The impact of entrepreneurial education on entrepreneurial intention of engineering students in Hong Kong

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Received 19 June 2016
Revised 30 October 2016
2 December 2016
5 December 2016
Accepted 6 December 2016

Abstract

Purpose – Theory of planned behavior (TPB) has been used to study the impact of entrepreneurial education (EE) on entrepreneurial intention (EI) for more than 20 years, yet an intensive literature review reveals that there are gaps in both the conceptual models and the research methods. The purpose of this paper is to investigate the impact of EE on EI with a view to address the gaps in previous research.

Design/methodology/approach – This research proposes a conceptual model that links the entire antecedent variables of TPB and the elaborated four components of entrepreneurship education (Why, What, How, and Who). The model is tested by a structural equation modeling with the empirical data from 200 engineering students from three universities in Hong Kong.

Findings – The empirical test reveals that the four components of entrepreneurial education do influence attitude, social norm, self-efficacy, and EI, correspondingly. Additionally, it also reveals that the four EE components and the three TPB antecedent variables are also interrelated with each other.

Originality/value – This study bridges specific education components and EI, providing significant insight into how the key components influence the entrepreneurial attitudes and intentions of students. It fills the gap in the knowledge required for fostering EI through entrepreneurship education. It not only answers the question on whether EE influences EI but also on how to nurture the intention by designing a relevant EE course.

Keywords Education components, Entrepreneurial intention (EI), Entrepreneurship education (EE), Theory of planned behaviour (TPB)

Paper type Research paper

1. Introduction

Entrepreneurship education started in business schools in the 1970s. In the past years, entrepreneurship education has been developing very rapidly. Across different countries, an increase in entrepreneurship education has also been found, such as in England (Levie, 1999), Spain, the Netherlands (Koch, 2002), Iran (Arasti *et al.*, 2012) and Malaysia (Hamzah *et al.*, 2016). Not surprisingly, entrepreneurship has become one of the fastest-growing subjects in colleges and universities (Solomon *et al.*, 2002; Vesper and Gartner, 1999). Entrepreneurship courses, programs, and activities are not only offered in schools of business but are also popular among engineering, social science, and arts students (Kuratko, 2005).

Entrepreneurship education focuses on developing entrepreneurial knowledge, capacity, skills as well as entrepreneurial attitudes and intentions that are congruent with the needs of the economy. Levie and Autio (2008) argued that entrepreneurship education is a good means to encourage entrepreneurship. The authors used seven years of Global Entrepreneurship Monitor data consisting of 232 year-country observations in 54 countries and showed that entrepreneurship education significantly impacts entrepreneurial activities and improves actual and potential entrepreneurial activities.

Management Decision
Vol. 55 No. 7, 2017
pp. 1371-1393

0025-1747
DOI 10.1108/MD-06-2016-0392

The study by Fox and Pennington (2009) also showed that entrepreneurship education has a positive impact on economic development through business start-ups that create additional jobs and revenues.

Are there any academic evidences that state EE influences students' entrepreneurial intention (EI) and behavior? There are academic studies reporting that education can influence students' EI (Autio *et al.*, 1997; Davidsson, 1995; Kolvereid, 1996a; Tkachev and Kolvereid, 1999). Chen *et al.* (1998) found that entrepreneurship students have significantly higher self-efficacy than nonentrepreneurship students, which significantly determines EI. This is also supported by Lüthje and Franke (2002) that students who studied entrepreneurship in undergraduate curriculum were more likely to create own businesses. Botha *et al.* (2006) and Del Valle and Castillo (2009) also confirmed the positive relationship between small business performance and training. Vesper and McMullan (1997) showed that entrepreneurship course is useful to improve students' decision-making skills during the startup process. This was supported by Dutta *et al.* (2011) using the similar research settings. In a comparative study by Lee *et al.* (2005), regardless of where students were from i.e., USA or Korea, entrepreneurship education was significantly linked with EI.

Even though many studies have shown that entrepreneurship education has a significant impact on EI and entrepreneurial behavior, these studies reported only the results or outcomes of entrepreneurship education (i.e. change in attitudes and intention toward entrepreneurship or startup rate) but failed to answer why and how these changes resulted. In other words, these studies were limited to a relatively general level without dealing with what actually caused the changes. As noted by Littunen and Virtanen (2006), Lortie and Castogiovanni (2015), and Nabi *et al.* (2016), more work needs to be done to reveal how exactly does entrepreneurship education influence EI. Undoubtedly, understanding of the "why" and "how" can provide an unambiguous picture for designing an entrepreneurship course or program by offering clearer education objectives, more appropriate teaching contents, and effective teaching methods. The question whether EE influences EI is useful but not an urgent one as of now. We would like to ask the following questions:

What education component influences attitude toward EI?

What education component influences social norm toward EI?

What education component influences perceived control toward EI?

What are the systematic relationships among educational components, attitude, social norm, perceived control as well as EI?

Additionally, the theoretical models that previous research is based on varied quite a lot as elaborated in literature review in the next section. The inconsistency in research models will be difficult to generate a generic theory in studies on the impact of EE. To fill the gap in the knowledge required for fostering students' entrepreneurial attitudes and intention through formal academic training, this research aims to bridge entrepreneurship education and EI based on a robust and complete intention model (i.e. theory of planned behavior (TPB)) by elaborating on the specific effect of entrepreneurship education components on EI. The result will be useful for contributing toward our systematic understanding of what specific elements of EE will enhance students' EI. We hope the result will also be useful for teachers to design the syllabus of an entrepreneurial course.

2. Literature review and research questions

In the 1970s, entrepreneurship research was mostly on creation of new venture and strategic management of small businesses. Since the 1980s, research on EIs emerged. The impact of social, political, and economic variables on EIs started to be discussed. Bird's seminal publication was the first to examine the topic of EIs through cognitive perspectives and offered a psychological model to explain how EIs are formed. The study on the impact of education on EI did not start until the 1990s.

Krueger and Carsrud (1993) were the first to apply the TPB (Ajzen, 1991) to the field of entrepreneurship. Although this research was conceptual, it produced very positive implications to conduct theory-driven research on the EI afterwards in both practice and education fields. Research based on TPB has been continued in the past 20 years.

The TPB has made a considerable contribution to the entrepreneurship literature. It is perhaps the best model that supports theory-based research on EI. However, Lortie and Castogiovanni (2015) reviewed 42 papers and concluded that there are many questions and gaps that remain unanswered and unfilled in the research based on TPB. They recommend scholars to continue in this stream of research for more significant contributions.

After reviewing 42 articles on entrepreneurship intention and behavior based on TPB, Lortie and Castogiovanni (2015) believed that there is a lack of understanding between different ways of using TPB. The way these articles used TPB was very different and cannot be comparable at all since the 42 articles picked different variables from TPB. Among the 42 articles, only one article (Kolvereid and Isaksen, 2006) tested the entire model of TPB while others considered only parts of TPB, either antecedents or alternate configurations of the model. However, all these papers claimed to have conducted research based on TPB model!

They also found that the exogenous factors are not directly related to entrepreneurship education but other factors like acquiring business skills, prior exposure to entrepreneurial activity and resource availability. The exogenous factors seem to be more relevant to experienced entrepreneurs than inexperienced students. In fact, Lortie and Castogiovanni (2015) concluded that research based on TPB has avoided student samples. It seems that there are two streams of entrepreneurial research based on TPB, the first about entrepreneurs in practice stream and the second about students in education stream.

In the education stream, the research by Fayolle *et al.* (2006) was perhaps the first to conduct research aiming at producing theory-grounded knowledge on the impact of EE on the EI of students. He applied TPB to investigate the relationship between EE and students' EI by elaborating EE content into know-what, know-how, know-why and know-who and know-when. However, latest research is still mostly trying to test whether TPB can explain the impact of EE in terms of EI without exploring further what education content really influences EI (Nasr and Boujelbene, 2014; Nasr and Boujelbene, 2014; Nasr and Boujelbene, 2014). Nabi *et al.* (2016) reviewed 159 papers from 2004 to 2016 and concluded that EE impact research severely under-describes the actual pedagogies being tested, and there are obviously contradictory findings from previous research. They suggested future research is still needed on EE impact from more elaborated education components and pedagogical perspective.

Just like the practice stream, the way researchers use TPB model is very different and is not comparable for generation of any generic theory or fact. Even the seminar work by Fayolle *et al.* (2006) only covers perceived control and intention. We reviewed all available recent research and surprisingly found similar conclusions, as reported in Table I.

It seems that most models are not complete, EE components are not elaborated, the results are not consistent, most are still testing whether EE is influential rather than how EE is influential, and the research methods are very different, not necessarily using structure equation modeling (SEM) to test the TPB model.

From a methodological perspective, if other antecedents are not included, part of the relationship may not be valid, not mentioning the entire model. The reason is very simple: there could be co-correlation among multiple variables. If one variable is added into a multiple correlation testing, the result can be totally different. Several simple correlation tests are not the same as one multiple correlation, not mentioning the SEM with network relationship.

The research based on TPB model aims to help educators to better understand students' intentions and thus to provide better training. However, the model is not complete, and the education components are not elaborated, as it can only tell us whether there is impact but cannot help us know how and where to improve the education accordingly.

Table I.
A review of recent research on the impact of EE on EI based on TPB models

Reference	Yes/No of EE	EE content elaboration	Variables of theory of planned behavior					Other factors	Research methods
			Attitude	Social norm	Perceived control of	Intention	Action		
Fayolle		✓			✓	✓		✓	SEM
Graevenitz *et al.*	✓		✓		✓				Bayesian equation
Engle *et al.* (2011)	✓			✓		✓		✓	n/a
Arasti *et al.* (2012)	✓		✓		✓	✓		✓	percentage
Karali (2013)	✓		✓	✓	✓	✓		✓	Before and post comparison
Kautonen *et al.* (2013)			✓	✓	✓	✓	✓		SEM
Karali (2013)	✓		✓	✓	✓	✓			SEM
Kittim *et al.* (2014)	✓		✓	✓	✓	✓			Binary logistic correlation
Nasr and Boujelbene (2014)	✓		✓		✓	✓	✓	✓	Yes or no question
Rauch and Hulsink (2015)	✓		✓		✓	✓	✓		Correlation and comparison
Saeed *et al.* (2015)	✓			✓	✓	✓		✓	Correlation
Buana		✓	✓	✓	✓	✓		✓	Mean
Din *et al.* (2016)	✓		✓		✓				Simple correlation
Hamzah *et al.* (2016)			✓	✓	✓	✓			Simple correlation

3. Hypotheses formulation

In order to develop a detailed education model, the specific variables for the two parts of the primary conceptual model should be studied. The first part, EI, is developed based on the TPB that consists of four variables: EI, attitude toward entrepreneurship, subjective norm, and perceived behavioral control. The second part focuses on specific entrepreneurship education components, which include four different learning variables: know-why, know-who, know-how, and know-what (Johannisson, 1991). Thus, there are totally eight variables considered in the education-EI. This section presents how the relationships among these variables are hypothesized. It can be divided into three parts: hypotheses related to TPB, hypotheses among entrepreneurship education components, and hypotheses between entrepreneurship education and TPB.

3.1 Hypotheses related to TPB

3.1.1 Verifying the effect of the three antecedents of EI. Many previous empirical studies on entrepreneurship have confirmed the relationship between the three attitudinal antecedents (attitude toward entrepreneurship, subjective norm, and perceived behavioral control) and EIs (Kolvereid, 1996a; Krueger *et al.*, 2000). However, the findings of existing literature on the direct relationship between subjective norm and EI are relatively inconsistent. Some researchers found subjective norm to significantly explain EI (Kolvereid, 1996a; Kolvereid and Isaksen, 2006; Tkachev and Kolvereid, 1999), whereas others found subjective norm to be insignificant (Autio *et al.*, 2001; Krueger *et al.*, 2000). Although based on the TPB, subjective norm has a direct impact on EI (Ajzen, 1991, 2005), more empirical findings regarding the influence of subjective norm are required to support the theoretical proposition (Krueger *et al.*, 2000). Furthermore, more empirical studies have been called for confirming the TPB in entrepreneurship research field (Kolvereid, 1996a; Krueger *et al.*, 2000). In order to verify the TPB model in the context of engineering students in our study, we suggest the following hypotheses:

H1a. Attitude toward entrepreneurship has a positive effect on the EI of students.

H1b. Subjective norm with respect to entrepreneurship has a positive effect on the EI of students.

H1c. Perceived behavioral control with respect to entrepreneurship has a positive effect on the EI of students.

3.1.2 The interrelationship among the three antecedents. In the formation process of intention, one antecedent may share the covariance of the other two (Ajzen, 1985, 1991, 2005; de Vries *et al.*, 1988). Some researchers have argued that attitude toward entrepreneurship, subjective norm, and perceived behavioral control are not independent (Taylor and Todd, 1995; Chang, 1998). This subsection discusses the relationships among the three antecedents.

3.1.3 Subjective norm and attitude toward entrepreneurship. Persuasion theory assumes that persuasive communication influences one's current beliefs and attitudes by producing new beliefs (Eagly and Chaiken, 1993). In this sense, people can internalize the opinions and advice of others and gradually change their original attitude toward a behavior.

The cognitive dissonance theory suggests that a person is likely to change his/her decision or behavior to seek cognitive consistency when inconsistence exists (Festinger, 1957). Thus, a person may change his or her attitude toward behavior in order to feel affiliated with people who are significant to this person.

There is also empirical evidence in business research indicating the positive relationship between subjective norm and attitude (Al-Rafee and Cronan, 2006; Chang, 1998; Liao *et al.*, 2010;

Lim and Dubinsky, 2005; Taylor and Todd, 1995). These findings supported that normative beliefs can be internalized through information from some sources:

H2. Subjective norm positively influences the students' attitude toward entrepreneurship.

3.1.4 Subjective norm and behavioral control. Perceived behavioral control reflects beliefs about the control over an entrepreneurial behavior in terms of entrepreneurial skills, knowledge, resources, or opportunity. This factor relates to the perceived capability (i.e. self-efficacy) of an individual to perform the entrepreneurial behaviors. According to Bandura's (1986) social cognitive theory, social persuasions play an important role in one's capability beliefs. The author argued that people could be persuaded to believe that they have the skills and capabilities to perform a behavior successfully. For example, the verbal encouragement of "I know you can do it" could help a person build confidence and achieve a goal. Such encouragement could help people to remove self-doubt and concentrate on their effort to perform a task (Bandura, 1997). Thus, persuasive comments have significant impact on one's capability beliefs. Effective persuasive comments make people trust in their capabilities and ensure that they have certain control over the behavior:

H3. Subjective norm influences the perceived behavioral control of students over the entrepreneurial activities.

3.1.5 Behavioral control and attitude toward entrepreneurship. Entrepreneurship is complex and challenging, and the entrepreneurial process involves uncertainties and risks. In order to succeed, one needs skills, abilities, confidence, and resources required to cope with the uncertainties and control the entrepreneurial actions. The higher level that the control is perceived, the more positive evaluation of the entrepreneurial action (i.e. carrying out the entrepreneurial action successfully) will result. According to TPB, evaluation of the entrepreneurial behavior is the belief about the expected consequence of entrepreneurship (i.e. behavioral belief), which reflects one's attitude toward entrepreneurship (Ajzen, 1991, 2005):

H4. Perceived behavioral control influences attitudes of students toward entrepreneurship.

3.2 Hypotheses among entrepreneurship education components

Balance of the diversity of education components is important to entrepreneurship education programs/courses (Ghosh and Block, 1993; Gibb, 1988). Based on Johannisson (1991) classification, we identified that know-what, know-why, know-who, and know-how are the fundamental components of entrepreneurship programs/courses at introductory level. Know-what refers to concept and knowledge of entrepreneurship; know-why is about values and motives of initiating entrepreneurial events; know-who concerns about the social interaction, that is, the interaction with teachers, successful entrepreneurs, or experts in the entrepreneurship research field; and know-how represents the abilities, techniques, and skills required for creating own business. All these are necessary components of developing the students' entrepreneurial attitudes and intentions (Johannisson, 1991; Rabbior, 1990). This section describes the hypotheses among the four education components.

3.2.1 Know-what and other three components. According to Johannisson (1991), know-what refers to the knowledge that is required for new venture creation. This factor should encompass elements of start-ups as well as knowledge required for business practice. They include development of new organizations, new products and new markets; resources allocation and finance analysis; salesmanship; idea generation; opportunity discovery; business planning; organization and team building; risk and rationality; legal issues; and SME management (Gartner, 1989). Furthermore, know-what also includes understanding of how to act entrepreneurially (Bailey, 1986); negotiation, leadership, creative thinking, and

technological innovation (Plaschka and Welsch, 1990); and tax framework and recruitment (Garavan and O'Cinneide, 1994).

Know-what is the basic component of entrepreneurship education (Fiet, 2001a) as it would be difficult to develop other three entrepreneurial competences without attaining the basic knowledge of entrepreneurship. Thus, acquiring the basic understanding of entrepreneurship will facilitate the development of other learning dimensions: know-why, know-who, and know-how (Johannisson, 1991). Accordingly, in our education-EI model, we propose the following hypotheses:

H5a. Know-what positively influences know-why.

H5b. Know-what positively influences know-who.

H5c. Know-what positively influences know-how.

3.2.2 Know-why and know-who. Know-why refers to the values and motives of entrepreneurial activity (Johannisson, 1991). The purpose of know-why competence is to develop students' motivation to engage in entrepreneurial activities with the entrepreneurial values and perceptions they obtained in entrepreneurship courses/programs.

As the learning of know-why is to develop the values and motives of initiating entrepreneurial endeavor, students with know-why competence appear more active and aggressive to interact with professional people in the field of entrepreneurship. This can be explained by motivation theory (Deci, 1972; Hunt, 1965; Ryan and Deci, 2000). The motivation theory states that people tend to behave when it leads to rewards (benefits, worth/value, needs, or advantages) and to avoid the behavior which leads to punishment (negative effect/results or disadvantages).

Furthermore, the relationship between know-why and know-who can also be explained by the functions of information seeking in goal theory (Butler, 2000). The functions of information seeking consider that information seeking is motivated and can be examined in terms of motives, goals, or interest. High motives and interest in entrepreneurship will lead to strong desire to seek useful information to strengthen one's competences required for entrepreneurship.

Based on the discussion above, understanding the values, benefits, and importance of entrepreneurship will help students develop own values and motives to perform entrepreneurial activities that facilitate them to be more desired to interact with entrepreneurial referents in order to seek professional information, comments, and recommendations, and to know more about creating a new venture and managing a company. That is, know-why arouses the development of "know-who":

H6. Know-why positively influences know-who.

3.2.3 Know-who and know-how. Know-who is about social interaction (Johannisson, 1991). Entrepreneurs can collect updated information which is useful to obtain supports and resources required for identifying business opportunities and set up a new company. Thus, know-who is an important component of entrepreneurship education programs/courses (Johannisson, 1991; Ronstadt, 1990; Raichaudhur, 2005). Through the learning of know-who, the experience of the entrepreneurial professionals, especially the practicing entrepreneurs, can be regarded as a resource for students to know more about the practice of entrepreneurship (Stokes and Wilson, 2010).

The learning of know-who has a positive impact on the development of know-how. This can be explained in Bandura and Walters' (1977) social leaning theory. The theory posits that learning occurs when a person is motivated to perform a behavior by observing experienced people to perform it. In general, people tend to imitate the behavior of models

that are skillful and are experts in the behavior (Luthans and Kreitner, 1985; Goldstein and Sorcher, 1974). Therefore, the information, opinions, and suggestions obtained from the entrepreneurial referents as well as their successful or failed experiences in entrepreneurship help the students have a better understanding of what needs to be done and how to do it in order to carry out the entrepreneurial events successfully (i.e. know-how):

H7. Know-who positively influences know-how.

3.3 Hypotheses between entrepreneurship education and TPB

3.3.1 Know-why and attitude toward entrepreneurship. According to Ajzen (1991, 2005), attitude is determined by beliefs, and these beliefs are related to possible outcomes of entrepreneurial behaviors. They are subjective assessments that indicate if an individual has positive feeling or negative feeling about performing entrepreneurship (Ajzen, 1991, 2005). Understanding of the values, motives, benefits, and importance of entrepreneurial actions (know-why) exerts certain impact on one's attitude toward entrepreneurship. This could be explained by adjustment or utilitarian function of attitude by Katz (1960) and probabilogical model by Wyer (1970, 1974).

The adjustment or utilitarian function of attitude (Katz, 1960; Katz and Stotland, 1959) states that attitudes allow people to maximize rewards (values and benefits) in a context. People form favorable attitudes toward an object associated with satisfaction of needs or benefits. Therefore, attitudes are energized and directed by certain motives or needs (Katz, 1960). Accordingly, people who believe that entrepreneurship is important, beneficial, and valuable to them (i.e. know-why) are more likely to have a favorable attitude toward entrepreneurship.

The probabilogical model explains the changes in attitude in more detail. According to the model, people will change their beliefs when they have certain logically related beliefs. As noted by Wyer (1970, 1974), people's belief in a conclusion is related to their beliefs associated with a premise, when these beliefs are expressed as subjective probabilities. Based on Wyer's model, changes in students' attitudes toward entrepreneurship (beliefs in a conclusion that entrepreneurship is good for them) are related to changes in their beliefs associated with a related premise showing that entrepreneurial engagement is valuable (Wyer and Hartwick, 1980).

Therefore, the learning of know-why is important to develop students' attitude toward entrepreneurship. With the knowledge of "know-why", the students are expected to develop their own values and motives toward engaging in entrepreneurial activities, that reflect their attitude toward entrepreneurship:

H8. Know-why positively influences attitude toward entrepreneurship.

3.3.2 Know-who and subjective norm. Know-who refers to social interaction. In this study, know-who comprises interaction with entrepreneurial professionals, including entrepreneurship teachers, guest speakers, and local practicing or successful entrepreneurs. The learning of know-who is theorized to have an impact on subjective norm which is about social/normative and informational influences (on entrepreneurship). This can be explained by social learning theory (Bandura and Walters, 1977) and social capital theory (Lin *et al.*, 1981).

Social learning theory (Bandura and Walters, 1977) depicts that learning occurs in a social environment. According to this theory, interaction with entrepreneurial professionals is an important source of entrepreneurial knowledge and motivation. Social learning not only affects the skills and techniques of entrepreneurship (know-how) but also the perceptions about social norm on entrepreneurship. Having a key function in the interaction or socialization of the students regarding entrepreneurship, the entrepreneurial experts (teachers,

guest speakers, and practicing entrepreneurs) would explicitly or implicitly deliver entrepreneurial norms and skills to the students, hence increase the intention of students to pursue an entrepreneurial career (Davidsson and Honig, 2003; Scherer *et al.*, 1989):

H9. Know-who positively influences subjective norm.

3.3.3 Know-how and perceived behavioral control and subjective norm. Know-how refers to the skills and abilities required for new business creation. Vesper (1990) suggested that education is an effective way to develop students and nascent entrepreneur the entrepreneurship and business skills and techniques to strengthen their self-efficacy to start up. The purpose of know-how is to teach students to prepare a business plan, identify business opportunities, and develop innovative products to the market through evaluating the risk and uncertainties involved.

The relationship between know-how and perceived behavioral control is relatively obvious. The learning of know-how can improve one's perceived behavioral control. According to Bandura's (1986) social cognitive theory, skills and abilities acquired are important sources of the development of self-efficacy (self-capability). Thus, know-how competence can strengthen one's capability to perform entrepreneurship. By applying the entrepreneurial skills and techniques learnt, the students are allowed to summarize the key learning points from their practical experiences. These practices will give useful feedback to the students:

H10. Know-how positively influences perceived behavioral control.

3.4 Summary of the conceptual model

Summarizing all the hypotheses developed above, an intentional entrepreneurship education model is developed as shown in Figure 1.

Developed based on the preliminary conceptual model, the education-EI model contains ten sets of hypotheses, and these hypotheses cover all the research questions of this thesis. The hypotheses can be divided into three groups. The first group includes hypotheses related to TPB: *H1a*, *H1b*, *H1c*, *H2*, *H3*, and *H4*. The second group of hypotheses is related to the relationship among the entrepreneurial education components. This group includes *H5a*, *H5b*, *H5c*, *H6*, and *H7*. The last group of hypotheses presents the relationships between entrepreneurship education and the TPB. Three hypotheses are included (*H8*, *H9*, and *H10*).

The hypotheses are developed based on theoretical support. The theories used to explain the relationships among the variables are summarized in Figure 1. , and *H1c* are formulated

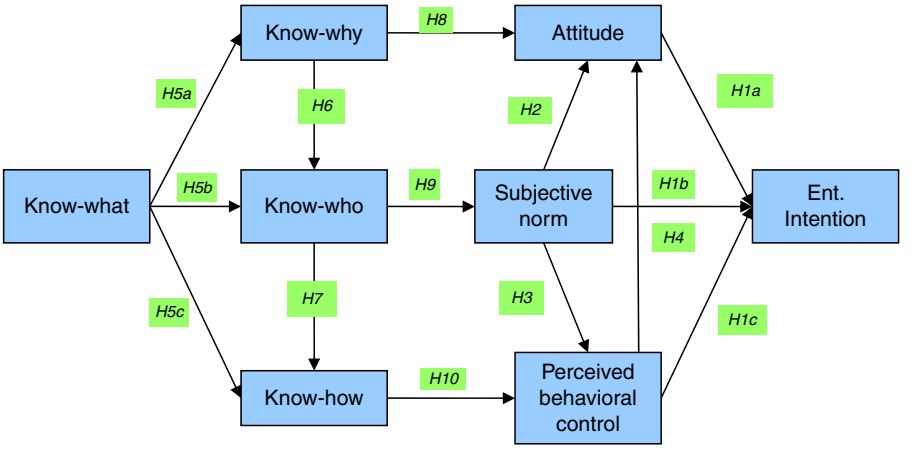

Figure 1.
Summary of theories used for hypothesis formulation

based on the TPB (Ajzen, 1991, 2005), and *H2* is developed based on persuasion theory (Eagly and Chaiken, 1993) and cognitive dissonance theory (Festinger, 1957). *H3* is developed based on Bandura (1986) social cognitive theory, while *H4* is formulated based on expectancy theory (Eagly and Chaiken, 1993; Feather, 1982). and *H5c* are developed based on Fiet (2001a) argument and Bloom (1956) taxonomy of learning level that know-what (knowledge) is the most basic component of entrepreneurship education that facilitates other three components. *H6* is supported by motivation theory (Deci, 1972; Hunt, 1965; Ryan and Deci, 2000) and function of information seeking in goal theory (Butler, 2000), while *H7* is developed based on Bandura and Walters (1977) social learning theory. *H8* is explained by adjustment or utilitarian function of attitude by Katz (1960) and Wyer's (1970, 1974) probabilogical model. *H9* is developed based on social learning theory (Bandura and Walters, 1977) and social capital theory (Lin *et al.*, 1981). Lastly, *H10* is supported by Bandura (1986) social cognitive theory.

4. Data and methodology

4.1 Measures

In the field of entrepreneurship research, cross-sectional survey has been widely used (Autio *et al.*, 2001; Kristiansen and Indarti, 2004; Krueger *et al.*, 2000; Lüthje and Franke, 2003) and regarded appropriate and reliable to investigate EIs. Autio *et al.* (2001) applied TPB to analyze factors influencing EI among university students. Similarly, Kristiansen and Indarti (2004) conducted surveys among Indonesian and Norwegian students to study the impact of different economic and cultural texts. In addition, Lüthje and Franke (2003) explored whether personality traits or contextual founding conditions (independent variables) have an impact on the intention (dependent variable) to create own business. Kolvereid (1996b), Tkachev and Kolvereid (1999) and Gird and Bagraim (2008) also used cross-sectional survey design to investigate the EI of students.

All these studies showed that survey design is effective to investigate the EI of students. Thus, in this current study, a cross-sectional survey design is applied to investigate the effect of education components on entrepreneurial attitudes and intentions of the engineering students.

In order to achieve the aim of this study, a questionnaire was developed to measure the response of the students regarding the constructs of the education-EI model. The ten sets of hypotheses developed were statistically tested in order to study the specific effect of the education components. The questionnaire was composed of three sections. Section 1 consists of four TPB constructs. Section 2 had four constructs of education components. The section 3 addresses demographic information. According to the education-EI model, there are totally eight variables, which are measured by multiple-item scales. Each of the items was measured by a seven-point Likert scale, which is the most frequently used variation of the summated rating scale.

4.2 Data collection

Data collection was conducted in three Hong Kong universities in 2010. All students are from system engineering and engineering management department and tool a very comparable course called entrepreneurship for engineers. The students were in the first, second, or third year of study when they joined the survey. The numbers of questionnaire distributed and returned were 158 and 102, 100 and 72, and 36 and 27 in three universities, respectively. The total number of questionnaires distributed was 294, and 201 qualified copies were returned, leading to a return rate of 68 percent. The data profile is shown in Table II. ANOVA test of all criteria was conducted, and no significant differences were found among the sample in terms of age, year of study, work experience, and role model. However, there are some differences in term of gender which will be reported in a separate paper.

Characteristic	Study (*n*)	Group (%)
Gender		
Female	60	29.85
Male	141	70.15
Age		
< 20	2	1.00
20-22	122	61.00
23-25	57	28.50
> 25	19	9.50
Year of study		
Year 2	113	56.22
Year 3	82	40.80
Other	6	2.99
Work experience		
< 1 year	127	63.82
1- < 2 years	41	20.60
2- < 3 years	19	9.55
≥ 3 years	12	6.03
Role model		
No	109	54.77
Yes	90	45.23

Table II.
The profile of the participants

To avoid common method variance, precautions have been taken. All the questions are in random order, and the students did not have any hint about the dependent and independent variables. Students did not know about the TPB model either. Students were clearly informed that the questionnaires were not an assessment of their study but for conducting a research of a course in order to prevent the correlation is inflated. After data collection, we used both Harman's single-factor test and partial correlation procedures to control common method biases. The result shows that in our study, common method variance of the data was not significant. The consequent data analyses will provide accurate results.

4.3 Reliability and validity test

4.3.1 Reliability test. The reliability analysis of an instrument determines its ability to yield consistent measurements. Reliability refers the degree of internal consistency (Nunnally, 1978). Cronbach's α statistic, the most commonly used test methods for the internal consistency (Flynn *et al.*, 1994; Nunnally, 1978), was used to check the reliability of the measurement. As all items had correlation with other items in their scale greater than 0.3 (Hair, 2010), calculation of Cronbach's α was then proceeded. As can be seen in Table III, the variables used in this study (attitude toward entrepreneurship, subjective norm, perceived behavioral control, intention, and know-why/-who/-what/-how) had high values of Cronbach's α (i.e., > 0.7). Therefore, the measurements used (for both groups) in this study were reliable (Hair, 2010). Once the reliability of the scales had been established, validity tests were conducted.

4.3.2 Content validity. The content validity measures the adequacy with which a specific domain of content has been sampled (Nunnally, 1978). Its determination is subjective and judgmental (Emory, 1980). Items for the variables used in our study were carefully developed based on the literature on entrepreneurship and education. All the items were designed according to the definition of the constructs as well as the related findings of the

Table III.
Reliability and validity tests of the measurements

Item	Eint	Att	SN	PBC	*K*-what	*K*-why	*K*-who	*K*-how
1	0.845	0.873	0.886	0.792	0.713	0.846	0.777	0.834
2	0.861	0.846	0.898	0.837	0.828	0.883	0.761	0.845
3	0.883	0.877	0.901	0.861	0.771	0.833	0.844	0.824
4	0.854	–	–	–	0.833	0.795	0.842	0.840
5	–	–	–	–	0.831	0.747	0.812	0.820
6	–	–	–	–	–	–	0.787	–
Total (eigenvalues)	2.964	2.246	2.402	2.070	3.172	3.378	3.883	3.467
% of variance	74.097	74.861	80.080	68.993	63.437	67.557	64.718	69.339
Cronbach's α	0.883	0.831	0.876	0.770	0.852	0.878	0.890	0.889

Note: $n = 201$

existing literatures. Moreover, the measurements were reviewed by two scholars (an entrepreneurship professional and one academic in management research) and tested through ten selected undergraduate engineering students who were exposed to the entrepreneurship course and ten who were not. Their comments were collected, reviewed, and used to verify the appropriateness and comprehensiveness of the questionnaire. Thus, the measurements used in this study were considered to have content validity.

4.3.3 Construct validity. Construct validity measures the extent to which the items in a scale all measure the same construct. Principal component factor analysis was used to test the validity of the scales used (Bryman and Cramer, 2005; Entrialgo *et al.*, 2000) following the procedures of Flynn *et al.* (1994). Assumptions of the factor analysis of our data were fulfilled: an examination of the correlation matrix indicated that a considerable number of correlations exceed 0.3 and thus the matrix suitable for factoring, the Bartlett test of sphericity was significant and that the Kaiser-Meyer-Olkin measure of sampling adequacy was far greater than 0.6, and measures of sampling adequacy values (inspection of the Anti-Image correlation matrix) were well above the acceptable level of 0.5. Thus, data were suitable to proceed with factor analysis.

In Table III, the items for each of the eight factors were converted into a unique factor with a high factorial weight (> 0.5) explaining over 503 percent of variance (Tabachnick *et al.*, 2001). For each factor, the loadings of its items all exceeded 0.5, indicating that all items contributed to the factors that they represented (Hair, 2010). Thus, the findings showed that the construct validity of the measurements used in this thesis was achieved.

5. Results

In the conceptual model, know-what, know-why, know-who, and know-how were defined as exogenous variables, and attitude, subjective norm, perceived behavioral control, and EI were defined as endogenous variables in the model. To be able to test the inter-relationships among these variables, this study employs SEM path analysis based on AMOS 18.0 (Kline, 2005). The test results are shown in Figure 2 and Table IV.

The path analysis process revealed the χ^2 statistic to be 33.750 with 15 degrees of freedom ($p < 0.05$). The χ^2 value is sensitive to sample size and it is not a reliable model fit index. Thus, we employed multiple good-of-fit indices, which indicated good fit: GFI = 0.959, RMSEA = 0.079; AGFI = 0.902; NFI = 0.961; TLI = 0.959; CFI = 0.978; normed $\chi^2 = 2.250$.

Next, we proceeded in analyzing the specific relationships among the variables. As indicated in Table IV, all the paths were significant. The strongest path was between know-what and know-why (path coefficient = 0.685, $p < 0.001$), while the weakest path was between perceived behavioral control and attitude (path coefficient = 0.146, $p < 0.05$). Therefore, all the hypotheses of the conceptual model were accepted at a level of 0.05.

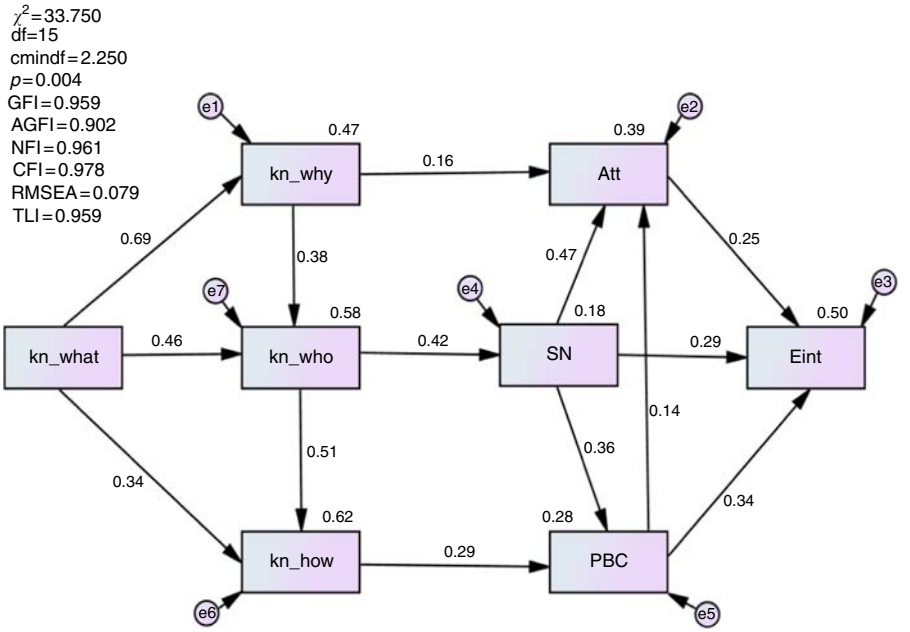

Figure 2.
Test results of the entrepreneurship education model (Standardized estimation)

Hypothesis				Estimate	SE	CR	*p*	Result
H1a	Att	→	Eint	0.248	0.063	3.953	***	Accepted
H1b	SN	→	Eint	0.285	0.064	4.449	***	Accepted
H1c	PBC	→	Eint	0.339	0.058	5.887	***	Accepted
H2	SN	→	Att	0.469	0.063	7.445	***	Accepted
H3	SN	→	PBC	0.354	0.063	5.654	***	Accepted
H4	PBC	→	Att	0.146	0.063	2.302	0.021	Accepted
H5a	k_what	→	k_why	0.685	0.051	13.324	***	Accepted
H5b	k_what	→	k_who	0.455	0.063	7.26	***	Accepted
H5c	k_what	→	k_how	0.339	0.062	5.467	***	Accepted
H6	k_why	→	k_who	0.376	0.063	5.994	***	Accepted
H7	k_who	→	k_how	0.508	0.062	8.176	***	Accepted
H8	k_why	→	Att	0.164	0.058	2.801	0.005	Accepted
H9	k_who	→	SN	0.421	0.064	6.57	***	Accepted
H10	k_how	→	PBC	0.285	0.063	4.554	***	Accepted

Table IV.
Test results of the hypotheses

The generalization of the model was further analyzed. The expected cross-validation index (ECVI) was used. ECVI examines the cross-validation of a sample across samples with similar size in the same population (Browne and Cudeck, 1989). In path analysis, ECVI values are calculated for three models: the null model, the hypothesized model, and the saturated model. The first model and the last model contain two extreme values of ECVI, and the hypothesized model contains a value in between. In our model, the value of ECVI was 0.379 which was between those of the saturated model (0.360) and the independence model (4.457), suggesting the generalization of the conceptual model of education-EI. That is, the education-entrepreneurial model is considered valid. The squared multiple correlation of the model was $R^2 = 0.50$, which states that 50 percent of variance in EIs was explained by this model.

6. Discussion and implications

Previous research contributes to our understanding of EE. However, it may only lead to such a theoretical conclusion: EE can enhance students' EI via attitude, and/or social norm and/or self-efficacy. The theory cannot answer the questions on what education elements contribute to attitude, social norm, and self-efficacy. This study integrates all the three antecedents in the TPB model and elaborates EE into four elements. In addition to the contribution from previous research, this study contributes to the following theoretical aspects, including TPB, role model theory, and experiential learning theory:

(1) First of all, this result helps us understanding the systematic nature of TPB. It is not one of the three that enhance EI, but all the three variables, namely, attitude, social norm, and perceive control. This should be the future direction of research based on TPB.

(2) Understand the reason of entrepreneurship (i.e. why) can enhance the positive attitude toward entrepreneurship. The core of TPB is the reasoning of people action and behavior. It is because a person has a positive attitude, he/she will take action accordingly. Nurturing positive attitude is the first step to predict the relevant intention and behavior. This theory is very useful in EE as well.

(3) Knowing the heroes and models in entrepreneurship (i.e. who) can enhance the social norm, and then EI. This result is consistent with the role model theory suggesting individuals compare themselves with reference groups of people who occupy the social role to which the individuals aspire (Calhoun, 2010). Therefore, case studies, guest speech, and interview of successful entrepreneurs will be good teaching approaches to teach this part.

(4) Know-how to do entrepreneurship will enhance self-efficacy (or perceived control) and then enhance EI. This suggests learning by doing or experiential learning approach in EE. Experiential learning theory refers to any learning that supports students in applying their knowledge and conceptual understanding to real-world problems or situations where the instructor directs and facilitates learning (Wurdinger and Carlson, 2009).

This study contributes to the understanding of a systematic approach to study EE and EI. It helps to validate that TPB is a solid and holistic model that explains not only whether EE influence EI but also what specific elements influence the three antecedents of TPB model. The theoretical and practical implications of its results and contribution will be explored below.

6.1 Theoretical implication

The findings of this study suggest a systematic approach to entrepreneurship education. In order to foster EI, three attitudinal perceptions of students should be first developed through the learning of know-what, know-why, know-who, and know-how. Reviewing the literature on entrepreneurship education, Kuratko (2005) claimed that the cognition among students should be emphasized as it is influenced by different contents.

However, in the field of entrepreneurship education, the education content designed to improve attitude toward entrepreneurship, subjective norm, and perceived behavioral control has not been well elaborated. The teaching of entrepreneurship in many cases is intuitive rather than scientific, based on the intuition and experience of teachers instead of a systematic education model (Béchard and Grégoire, 2005). Entrepreneurship educators and scholars have longed for a systematic education model for entrepreneurship, which details how to teach the subject and what the teaching content should be.

The teaching of entrepreneurial knowledge alone is insufficient to improve the three entrepreneurial attitudes of students. An effective entrepreneurship program/course should

teach not only "what" entrepreneurship is, but "why" to perform entrepreneurship, "how" to perform, and "who" will be helpful in the entrepreneurial endeavor (Fayolle *et al.*, 2006; Johannisson, 1991). Understanding of know-what can only facilitate other entrepreneurial learning (know-why/who/how), but it cannot directly improve students' attitude, subjective norm, and perceived behavioral control toward entrepreneurship. Apart from traditional lectures, other non-traditional methods should also be used in entrepreneurship education. The teaching of know-why should focus on an understanding of the values, importance, and benefits of entrepreneurship that helps the students to develop positive belief about entrepreneurship. Teaching methods for this component may include both guest lecture, videos of interviewing successful/famous/student entrepreneurs, and psychological assessment and discussion. The teaching of know-who should stress on providing opportunities for students to interact and communicate with entrepreneurial professionals, in order to collect useful opinions, suggestion, and information and learn from them. This competence can be developed through seminar and interview with practicing entrepreneurs. Know-how should focus on offering entrepreneurial project experience for students to apply and test their entrepreneurial knowledge and skills learnt from the entrepreneurship course. The teaching of this component may include games and exercises, business plan project, company visit, and computer simulations.

In summary, the systematic education approach this study proposes allows for the combination of education components and the EI in a theory-driven framework. Such teaching framework provides a bridge between fostering the EI of students and teaching the specific components, and it seeks to stress on a systematic approach to entrepreneurship education. Although some researchers have investigated the influence of education on the entrepreneurial attitudes and intention of participants (Autio *et al.*, 1997; Fayolle *et al.*, 2006; Kolvereid, 1996a; Tkachev and Kolvereid, 1999), they did not consider how the specific education components work in the formation process of EI of students. The review of recent literature identifies very similar pattern of linking EE and EI (Von Graevenitz *et al.*, 2010; Engle *et al.*, 2011; Arasti *et al.*, 2012; Karali, 2013; Kautonen *et al.*, 2013; Küttim *et al.*, 2014; Nasr and Boujelbene, 2014; Rauch and Hulsink, 2015; Saeed *et al.*, 2015; Din *et al.*, 2016; Hamzah *et al.*, 2016). Most do not elaborate EE into specific components but treat EE as one exogenous variable to the three antecedents of TPB model. Additionally, the entire three antecedents of TPB should all be coved to test the TPB model. Thus, our theory-driven approach to entrepreneurship education provides valuable evidence on teaching entrepreneurship in a systematic way.

The intention-focus education approach not only emphasizes know-what and know-how but also know-why and know-who. Thus, this approach provides more complete teaching content for an entrepreneurship course/program to foster the EI of students (i.e. awareness education). This theory-driven approach leads to the practical implications for providing guidelines on how to teach the four key education components in order to finally increase students' intention to start up. The implications for the teaching practice of entrepreneurship are discussed in the following section.

6.2 Practical implication

Typical business education or conventional entrepreneurship education usually stop at the level of know-what (Green, 2009); in contrast, entrepreneurship education should involve a wider learning content that moves forward to the development of other entrepreneurial competencies of know-why, know-who, and know-how. The implications for teaching what, who, why, and how will be elaborated below.

6.2.1 Teaching of know-what. Know-what is considered as the most fundamental element of an entrepreneurship course, which is the basis of teaching know-why, know-who, and know-how. The teaching purpose of know-what is to transmit entrepreneurial

knowledge to students. This education component includes entrepreneurial concepts, theories, skills, business functions and strategies, business plan, concepts of innovation, and creativity. The entrepreneurial knowledge is offered throughout the course from the most basic concepts to advanced ones.

Know-what competence can be achieved through a combination of lectures and case studies, which are the most prevalent pedagogical tools for teaching small business management and entrepreneurship (Ahiarah, 1989; Bennett, 2006). Lecturing or traditional teaching is effective to convey theories to students (Ahiarah, 1989; Fiet, 2001b), and case studies, for example, discussion of cases and real life examples of enterprises, can be applied in the classroom to convey entrepreneurial principles and theories (Ahiarah, 1989; Theroux and Kilbane, 2004). Recent development of Massive Online Open Course can also be used to teach know-what in an entrepreneurship course.

6.2.2 Teaching of know-why. Based on the learning of know-what, the next step is to develop know-why competence. The purpose of know-why component is to draw the attention of students to the "entrepreneurship world" and help them develop their own values and motives to perform entrepreneurial behaviors in the future. Teaching of this component thus emphasizes the values, importance, and benefits of entrepreneurship to both the society and individuals. Even if the students do not engage in entrepreneurial career, development of entrepreneurial spirits and skills is important for them as being creative, innovative, and adaptive to change is useful for people in all occupations for solving problems and dealing with risks and uncertainties. It is important to teach students how entrepreneurship is important to them and develop right attitude toward entrepreneurship.

The teaching method for this component may include lectures, watching videos (interviews with successful/young/male and female entrepreneurs), case study, self-assessment, or evaluation on personalities. In teaching this component, teachers should emphasize that entrepreneurs are from all backgrounds and give the students a positive outlook on their future opportunities in order to hook the students' attention and stimulate their interest in entrepreneurship. Furthermore, teachers should consider the effect of gender on attitude toward entrepreneurship and intention. Visiting and interviewing entrepreneurs, especially alumni entrepreneurs, are used in many courses now for students to understand the why and who components.

6.2.3 Teaching of know-who. The next step is to teach know-who by offering opportunities to the students to interact and communicate with entrepreneurial models through seminars or interviewing entrepreneurs and guest lectures. The purpose of this component is to develop effective interaction/communication between students and the entrepreneurial models, so that the students have chances to test their knowledge and business concepts and learn skills/techniques from those entrepreneurial referents and collect useful information and comments.

Given the theory of observational learning (Bandura, 1986), learning from entrepreneurs will have a crucial impact on the beliefs of students toward entrepreneurship. Therefore, selecting the right entrepreneurial models is a critical and careful step in the entrepreneurship course design. The entrepreneurial models may include successful and famous entrepreneurs, young and graduate entrepreneurs, and experts in the research field. Interaction with the successful and practicing entrepreneurs who are "closer" to the students in terms of age, academic background, cultural background, and gender will lead to a stronger interest in entrepreneurship and motivate them to imitate the experiences and behaviors of the entrepreneurs.

It is noted that role models have a significant effect on EI and that people who have entrepreneur parents or close friends are usually considered more suitable to exhibit entrepreneurial behaviors. What can entrepreneurship education do to cope with such belief?

Can we teach those who do not have entrepreneurial parents or close friends to create new businesses? These concerns reflect the importance of know-who.

6.2.4 Teaching of know-how. Know-how refers to the application of the entrepreneurial knowledge and skills acquired throughout the course. This component links experience, practical skills, techniques, and abilities. In an effective entrepreneurship course or program, students should have opportunities to attain practical skills and develop entrepreneurial attitudes (Morrison, 1998). Thus, an interactive pedagogy is very important to enhance know-how (Duchéneaut, 2001; Morrison, 1998). In this sense, teaching of this component should comprise creativity exercises, games, business project, company visit, internship, and computer simulation.

The training of creative thinking (Ronstadt, 1990) can be developed through creativity exercise and games. Divergent thinking and brain storming skills will be practiced by students to discover alternative solutions (Sternberg and Lubart, 1999). Students may work in teams and compete with each other to achieve high performance. The creativity training is important for developing business ideas, exploiting business opportunities, and planning a business. All these will be realized in the business plan project.

In this approach, the role of a teacher is that of "guide and partner in the learning process" (Gibb, 1993). Students are usually required to accomplish a business project about developing a new product or services. This approach emphasizes group learning that enables students learn from one another in a group. It is useful to build up a knowledge-based team to initiate entrepreneurship. The feedback of professors, entrepreneurs, and other entrepreneurial experts will further enhance the learning experiences of the students.

Through the learning of know-how, students are expected to develop and improve their entrepreneurial skills and abilities to perform entrepreneurship-related activities. With these skills and abilities, the students perceived higher level of control over the entrepreneurial activities, and consequently higher intention to start up a business. Group-based project is one of the widely adopted learning approaches to practice the know-how component.

7. Conclusions and future research

TPB has been used for more than 20 years to study the impact of EE on IE. It does contribute to our understanding of the relationship between EE and EI. However, reviewing literature from the 1980s to the 2000s and then 2010-2016, we found three research areas that can be improved. First, most previous research treated EE as one exogenous variable before TPB model and answered the question whether EE influences EI. It could not answer the question of how to enhance each of the three antecedent variables. Second, many researchers did not test the entire TPB model with all the three antecedents (i.e. attitude, social norm, and self-efficacy or perceived control). Third, the testing methods vary dramatically from simple correlation, multiple correlation, to SEM.

This study improves the aforementioned three areas with a view to provide an in-depth insight into how specific education components influence the EI through attitude, social norm, and perceived control. This study suggests an elaborated and systematic approach to teaching entrepreneurship that emphasizes nurturing EI of students in a systematic way. In this approach, EI can be fostered through improving attitude toward entrepreneurship, subjective norm, and perceived behavioral control, and which can be developed through the four key components of know-what, why, who, and how.

It is explicit that an effective entrepreneurship course has to consider the development of all the four key education components (know-what/why/who/how) in a systematic way. Through the learning of these components, the EI of students will be systematically increased by improving their entrepreneurial attitudes including attitude toward entrepreneurship, subjective norm, and perceived behavioral control. Under this systematic approach to

entrepreneurship education, the curriculum design, teaching procedures, and methods for each of the components are all specifically highlighted. It is useful for teachers in different phases of an entrepreneurship course, such as conception phase, implementation phase, and evaluation phase, to be explicit about what to teach and how to teach the subject.

There are two limitations of this study. First the data are from a general education course for engineering students. The result may not be able to be generalized to other courses at other levels like senior and postgraduate students. The research is only about one course, and it should not be generalized to entrepreneurship programs with a set of courses, either. Future research can be conducted to other levels of EE. The second limitation of this research is its focus on the stage of on-campus study. The result does not touch late stage about behavior, as some previous studies did. Callanan and Zimmerman (2016) suggested two stages of entrepreneurship research, namely, learning stage on campus and action stage after graduation as well as the relationship between the two stages. This seems to be a new direction of entrepreneurship research in the future. As most previous research is based on TPB, this research is about the learning stage and covers intention but ignores the entrepreneurial action (behavior) since not all the students have the time and resources to start their business while on campus. In fact, less than one-fourth testes the intention-behavior relationship in practice stream (Lortie and Castogiovanni, 2015), while nearly no in education stream (Nabi *et al.*, 2016). It is difficult since it needs longitudinal data. Future research based on longitudinal data should be encouraged. Universities are encouraged to follow-up their graduates in terms of entrepreneurship start-ups. At least qualitative case studies should be started first on graduate entrepreneurship to provide preliminary evidences for future empirical test between intention and behavior to follow those students who took entrepreneurial education for five to ten years and then evaluate the long-term impact. This research direction bears policy implications as well. The research on the long-term impact is not easy and takes a long time. This seems to be difficult in Asian countries where many universities evaluate research output year by year and researchers may not dare to invest time for long-term research.

In summary, future research should specify level of students (undergraduate, MBA, and executive development) and the stage of research focus (campus learning vs real entrepreneurship in the society).

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