET) which identifies the belief of an individual that he/she is capable of performing a given task [31]. Due to this notion, self-efficacy or to be more specific, entrepreneurial self-efficacy is a concept closely related to entrepreneurial intention [15]. In the Shapero's Entrepreneurial Event (SEE), the role of entrepreneurial self-efficacy is also indicated. Krueger et al. [32] developed the Classical Model of Entrepreneurial Intention based on Shapero and Sokol and Ajzen's earlier works. As shown in Figure 2, entrepreneurial intention is the outcome of perceived desire and perceived viability. Perceived norms which are similar to subjective norms in the TPB is a predictor of perceived desire while perceived self-efficacy in SET and SEE determines perceived viability.

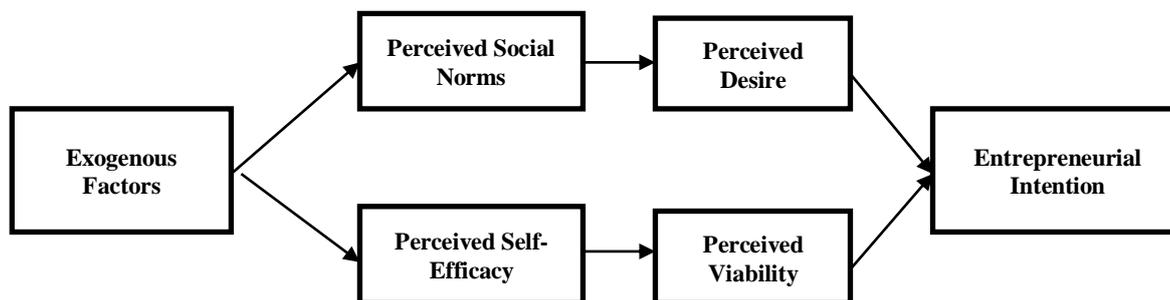


Fig. 2: Classical Model of Entrepreneurial Intention

Source: Krueger et al. (2000); Barral et al. (2018)

### C. Related Works on Entrepreneurial Intention

Studies on entrepreneurial intention among university students are growing in numbers in many countries all over the world including Malaysia. For instance, Serra Yurtkoru et al. [15] conducted a study on entrepreneurial intention and its antecedents based on 425 Turkish university students. The underlying theory of this study is TPB, focusing on personal attitude and perceived behavioral control. They also investigated the effect of support in terms of educational, relational (subjective norm) and structural on personal attitude and perceived behavioral control. Their study showed that only relational support had a significant influence on personal attitude while educational support and relational support had significant influences on perceived behavioral control. Both personal attitude and perceived behavioral control significantly influence entrepreneurial intention. Hence, this study implies that educational support is important to enhance perceived behavioral control or self-efficacy, which

eventually leads to entrepreneurial intention. In another study by Anjum et al. [18], 330 university students in Pakistan were involved in a study on the impact of perceived creativity disposition on entrepreneurial intention based on TPB as the underlying theory. This study showed that perceived creative disposition has direct effects on both attitude towards entrepreneurship and entrepreneurial intention. Mediation analysis indicated that attitude significantly mediated the relationship between perceived creative disposition and intention while moderation analysis showed that the relationship of perceived creative disposition and intention is strengthened when perceived university support is high. Thus, this study indicated the role of university support to enhance students' creativity for entrepreneurship endeavors. In Saudi Arabia, Elnadi and Gheith [33] carried out a study to link entrepreneurial ecosystem through the mediation of entrepreneurial self-efficacy with entrepreneurial intention among university students. Based on a sample of 259 students, their study

showed that entrepreneurial ecosystem has direct and indirect effects on entrepreneurial intentions. Therefore, this study also indicated the role of entrepreneurial self-efficacy as a mediator, and at the same time, implied the role of a positive entrepreneurial ecosystem at the university to boost intention for entrepreneurship.

In the Malaysian context, studies on entrepreneurial intention are also increasing in numbers. Recent studies include Song et al. [34] who investigated entrepreneurial intention of UiTM students and the mediating role of entrepreneurship education, Hassan et al. [35] who examined the relationships of entrepreneurship education, financial support and market availability with entrepreneurial attitude and entrepreneurial intention, and Al-Jubari et al. [36] on entrepreneurial intention based on the effects of needs satisfaction and need frustration that were mediated by attitude, subjective norms and perceived behavioral control. This study integrated self-determination theory and TPB in the exploration of entrepreneurial intention among 438 university students from four Malaysian public universities. Findings indicated strong indirect effect of basic psychological needs (autonomy, competence and relatedness) on entrepreneurial intention through mediation of attitude, subjective norm and perceived behavioral control. Other studies explored different antecedents like big-five personality traits [37], entrepreneurship policy [38], entrepreneurial characteristics [39], among others.

Studies on entrepreneurial intentions that focus solely on engineering students are also becoming more popular in research field [16, 40, 41, 42]. Studies like Barba-Sánchez and Atienza-Sahuquillo [16] and Sandi and Nurhayati [43] focused on entrepreneurship education while other studies [43, 44] considered entrepreneurial self-efficacy to explain entrepreneurial intention.

#### D. Entrepreneurship Education

The importance of entrepreneurship education to address unemployment issues and increase the employability of graduates has been noticed leading to entrepreneurship being offered as a course, and then an added subject for other social and business students as well as non-business students like engineering. In Malaysia, initially only public universities offer entrepreneurship subject to non-business students but eventually, private universities as well, join the bandwagon of enriching students regardless of their course background to take up entrepreneurship education. Mozahem and Adlouni [45] stated that entrepreneurship education has the potentials of increasing entrepreneurial self-efficacy and further to that, leading to greater intent to become an entrepreneur. Numerous studies support the notion that entrepreneurship education leads to greater entrepreneurial intention [14, 43, 46]. Based on empirical evidences, the following research hypothesis is presented.

- H1: Entrepreneurship education positively influence entrepreneurial self-efficacy
- H2: Entrepreneurship education positively influence entrepreneurial intention

It should also be noted that the curriculum, teaching methodologies and support provided by universities are not consistent and may vary among institutions. It highlights the questions of what matters the most in providing entrepreneurship education for undergraduates, or in the case of this study, the engineering students. Three main aspects of entrepreneurship education given focus in this study are entrepreneurship curriculum, teaching methodologies and university support.

#### E. Entrepreneurship Curriculum

Bauman and Lucy (2020) stated that the entrepreneurial environment itself is changing and therefore, there is a need to scrutinize and make necessary changes in the topics to be included in an entrepreneurship curriculum. A greater focus on soft skills as compared to hard skills needs to be considered to ensure successful business venture [47]. Hard skills refer to the technical and measurable competencies or practical skills that are taught in higher education involving theory and knowledge whereas soft skills are inclined more towards the attitude, personality and ability of the student to work with others [48, 49]. Employers identified ten important soft skills which are communication, work ethics, responsibility, teamwork, positive attitude, social skills, courtesy, professionalism, integrity and flexibility [48]. According to Mahmood et al. [50], entrepreneurship curriculum that is offered at the tertiary level can help students in conducting business activities in an effective manner due to the knowledge and skills learned from the entrepreneurship education. Bui et al. [51] added that the provision of entrepreneurial education encouraged greater openness for entrepreneurial activities. There, the following research hypotheses are presented.

- H3: Entrepreneurial curriculum positively influence entrepreneurial self-efficacy
- H4: Entrepreneurial curriculum positively influence entrepreneurial intention

#### F. Teaching Methodologies

According to Bauman and Lucy [52], there is also a need to reconsider the current ways how entrepreneurship education is taught at the university level. Fayolle et al. [53] explained that there is diversity in terms of pedagogy, objectives, student-base and programs offered on entrepreneurship education in different countries and institutions. According to Ratten [54], entrepreneurship education has become more independent with more flexibility than merely about dissemination of knowledge and information about entrepreneurship, but also development of entrepreneurial incubators, accelerators and collaboration centres. Further to that, Bauman and Lucy [52] argued that despite the importance of providing awareness and knowledge about financial risk management, marketing management, strategic management and accounting principles, the students might not have the ability to handle challenging situation or recover from failed endeavors. Yamakawa et al. [55] proposed that entrepreneurial education should then be designed to include both theoretical and practical experiences. Bhatti et al. [22] stated that the use of active

learning and learner-centered approaches can improve entrepreneurial intention of female university students. Henceforth, the following research hypothesis are presented.

- H5: Teaching methodology positively influence entrepreneurial self-efficacy
- H6: Teaching methodology positively influence entrepreneurial intention

**G. University Support**

Serra Yurtkoru et al. [15] stated that contextual factors such as relational, educational and structural support are important antecedents of attitude and perceived behavioral control, which subsequently lead to entrepreneurial intention. Similarly, Anjum et al. [18] investigated university support as a moderator of the relationship between perceived creative disposition and entrepreneurial intention and found its significant contribution to strengthen the relationship. Su et al. [56] remarked that universities can provide support in the form of policies and practices that promote entrepreneurial activities among the undergraduates. Further to that, the university can define the culture, norms, beliefs and expectations for entrepreneurial activities among its students [57]. Based on such information, it is therefore apt to propose the following research hypothesis.

- H7: University support positively influence entrepreneurial self-efficacy
- H8: University support positively influence entrepreneurial intention

**H. Entrepreneurial Self-Efficacy**

Self-efficacy plays a role in identifying the individual’s ability to control thoughts, feelings, motivations and actions [58]. Bandura [31] further explained that self-efficacy determines the person’s ability to express behaviors that show their strengths in times of difficulties or failures, and how these successes and failures affect their future behaviors. There are four sources of

information to shape self-efficacy of an individual, namely: (i) performance axoplasm, experience arising from the act of performing an expected behavior or similar behavior; (ii) vicarious experience, seeing others doing the behavior or similar behavior; (iii) verbal persuasion, being persuaded or advised by others to encourage or discourage the behavior; and (iv) emotional arousal, emotional feelings towards the intended behavior [13]. Hence, by providing information or experience relating to entrepreneurship, an individual develops entrepreneurial self-efficacy with a more positive attitude towards performing entrepreneurial behaviors. The following research hypothesis is posited.

- H9: Entrepreneurship self-efficacy positively influence entrepreneurial intention

In most studies involving entrepreneurship education, entrepreneurial self-efficacy and entrepreneurial intention, entrepreneurial self-efficacy is often regarded as a mediator [59, 60, 61]. Therefore, the following research hypotheses are presented.

- H10: Entrepreneurial self-efficacy mediates the relationships of entrepreneurship curriculum and entrepreneurial intention
- H11: Entrepreneurial self-efficacy mediates the relationships of teaching methodology and entrepreneurial intention
- H12: Entrepreneurial self-efficacy mediates the relationships of university support and entrepreneurial intention

**III. METHODS**

This study undertakes a descriptive and quantitative approach and based on a partial least square structural equation modeling (PLS-SEM) analysis to determine the interrelationships of entrepreneurship education, entrepreneurial self-efficacy and entrepreneurial intention. Figure 3 shows the research model of this study.

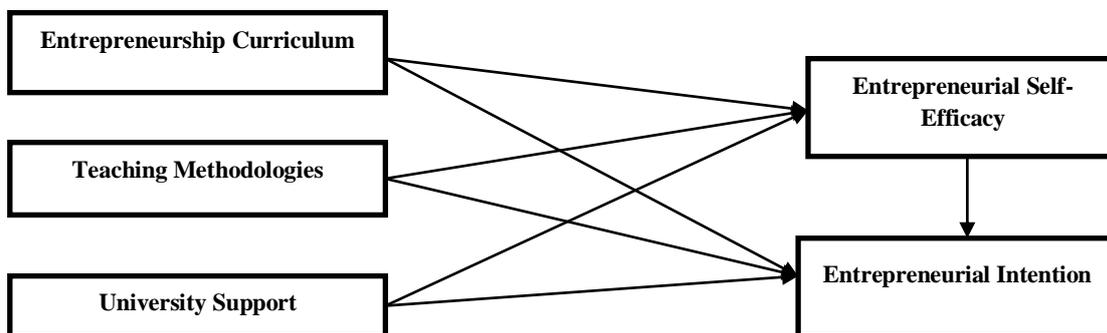


Fig. 3: The Research Model

The population of this study comprises of engineering undergraduates from two public universities and two private universities in Malaysia who were sampled using purposive sampling method. Respondents were gathered through dissemination of online questionnaire with two inclusive criteria, which are: (i)

respondent is an engineering undergraduate student from the four universities; and (ii) respondent has taken and completed entrepreneurship education. A total of 292 valid questionnaires collected from the respondents was used in this study. There were slightly more female students, accounting for 52.7% compared to only 47.3%

male students. About half of the students are below the age of 25 while 42.1% are between the age of 25 and 30 years old, and 7.5% were above 30 years old.

The questionnaire was developed based on adaptation of items from Rengiah [62] for the measurement of entrepreneurship education, Urban [63] for entrepreneurial self-efficacy, and Linan et al. [64] for entrepreneurial intention. Entrepreneurship education has 27 items divided into entrepreneurship curriculum, teaching methodologies and university support with 9 items each. Meanwhile, entrepreneurial self-efficacy has 14 items and entrepreneurial intention has 6 items. All the measurement scales are based on a 5-point Likert scale. A pilot study was conducted using a sample of 30 respondents which determine the internal consistency of the measurement scales. The values of Cronbach's Alpha for the three measurement scales were all above 0.70,

indicating satisfactory internal consistency. Data collected from the online questionnaires were analyzed with SPSS version 26.0 mainly for descriptive analysis, and SmartPLS3.3.5 for inferential analysis.

#### IV. RESULTS

##### A. Measurement Model Assessment

The assessment of the measurement models provides evidences on the reliability and validity of the measurement scales at item (indicator) and construct levels. Table 1 presents the indicator and construct reliability and validity of the five measurement models. Results indicated that convergent validity is adequate with all items having outer loading, Cronbach's Alpha and Composite Reliability more than 0.70, and Average Variance Extracted more than 0.50 [65].

Construct	Indicator	OL	CA	CR	AVE
Entrepreneurship Curriculum	DA1	0.809	0.935	0.946	0.659
	DA2	0.818			
	DA3	0.810			
	DA4	0.820			
	DA5	0.782			
	DA6	0.821			
	DA7	0.808			
	DA8	0.816			
	DA9	0.820			
Teaching Methodology	DB1	0.836	0.947	0.955	0.703
	DB2	0.836			
	DB3	0.844			
	DB4	0.830			
	DB5	0.848			
	DB6	0.827			
	DB7	0.833			
	DB8	0.846			
	DB9	0.847			
University Support	DC1	0.844	0.935	0.946	0.659
	DC2	0.830			
	DC3	0.799			
	DC4	0.793			
	DC5	0.785			
	DC6	0.822			
	DC7	0.796			
	DC8	0.823			
	DC9	0.813			
Entrepreneurial Self-efficacy	CA1	0.781	0.960	0.964	0.939
	CA2	0.810			
	CA3	0.781			
	CA4	0.795			
	CA5	0.832			
	CA6	0.805			
	CA7	0.826			
	CA8	0.799			
	CB1	0.810			
	CB2	0.820			
	CB3	0.780			
	CC1	0.795			
	CC2	0.805			
	CD1	0.791			

	CD2	0.750			
Entrepreneurial Intention	E1	0.799	0.892	0.918	0.651
	E2	0.815			
	E3	0.806			
	E4	0.739			
	E5	0.883			
	E6	0.792			

Table 1: Indicator and Construct Reliability and Validity

Discriminant validity of the measurement models was determined using Fornell-Larcker Criterion which is shown in Table 2 and Hetero-Trait Mono-Trait (HTMT) ratio in Table 3. Based on Fornell-Larcker criterion, it was found that all values on the top of the column is greater than any numbers below it and to its left, implying that the squared roots of AVE for the same construct is always higher that

the squared roots of AVE of different construct [66]. Thus, this indicates an acceptable discriminant validity for the measurement models. The HTMT ratio in Table 3 further confirmed the discriminant validity based on the values presented to be less than 0.850. The cut-off value of acceptance to determine construct validity is less than 0.850 [65].

Constructs	1	2	3	4	5
Entrepreneurship Curriculum (1)	0.812				
Teaching Methodologies (2)	0.614	0.839			
University Support (3)	0.762	0.698	0.812		
Entrepreneurial Self-Efficacy (4)	0.583	0.483	0.566	0.799	
Entrepreneurial Intention (5)	0.683	0.548	0.655	0.780	0.807

Table 2: Discriminant Validity with Fornell-Larcker Criterion

Constructs	1	2	3	4	5
Entrepreneurship Curriculum (1)					
Teaching Methodologies (2)	0.650				
University Support (3)	0.814	0.742			
Entrepreneurial Self-Efficacy (4)	0.614	0.503	0.593		
Entrepreneurial Intention (5)	0.744	0.589	0.714	0.840	

Table 3: Discriminant Validity with HTMT Ratio

Collinearity issue was determined based on Variance Inflation Factor (VIF) which should be below 5.00 for every construct [67]. Table 4 indicated that the condition is met, thus implying that there is no collinearity issue for the measurement models in this study.

Constructs	Entrepreneurial Self-Efficacy	Entrepreneurial Intention
Entrepreneurship Curriculum	2.460	2.647
Teaching Methodologies	2.012	2.034
University Support	2.985	3.068
Entrepreneurial Self-Efficacy		1.619

Table 4: Collinearity Issue with Variance Inflation Factor

**B. Structural Model Assessment**

**a) Direct Path Analysis**

Figure 4 presents the bootstrapping analysis result depicting the direct paths. Table 5 further illustrates the result of this analysis. The result shows that seven of the research hypotheses were supported but two hypotheses

which relate teaching methodologies with entrepreneurial self-efficacy and entrepreneurial intention were not supported. Hence, only entrepreneurship curriculum and university roles were significant predictors of entrepreneurial self-efficacy and entrepreneurial intention.

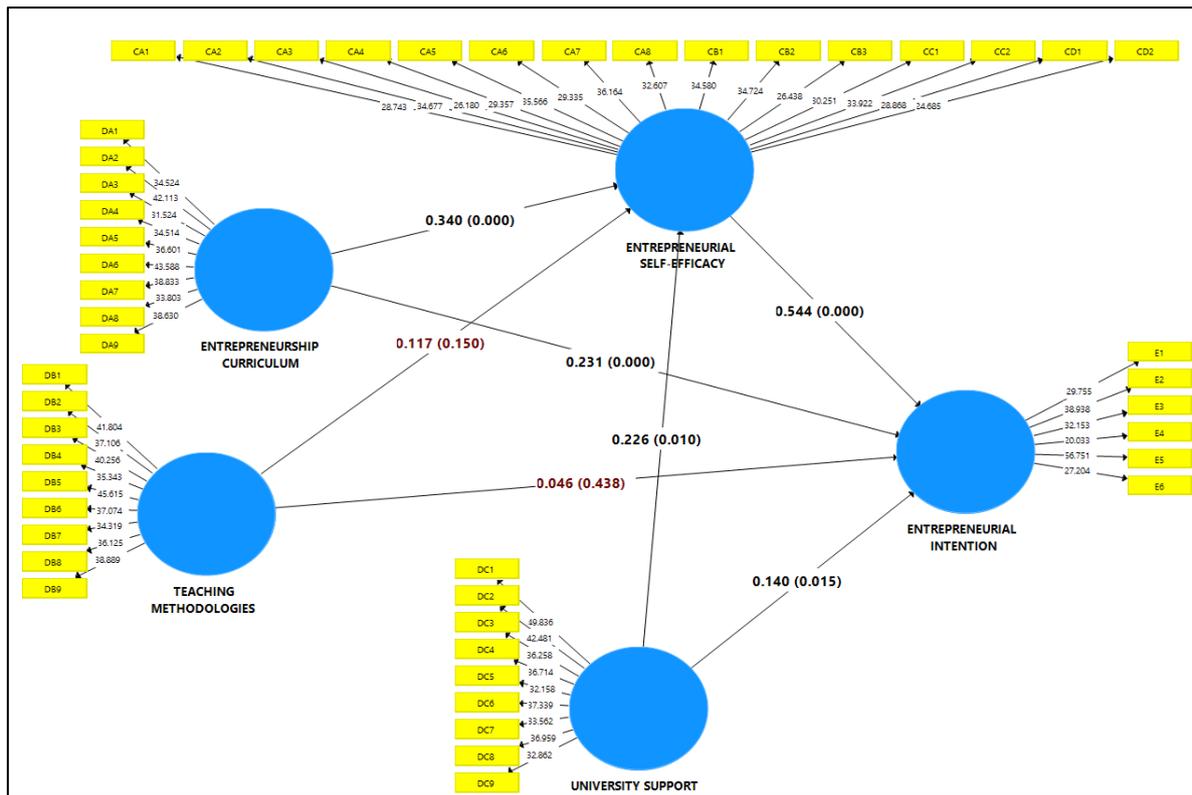


Fig. 4: Bootstrapping Analysis Result

	Path	Beta (β)	T-Statistics	p-Value	
H1	EE → ESE	0.613	13.392	0.000	Supported
H2	EE → EI	0.553	11.000	0.000	Supported
H3	EC → ESE	0.340	4.716	0.000	Supported
H4	EC → EI	0.231	4.142	0.000	Supported
H5	TM → ESE	0.117	1.443	0.150	Not Supported
H6	TM → EI	0.046	0.776	0.438	Not Supported
H7	US → ESE	0.226	2.600	0.010	Supported
H8	US → EI	0.140	2.432	0.015	Supported
H9	ESE → EI	0.544	10.041	0.000	Supported

Table 5: Direct Path Analysis

b) Mediation Analysis

The mediation analysis result presented in Table 6 shows that entrepreneurial self-efficacy mediated the relationships of entrepreneurship curriculum and university

support with entrepreneurial intention but not for teaching methodologies. Hence two hypotheses were supported and one was not supported.

	Path	Beta (β)	T-Statistics	p-Value	
H10	EE → ESE → EI	0.185	4.293	0.000	Supported
H11	TM → ESE → EI	0.064	1.449	0.148	Not Supported
H12	US → ESE → EI	0.123	2.475	0.014	Supported

Table 6: Indirect Path Analysis

C. Predictive Accuracy and Relevance of the Research Model

Based on the effect size ( $f^2$ ), entrepreneurship education as a whole has a very large effect size ( $f^2 = 0.601$ ) on entrepreneurial self-efficacy and medium ( $f^2 = 0.278$ ) on entrepreneurial intention. Similarly, entrepreneurial self-efficacy also has a very large effect size ( $f^2 = 0.622$ ) on entrepreneurial intention. As for the three aspects of entrepreneurship education, teaching methodologies have

negligible effect size ( $f^2 = 0.011$ ) while entrepreneurship curriculum ( $f^2 = 0.076$ ) and university support ( $f^2 = 0.028$ ) have small effect sizes on entrepreneurial self-efficacy. The effect size of teaching methodologies on entrepreneurial intention is also negligible ( $f^2 = 0.003$ ) while the effect sizes of entrepreneurship curriculum ( $f^2 = 0.067$ ) and university support ( $f^2 = 0.021$ ) are small on entrepreneurial intention. Overall, the predictive accuracy ( $R^2$ ) of the structural model to explain variance in entrepreneurial self-efficacy is weak ( $R^2 =$

0.382) but moderate ( $R^2 = 0.698$ ) for entrepreneurial intention. The model has predictive relevance to explain both entrepreneurial self-efficacy and entrepreneurial intention.

Table 7 summarizes the predictive accuracy and relevance of the structural model along with the effect sizes of the constructs.

Construct	Entrepreneurial Self-Efficacy			Entrepreneurial Intention		
	$f^2$	$R^2$	$Q^2$	$f^2$	$R^2$	$Q^2$
Entrepreneurial Self-Efficacy				0.622		
Entrepreneurship Education	0.601			0.278		
Entrepreneurship Curriculum	0.076	0.382	0.239	0.067	0.698	0.448
Teaching Methodologies	0.011			0.003		
University Support	0.028			0.021		

Table 7: Effect Sizes and Predictive Accuracy and Relevance

Note: (1) Effect size: small  $>0.02$ ; medium  $>0.15$ ; large  $>0.35$ ; (2) Predictive Accuracy ( $R^2$ ): weak  $>0.25$ ; moderate  $>0.50$ ; substantial  $>0.75$

Source: [66]

**D. IPMA Result**

The Importance-Performance Map Analysis (IPMA) was also carried out to determine which aspects of entrepreneurship education need to be given greater consideration in terms of importance (total effects) and performance. In terms of importance, it is shown that entrepreneurship education is the most important to enhance entrepreneurial self-efficacy and entrepreneurial intention, followed by university support and least of all, teaching methodologies. However, in terms of performance, it is shown that teaching methodologies have the highest performance followed by university support and least of all, entrepreneurship curriculum.

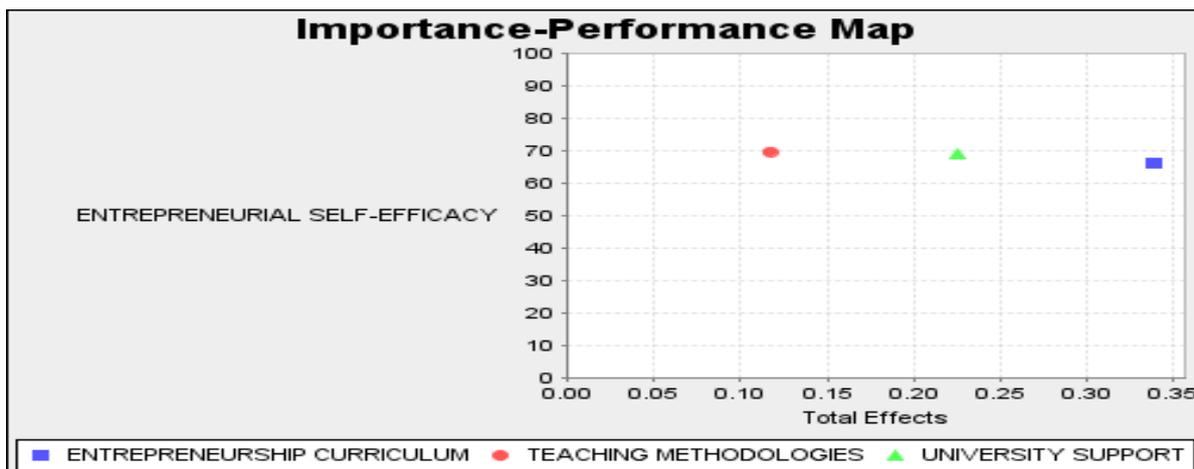


Fig. 5: IPMA Result for Entrepreneurial Self-Efficacy

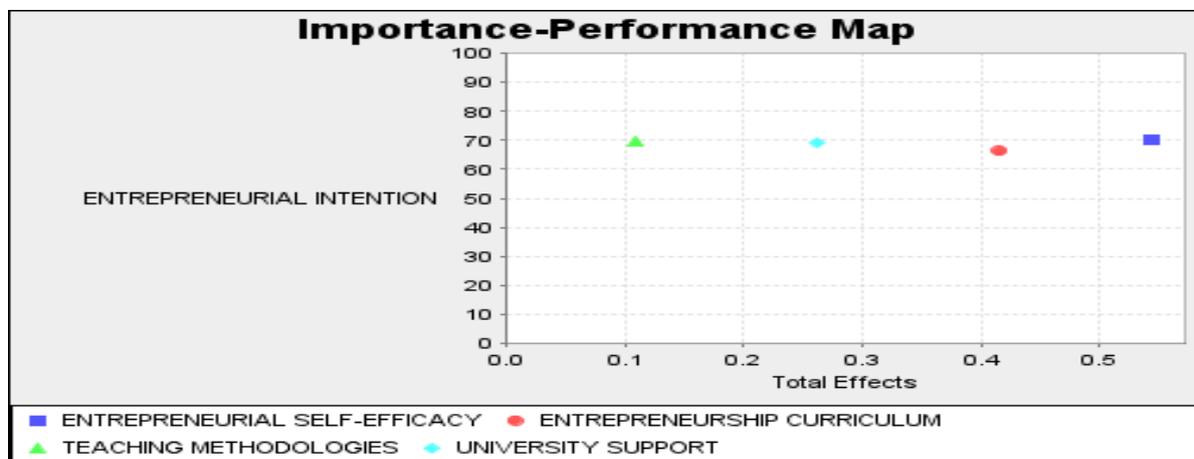


Fig. 6: IPMA Result for Entrepreneurial Intention

Constructs	Entrepreneurial Self-Efficacy		Entrepreneurial Intention	
	Total Effects (Importance)	Performance	Total Effects (Importance)	Performance
Entrepreneurship Curriculum	0.340	66.338	0.416	66.338
Teaching Methodologies	0.117	69.744	0.109	69.744
University Support	0.226	69.223	0.263	69.223

Table 8: IPMA Results

## V. DISCUSSION

This study provided more empirical evidence to support previous findings regarding the positive influence of entrepreneurship education on entrepreneurial self-efficacy and entrepreneurial intention [14, 43, 46]. However, this study has explored more in-depth into the aspects of entrepreneurship education that matter the most in enhancing entrepreneurial self-efficacy and entrepreneurial intention. Interestingly, this study showed that entrepreneurship curriculum is the most important aspect of entrepreneurship education in determining students' self-efficacy and intention for entrepreneurial endeavors. Further to that, teaching methodologies were considered insignificant in determining students' self-efficacy and intention for entrepreneurship but the IPMA result indicated that despite being the least important, it is critically tied to the performance of entrepreneurship education in persuading more students to be efficacious and intent on entrepreneurship. Additionally, this study has also highlighted the importance of university support as a needed environment of harnessing an entrepreneurial ecosystem at the university [68]. Hence, from a research perspective, the use of more advanced analysis methods offered in PLS-SEM such as IPMA can lead to more interesting discovery and provide more insights about entrepreneurial intention. These findings also lead to implications for practice particularly to act as a reminder about the needs of devising an effective curriculum that is aimed for entrepreneurship rather than about entrepreneurship. Ooi et al. [69] stated that there is a significant difference in a curriculum designed for entrepreneurship and about entrepreneurship as the former focuses on the production of students with entrepreneurial competences and capabilities whereas the latter is more towards explaining what entrepreneurship is by means of traditional methods. At the same time, it is also important to use teaching deliveries that are relevant to the 21st century students with technical backgrounds like engineering [70].

This study has provided interesting findings that can be applied in future research and practice. Despite its limitations in terms of population coverage whereby only engineering students were focused on, this study has provided a strong platform with robust measurement scales that can be emulated in future studies involving a wider array of educational fields in higher education institutions. Inasmuch, this study indicated three important aspects of entrepreneurship education but there are other aspects yet to be explored such as provision of other entrepreneurial supports (financial, expertise), participation in more specific entrepreneurial activities (incubators' program, start-up program, business pitching) and so forth. Further to that, the exploration of entrepreneurship curriculum,

teaching methodologies and university support in this study was quite general and not specific to certain designs, methods and approaches. Thus, more exploration in these areas could potentially bring more insights in future research endeavors.

## VI. CONCLUSIONS

Entrepreneurship education is indeed a much-needed experience for students yearning to become entrepreneurs but the questions of what and how are also critical in designing the curriculum, its delivery and supporting roles of the university to ensure its effectiveness to enhance students' capability and intention for entrepreneurship. This study concludes that entrepreneurial self-efficacy and entrepreneurial intention can be further enhanced with the right curriculum and delivery of entrepreneurship education, while at the same time, boosted with strong support from the university that emphasizes on entrepreneurship in both in and out of the classroom.

### • Author contributions

Maluda is the main contributor of the research article which entails her work in developing the research model, literature review, collecting and analyzing data. Alias is the co-author who is responsible for supervising the research and providing opinions for improving the article.

### • Competing interests

None

### • Grant information

None

### • Acknowledgements

None

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