THE IMPACT OF NTREPRENEURSHIP EDUCATION ON ENTREPRENEURIAL INTENTION OF ENGINEERING STUDENTS

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The Impact of Entrepreneurship Education on Entrepreneurial Intention of Engineering Students
創業教育對工程學生創業意圖的影響

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Abstract

Entrepreneurship education has become very popular nowadays both in management schools and engineering schools. However, the impact of entrepreneurship education on entrepreneurial intention of engineering students remains in question. What is the value of entrepreneurship education? What should be taught and how to teach the subject? In order to develop guidelines for entrepreneurship education for engineering students, this thesis aims to propose an entrepreneurship education model by empirically investigating how specific education components influence the entrepreneurial intention of engineering students.

To achieve the aim, four objectives need to be addressed. The *first* one is to identify a theoretical approach and develop a conceptual model for studying the impact of entrepreneurship education on entrepreneurial intention of engineering students. The *second* one is to test the effectiveness of entrepreneurship education in terms of entrepreneurial intention. The *third* one is to empirically test the influence of education components on entrepreneurial intention. Finally, the *fourth* one is to develop an entrepreneurship education model and provide guidelines for entrepreneurship education.

An extensive review on entrepreneurship and education was conducted in order to achieve the first objective. The theory of planned behavior (TPB) was found appropriate to be the theoretical basis of entrepreneurship education because it provides most information about the formation process of entrepreneurial intention at both personal and social level. Further, entrepreneurship is a planned behavior that a new business is seldom created suddenly without planning, and thus it is best predicted by entrepreneurial intention. The second objective was reached by a comparison study between entrepreneurship students and control group students. The third objective was achieved through testing the effect of specific education components on entrepreneurial intention. The fourth objective was achieved by exploring the results from the theoretical and practical perspectives.

Based on the TPB and elaboration of entrepreneurship education into four components, a conceptual model linking entrepreneurship education and entrepreneurial intention was proposed. Ten sets of hypotheses were formulated in the

conceptual model. A survey of 411 engineering students was conducted in order to test the model. Of the respondents, 201 took an entrepreneurship course (entrepreneurship group) and 210 did not take the entrepreneurship course (control group).

There were two major data analyses in this thesis. *First,* the two groups of students were compared by t-test and ANOVA. The results show that there are significant differences in their entrepreneurial intentions confirming the effectiveness of entrepreneurship education on enhancing entrepreneurial intention. *Second,* the conceptual model was tested by SEM (structural equation modeling) path analysis in order to identify the specific relationship between entrepreneurship education components and entrepreneurial intention. Among others, three paths are tested to be significant. They are the paths 1) from know-why to attitude toward entrepreneurship, 2) from know-who to subjective norm (i.e., social influence), and 3) from know-how to perceived behavior control (i.e., self-efficacy or capability). Further, know-what is considered as the basic element which facilitates other components. The findings also reveal significant dependent relationships among the three antecedent attitudes of entrepreneurial intention. For example, subjective norm plays an important role in facilitating attitude toward entrepreneurship as well as perceived behavioral control. Perceived behavioral control can also improve one's attitude toward entrepreneurship. The model suggests the systematic impact of entrepreneurship education on entrepreneurial intention.

Both theoretical and practical implications are explored from the results. Theoretically, this study identifies a robust approach to study the impact of entrepreneurship education on entrepreneurial intention. Further, it provides more detailed information on how entrepreneurial intention forms, considering the inter-relationships among the antecedent attitudes. Moreover, this study provides significant implications for the teaching of entrepreneurship by suggesting an intention-focus approach. Practically, the findings offer useful guidelines for teachers to develop teaching strategies for entrepreneurship.

The most salient feature of this study is that it bridges specific education components and entrepreneurial intention, providing significant insight into how the key components influence the entrepreneurial attitudes and intentions of students. It is probably the first study to fill the gap in the knowledge required for fostering

entrepreneurial intention through entrepreneurship education. Further, this thesis employs SEM path analysis for modeling the students' entrepreneurial intentions. Fitness of the *overall* model (rather than the separated relationships in regression analysis) that path analysis concerns provides more reliable results on the influence of specific education components on entrepreneurial intention.

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Definition of Terms

Term	Abbreviation	Definition in this thesis
Entrepreneurship	--	An innovation process to exploit a business opportunity by applying entrepreneurial learning (knowledge and skills)
Entrepreneur	--	An individual who utilizes own entrepreneurial learning (knowledge and skills) to exploit a business opportunity.
Entrepreneurship education	--	A process of transmitting entrepreneurial knowledge and skills to students to help them exploit a business opportunity
Entrepreneurial intention	Eint	A cognitive representation of actions for exploiting a business opportunity by applying entrepreneurial learning (knowledge and skills)
Attitude toward entrepreneurship	Att	The degree to which a person has a favorable or unfavorable evaluation of engaging in entrepreneurial activities
Subjective norm	SN	The social pressures perceived by individuals to perform or not to perform entrepreneurial activities
Perceived behavioral control	PBC	The perception of easiness or difficulty in performing entrepreneurial behaviors
Know-what	k-what	Knowledge required for entrepreneurship
Know-why	k-why	Values and motives about performing entrepreneurial activities
Know-who	k-who	Social interaction with entrepreneurial people (entrepreneurship teachers, entrepreneurs, project mentors, classmates, and other professionals in the field)
Know-how	k-how	Skills, techniques and abilities to perform entrepreneurial behaviors

Chapter 1: Introduction

1.1. Background of the Study

1.1.1. Importance of entrepreneurship

Entrepreneurship has been recognized as the “engine” that drives an economy to create new businesses, new jobs and well-being (Drucker, 1985; Gorman et al., 1997). It facilitates the economy by stimulating the growth in innovation and competition. Innovation includes the creation of new businesses, new products/ services, or new operation processes of a firm (Thurik & Wennekers, 2004). According to Hebert and Link (1989), the relationship between entrepreneurship and economic growth reflects the innovative role of entrepreneurship in new entry and economic regeneration. This is supported by Acs et al. (1992) who argued that entrepreneurship is an important source of innovative activities and job opportunities and thus has an important impact on economic development. Thus, entrepreneurs play an important role in transforming inventions and ideas into economic activities (Baumol, 2002).

Entrepreneurship can be pulled by market demands. On the other hand, it also produces new demands by successfully arousing the need of the society and the desire for better products or services. Schumpeter’s (1934) “creative destruction” demonstrates the phenomenon of entrepreneurship as some new insight, product and process that change the existing business approaches. Nowadays, globalized economy has intensified competition in all aspects and entrepreneurship is believed to be an ever-important tool to cope with the new challenges, especially under the current economic crisis, where industries and the markets are experiencing reconstruction (or creative destruction), where new business models, new technologies, and new products or services that shot the market demand are required. All these are highly associated with the entrepreneurial activities that energize the economy.

Entrepreneurship also has a significant impact on producing “a lower orientation towards exports, a lower propensity to export employment, a qualitative change in the demand for capital and consultancy inputs, more variety in the supply

of products and services or in the manner and aims of conducting research and development" (Thurik & Wennekers, 2004, p. 146). Audretsch and Thurik (2000) studied 23 OECD (Organization for Economic Co-operation and Development) countries during 1984 and 1994 also found that entrepreneurship can significantly lower the unemployment rate. Other researchers (Carree & Thurik, 1998; Thurik, 1996) also supported the positive impact of entrepreneurship on the economy development and claimed that new firms generation creates extra output in the entire economy.

Hence, entrepreneurship combining with innovation is always considered as the impetus to sustain the economic growth. Entrepreneurship and innovation are highly related to creating something new and policies dealing with economic dynamism always emphasize these two concepts. New business creation leads new products, processes and business structures that shape the market and economy. Thus, entrepreneurship holds the key to economic regeneration (Jack & Anderson, 1998). Encouraging entrepreneurship and new business creation are important to make economies continue to grow and prosper.

The past decades have witnessed the rapid emergence of entrepreneurial activity across the globe. According to the Kaufman Index of Entrepreneurial Activity (2005), about 550,000 new businesses were generated every month in America during 1996-2004. These indicate that about 6.6 million firms were created every year accounting for 75% of the net new jobs of the country (Scarborough & Zimmerer, 2006). These reflect that the US economy is highly entrepreneurial. Indeed, not only in the USA, has entrepreneurship also perceived important in other nations. For example, Canadian small companies accounted for about 66% of new jobs of the whole country (Ibrahim & Ellis, 2002). In Europe, small companies represented more than 90% of all European Union enterprises and produced approximately 66% of all jobs (Henderson & Robertson, 2000). In China, nearly 75% of growth in GDP during 1980-2002 was due to the entrepreneurial activities created by the small and medium-sized companies which constituted over 99% of all firms in China (Li et al., 2003).

According to the latest statistics, the Global Entrepreneurship Monitor (GEM) which annually publishes information about the entrepreneurial activity in the Early-Stage Entrepreneurial Activity (TEA Index) by country, the level of entrepreneurial activities in the USA and other countries is slightly decreased from previous record

due to the financial crises, but entrepreneurship generally keep thriving all over the world (Bosma & Levie, 2009). TEA expresses the number of people who are in the preparation stage of starting a new venture plus those that are already running a new firm for less than 42 months. The TEA serves as an indication of entrepreneurial activity as a percentage of the population between 18 and 64 years old (Bosma & Levie, 2009). As the GEM 2009 [1] reports, the USA (8.0%), and China (18.8%) are the entrepreneurial juggernauts, although they do not have the highest rates of TEA. Uganda (33.6%), Colombia (22.4%) and United Arab Emirates (13.3%) show the highest rates of TEA in the three categories respectively, while lowest rate is measured in Saudi Arabia (4.7%), Russia (3.9%), and Japan (3.3%) respectively. It has been specified the increasing recognition worldwide that entrepreneurship significantly contributes to economic wealth, such as the creation of job opportunities and innovation. Even without knowing the precise quantity of new jobs generated by the new companies, the TEA index simply indicates that entrepreneurs, varying in different countries, occupy between 3.3% and 33.6% (Japan and Uganda) of the total occupational population. Most countries (covered in GEM) have entrepreneurial population between 5% and 20%. These figures point out the fact that entrepreneurship makes a considerable contribution to the workforce.

Additionally, GEM 2009 research shows that early-stage entrepreneurs are most prevalent in the 25-34 age group. This confirms a general assumption of the ages of university graduates who start their own ventures. That is, it suggests that university graduates at this age range have high probability to start up. This provides evidence that it is appropriate for our research to investigate the entrepreneurial intention of university students.

1.1.2. Importance of entrepreneurship education

Ascertaining the importance of entrepreneurship, continuously supplying or fostering entrepreneurial persons has become the pinpoint of the economic prosperity.

[1] Totally 54 countries are grouped into three categories by phase of economic development: factor – driven economies, efficiency-driven economies, and innovation-driven economies. Factor-driven economies are primarily extractive in nature, while efficiency-driven economies exhibit scale-intensity as a major driver of development. At the innovation-driven stage of development, economies are characterized by their production of new and unique goods and services that are created via sophisticated, and often pioneering, methods.

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.

Many studies have shown the importance of entrepreneurship education to new business creation and economic development. Cho's (1998) study revealed that entrepreneurship education promotes entrepreneurial intention because the entrepreneurial knowledge and skills acquired by the participants can rouse their interest and motivation to start up. More recently, Menzies & Paradi (2002) studied 287 engineering students (177 entrepreneurship students and 110 control group students) and tracked their entrepreneurial behavior for 15 years. They found that 48% of the entrepreneurship group students had created their own companies after they graduated for 15 years, and this figure was much higher than the start-up rate of 26% of those who did not receive the entrepreneurship education course. This is further supported by the longitudinal study of Henry et al. (2004), who found that entrepreneurship education significantly increases the start-up rate. The authors investigated the start-up rate after the participants completed the entrepreneurship program/course more than 3 years and they found that the start-up rate of those who received entrepreneurship education was 35% which was much higher than that of the control group (17%).

Levie and Autio (2008) argued that entrepreneurship education is a good means to encourage entrepreneurship. The authors used 7 years of GEM (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. The study of 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. In their study, 35% of 142 students started their own businesses after completing an entrepreneurship course and the average number of years that the business survived was 3.54 years. For those who did not start up, about 50% of them had a strong intention toward entrepreneurship.

Further, the GEM Report (Bosma et al., 2008) covering the occupational population aged between 18 and 64 from 34 countries also presented similar findings. According to the report, individuals who had taken entrepreneurship education

(voluntary and compulsory) were significantly more likely to expect to start a business in the next three years (39.9%) than the non-trained group which only accounted for 8.8%. That is, the entrepreneurship educated people have higher level of entrepreneurial intention than the non-entrepreneurship educated. This is also true for the engagement in entrepreneurship activities. For example, the GEM report revealed that among the fore-mentioned population, 22.4% of people who engaged in entrepreneurship activities had received entrepreneurship education (either voluntary or compulsory), while only 5% who engaged in entrepreneurship activities did not received the entrepreneurship education. That is, higher ratio of entrepreneurship activities performed by those who had taken an entrepreneurship education program or course than the non-trained group.

The increasingly popular entrepreneurial behavior has evoked a demand for better entrepreneurial skills and abilities for dealing with risks and uncertainties. Innovation, creativity, self-confidence, risk-taking, readiness for change, and solving problems in deferent ways have become more and more important to tackle the dynamic economic, social, and political challenges. All these attributes are indeed related to entrepreneurship. Therefore, the need for entrepreneurship education has never been greater.

Entrepreneurship education is expected to promote entrepreneurship by advancing cognitive abilities required for business opportunity exploitation and new business creation (DeTienne & Chandler, 2004; Honig, 2004). Through exposing students to the experiences of identifying and pursuing a business opportunity, the students can learn and internalize the theories and techniques needed to for start up. According to these cognitive effects, entrepreneurship education should enhance opportunity discovery or identification (Parker, 2006). Further entrepreneurship education can also enhance entrepreneurship through the cultural effect on students' attitudes and intentions (Peterman & Kennedy, 2003).

Different from specialists or engineers, entrepreneurs are considered more as a generalist with multiple skills (Lazear, 2004; Michelacci, 2003). Not only technical skills, entrepreneurs also need professional business skills and innovation skills for setting up a new venture. The multi-functional role demonstrated by entrepreneurs includes domain-specific as well as general management skills, which enable them to deal with risks and uncertainties involved in the entrepreneurial process (Lazear,

2005). Thus, entrepreneurship education should be wide-ranged and practice-oriented, and should provide management, leadership and organizing skills and emphasize approaches to business planning (DeTienne & Chandler, 2004; Garavan & O'Cinneide, 1994; Honig, 2004).

Students who are exposed to entrepreneurship education are expected to develop "entrepreneurial attitudes and intention—designed to get students to start their own business" (Nelson & Mburugu, 1991). Hartshorn (2001) argued that through learning of entrepreneurship, every student has opportunity to be entrepreneurial. Different individuals possess different capabilities and attributes for performing entrepreneurial activities. It is important to provide students from different disciplines (e.g., business, engineering, arts, and etc.) chances to learn entrepreneurship.

Since the first entrepreneurship course was taught at Harvard University in 1947, entrepreneurship education has begun to receive the attention of scholars. Entrepreneurship education has become popular in business schools since 1970s. In past years, entrepreneurship education has developed very rapidly. In the US, by the 1980s, there were 300 universities offered entrepreneurship courses. Up to the 1990s, there had been over 1000 schools offering entrepreneurship courses (Vesper & Gartner, 1997). In the early 2000s, over 1600 schools were offering more than 2200 courses (Kuratko, 2005), over 50 universities were offering single entrepreneurship courses as well as complete programs (Koch, 2003). Today, entrepreneurship is being taught in more than 2000 universities in the US (Cone, 2008). The rapid development of entrepreneurship education has also been observed in other countries, such as England (Levie, 1999), Spain and The Netherlands (Koch, 2003). Not surprisingly, entrepreneurship has become one of the fastest-growing subjects at universities (Gartner & Vesper, 1999; Solomon et al., 2002). Not only offered in school of business are entrepreneurship courses, programs and activities also popular for engineering, social science and arts students (Kuratko, 2005).

1.2. Statement of Research Problem

Given the above, one may think that a solid framework or theory of entrepreneurship education should be well established. However, it is not the case. In deeded, entrepreneurship education is challenged in the literature. Vesper and Gartner (1997) argued that "the evolution of entrepreneurship programs in colleges and universities is still in its infancy" (p.420). Little is known about why people create new business (Reynolds, 1995) or, whether or how we can educate people to be entrepreneurs (Fiet, 2001a; 2001b). Although many studies have been published on entrepreneurship and entrepreneurial education, development of this field of research is slow, being at an early state (Co & Mitchell, 2006; Kabongo & Okpara, 2010). How entrepreneurship education fosters entrepreneurial persons to the economy is challenging topic. This relates to a set of questions: Is entrepreneurship teachable? How should we teach? And what are the influences of entrepreneurship education on the entrepreneurial attitudes and intentions of students?

1.2.1. Is entrepreneurship teachable?

Can we teach entrepreneurship? This question has been argued for years (Cunningham & Lischeron, 1991; Henry et al., 2004). Researchers, for example, Fiet (2001a) stated that "There is an ongoing debate in the entrepreneurship academy about whether we can actually teach students to become entrepreneurs" (p.1). Some commentators contend that we cannot or should not teach entrepreneurship. For them, on one side, entrepreneurship is a matter of personality and psychological characteristics that cannot be taught. This relates to the trait model which states that whether people engage in an entrepreneurial behavior is determined by their personality traits (Herron & Robinson, 1993) such as need for achievement (McClelland, 1987), risk-taking (Shaver & Scott, 1991) and locus of control (Rotter, 1966). However, entrepreneurship is the process to create a new organization and thus, it should be understood by studying the individual activities, processes and outcomes rather than characteristics (Gartner, 1988; Van de Ven et al., 1984). Researchers have been found that intention is a more reliable predictor of behavior, especially the planned behavior, such as entrepreneurship (Krueger et al., 2000).

On the other hand, from the perspective of teaching format, the effectiveness of the teaching of entrepreneurship through formal education is disputed (Saee, 1996; Singh, 1990). Unlike other professional disciplines (e.g., arts, fashion, medicine, and veterinary medicine) that a set of principles can be taught to students and master them to become competent practitioners and prepare them to end up with new business creation, entrepreneurship is difficult. It is because entrepreneurship teachers cannot teach students how to see specific niches in a market and recognize whether they will be successful. However, is entrepreneurship intrinsically different from these professions? The artistic professions, fashion, medicine and veterinary medicine, for example, require solid training in technique and related knowledge. We teach the fashion design students the basic skills to draw and design, but we cannot teach them what they should tailor. Entrepreneurs likewise learn about entrepreneurship knowledge, skills and management strategies, but we cannot teach entrepreneurship students to predict what kind of market-niches they should pursue or what they should exactly do when confronting specific business opportunities. There are always uncertainties even for the professional disciplines. Drucker (1985), a leading management expert, argued that entrepreneurship is a discipline and like any discipline, it can be taught and learnt. The 10-year review by Gorman et al. (1997) also supported this point of view. The authors reviewed studies on enterprise, entrepreneurship, and small business management education and found that “most of the empirical studies indicated that entrepreneurship can be taught, or at least encouraged, by entrepreneurship education” (p.63).

Although experience could be a source of some knowledge, and even some famous entrepreneurs are uneducated, researchers have found that entrepreneurship education is highly relevant to entrepreneurial activities (Borjas, 2000; Donckels, 1991; Parker, 2004). Entrepreneurship education can improve entrepreneurial skills and abilities (Honig, 2004), attitudes and desirability (Donckels, 1991; Peterman & Kennedy, 2003). Mitra and Matlay (2004) argued that entrepreneurship education provides many start-up knowledge and skills that seem not to be acquired from experience. Similarly, Borjas (2000) and Parker (2004) claimed that the business and entrepreneurial skills that entrepreneurship education provides are especially useful at an early stage of entrepreneurship. The study of Clark et al., (1984) also supported the positive effect of entrepreneurship education on new venture creation.

Further, Ronstadt (1987) posited that “strong indications exist that entrepreneurial education will produce more and better entrepreneurs than were produced in the past” (p.69). Charney and Libecap (2000; 2003) argued that through entrepreneurship education improves entrepreneurial abilities and facilitate entrepreneurial start-ups. The authors reported that approximately 54% of entrepreneurship graduates were involved in entrepreneurial activities, while only 17% was found in the non-entrepreneurship graduates. Further, 27% of entrepreneurship graduates were finally created own business compared to 9% of their counterparts. That is, the average start-up likelihood of entrepreneurship graduates was three times of that of non-entrepreneurship graduates.

Based on the discussion above, we acknowledge that entrepreneurship is learnable. Entrepreneurship education has positive effect on creating new ventures and improving entrepreneurial performance. Although, teaching of entrepreneurship may not necessarily make participants to be entrepreneurs, it is essential to improve their attitudes toward start up and stimulate their interest in entrepreneurship. Whether the participants will pursue an entrepreneurial career, they will benefit from acquiring entrepreneurial knowledge and skills, developing entrepreneurial spirits, and being creative and innovative through entrepreneurship education. **Therefore,** entrepreneurship education and training is valuable for encouraging entrepreneurial activities and producing entrepreneurial persons. It is expected that more and better entrepreneurship education would result in more and better entrepreneurial persons (Matlay, 2008). In this sense, a well-designed entrepreneurship education program or course and its impact on entrepreneurial attitudes/intentions and new venture creation are every important (Gibb, 1993; Hytti & O'Gorman, 2004).

1.2.2. How to teach entrepreneurship?

Despite the rapid growth in numbers of entrepreneurship programs and courses (Katz, 2003), it has been challenging for educators and teachers to deal with the teaching of the subject, because there is lack of consensus on what to teach and how to teach (Fiet, 2001a; 2001b; Hills, 1988; Norton et al., 1999). The entrepreneurship discipline “remains particularly fragmented, often isolated, and surprisingly unsure of itself” (Katz, 1991, p.85). Some researchers suggested that

educators should increase the theoretical content of entrepreneurship courses/programs because cognitive skills for entrepreneurial decision-making are largely developed through theory–based activities (Fiet, 2001a; 2001b). However, other commentators argued that adoption of a more practically focused and active-based approach to entrepreneurship education is more valid (Plaschka & Welsch, 1990; Hostager & Decker, 1999).

In terms of teaching methods, some researchers suggested problem-based learning for entrepreneurship, where learning is student-centered with teachers acting as facilitators (Wee, 2004; Hanke et al., 2005), while others suggested the project methods for the teaching of entrepreneurship (Preshing, 1991) or case methods (James & Clare, 2004).

In addition, some scholars emphasized the development of creativity projects central to venture success (McMullan & Long, 1987) or encouraged attitudinal training in entrepreneurship education (Root & Gall, 1981), while others stressed developing students appropriate personality traits, values, and attitudes of students regarding entrepreneurship, as these are essential to help them better cope with risks and uncertainties in entrepreneurship (Rice, 1985).

From the review presented, it is evident that despite the rapid development of entrepreneurship education programs, there is still not a generally accepted curriculum for the teaching of entrepreneurship (Koch, 2003; Plaschka & Welsch, 1990). The previous studies seemed to present diverse mechanisms of teaching the subject leading to an unclear picture for educators, policy makers and stakeholders to make decisions on founding or designing an effective entrepreneurship course or program.

It is recognized that entrepreneurship education may be different across different contexts. However, the current diversity in entrepreneurship education is so confused that it inhibits a theory-driven education model for entrepreneurship that guides the teaching practice (Fayolle et al., 2006a; Matlay, 2005; 2006). As a professional domain, there should be a theoretical basis that features entrepreneurship education. To understand the education of entrepreneurship, it is crucial to understanding how entrepreneurship education influences students' intentions toward entrepreneurship. This leads to the research interest in the influence of entrepreneurship education, as discussed in next section.

1.2.3. What are the influences of education on entrepreneurial intention?

Entrepreneurship education undoubtedly takes responsibility for continuously supplying entrepreneurial persons or entrepreneurs to meet the demand of economic growth. Therefore fostering the attitudes and intentions of students toward start-up is the ever important part of entrepreneurship education (Autio et al., 1997; Fayolle et al., 2006a; Kolvereid, 1996b). An entrepreneurship education program or course to be effective should emphasize the development of these entrepreneurial attributes and how they are influenced by specific education components.

Some studies have investigated the influence of education and training on the entrepreneurial attitudes and intention of participants and reported that entrepreneurship education influences the entrepreneurial intentions and start-up actions (Fleming, 1994; Henry, 2004; Kuratko 2003; 2005; McMullan et al., 2001). Clark et al. (1984) investigated the university students who studied an entrepreneurship course and reported that most of the students (80%) had entrepreneurial intentions which significantly predicted actual entrepreneurial actions. According to the authors, 75% of the students who had entrepreneurial intention subsequently started their own businesses after graduation. Similar findings were obtained by McMullan et al. (1985) who argued that entrepreneurship education has a positive effect on the entrepreneurship rate of MBA students. This is supported by Brown (1990) that entrepreneurship education facilitates participants' engagement in entrepreneurship.

In another study, Autio et al. (1997) emphasized the positive impact of students' perception of entrepreneurship, university supports on students' attitudes towards entrepreneurship. Kolvereid (1996b) and Tkachev and Kolvereid (1999) also reported that education can influence students' entrepreneurial intention (e.g., career choice of entrepreneurship). Chen et al., (1998) found that entrepreneurship students have significantly higher self-efficacy than non-entrepreneurship students, which significantly determines entrepreneurial intention. This is also supported by Luthje 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 during the start-up process. The study of Charney and Libecap (2000), considering entrepreneurship education as an independent variable, also evidenced that entrepreneurship education significantly impacts new venture creation and wealth generation. This was supported by Dutta et al. (2010) using the similar research settings. In a comparative study by Lee et al. (2005), regardless where students were from (e.g., US & Korea), entrepreneurship education was significantly linked with entrepreneurial intention.

Varela and Jimenez (2001) using a longitudinal research design found that entrepreneurship rate is related to university supports. According to the authors, universities that invested most in entrepreneurship education and guidance had highest entrepreneurship rates. Fayolle et al. (2006b) tried to access the impact of an entrepreneurship program in terms of attitudes and intentions. They argued that the entrepreneurship education could have some strong positive effects for some students, depending on their background and initial perspectives on entrepreneurial intention. Other researchers studied the relationship between entrepreneurship education and personality traits, such as need for achievement and locus of control (Hansemark, 1998) or the self-efficacy (Ehrlich et al., 2000). Their results suggested that entrepreneurship education has a positive impact on enhancing these characteristics and the chance of start-up in the future.

Even though many studies (mentioned above) have shown that entrepreneurship education has a significant impact on entrepreneurial intention and entrepreneurial behavior, these studies reported only the results or outcomes of entrepreneurship education (i.e., change in attitudes and intention toward entrepreneurship or start-up rate), but failed to answer *why* and *how* these changes resulted. In other words, these studies were trapped in a relatively general level without dealing with what actually caused the changes. Such general findings seem to provide little implications for how to teach entrepreneurship in order to stimulate or enhance the interests in, attitudes and intentions toward entrepreneurship of students. As noted by Littunen and Virtanen (2006), more work needs to be done to reveal how exactly entrepreneurship education influence entrepreneurship. 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.

Taking this as a starting point, the purpose of this study is to fill the gap in the knowledge required for fostering students' entrepreneurial attitudes and intention through formal academic training. We investigate the formation process of entrepreneurial intention and go deeper to study how specific education components influence students' attitudes and intentions. Based on these, we develop a conceptual education model for entrepreneurship which bridges entrepreneurial intention and the specific education components. Such a model should indeed be very useful for entrepreneurship educators to design an effective entrepreneurship course or program, to implement the teaching of entrepreneurship in practice (by establishing a teaching model including teaching contents and pedagogical methods), and to promote effective learning process in entrepreneurship. The scope and aim of the study are detailed in next section.

1.3. Scope, Aim, and Objectives

1.3.1. Scope

1.3.1.1. A focus on entrepreneurial intention

This thesis concerns the entrepreneurial intention of students rather than their actual entrepreneurial behavior. This study focuses on how the entrepreneurial intention of students is formed during entrepreneurship education. Thus, the ultimate dependent variable of this study is entrepreneurial intention, not actual entrepreneurial behavior. The rationale of this assumption is based on the following reasons.

First of all, entrepreneurial intention is the best predictor of entrepreneurial behavior. In social science, the findings of various studies have shown that a person's intention to perform (or not to perform) a behavior is the most important determinant of that action (ref. examples in Ajzen (2005)). In psychology literature, psychologists have proved that intention is essential to understand a behavior and it is the best predictor of planed behavior (Ajzen, 1991; 2005; Bird, 1988). As a general rule, the

stronger the intentions, the more powerful the intentions are to predict a behavior (Ajzen, 1991). In entrepreneurship research, intention toward entrepreneurship has also been recognized as an antecedent of entrepreneurship (Krueger & Brazeal, 1994; Krueger et al., 2000). Entrepreneurial intention precedes the engagement in entrepreneurial activities, such as identifying and exploiting a business opportunity (Krueger & Carsrud, 1993). It is "evident that much of what we consider entrepreneurial activity is intentionally planned behavior" (Krueger et al., 2000, p. 413).

The notion that entrepreneurship is a planned behavior is supported by other entrepreneurship scholars, for example, Autio et al. (1997) and Kolvereid (1996a; 1996b). A planned behavior is intentional and is best predicted by intention (Ajzen, 1987; 1991; 2005; Krueger & Carsrud, 1993). Entrepreneurial business or firm seldom emerges suddenly. Instead, it usually needs a careful planning for a certain period of time given the complex nature of entrepreneurship. Entrepreneurs require making a series of purposeful, perception-driven decisions (Bird, 1988; Gartner, 1989; Katz and Gartner, 1988; Shapero, 1982) to organize all stuff clearly into a flow step by step, such as discovery (identifying opportunities and shaping them into business concepts), feasibility analysis and assessment (industry research, market research, discussion with relevant people to get more information and develop networks), business plan development and launching the business. Thus, the entrepreneurial process is highly sensitive to initial intention that governs one's interest in and motivation toward entrepreneurship. This initial intention hence has a significant impact on persisting long for an entrepreneurial behavior (Krueger et al., 2000). Therefore, entrepreneurial intention is crucial to understanding the overall process of new venture creation (Bird, 1988; Schoonhoven & Eisenhardt, 1990).

Researchers have found that intentions explain behavior, and in turn attitudes (i.e., personal attitude toward entrepreneurship, attitudes related to social influence, and attitude related to personal capability) explain intention. Attitudes are influenced by exogenous influences (Ajzen, 1987). Thus, intentions are indirectly affected by exogenous factors such as personality, demographic factors, situational and environmental factors. These factors either facilitate attitudes or moderate the relationship between intentions and behavior (Ajzen, 2005; Krueger & Carsrud, 1993).

Many studies have found that intention is the most critical factor of behavior and they suggested that attitude explain over 50% of the variance in intentions, and intentions explain over 30% of variance in behavior (Ajzen, 1991; 2005; Krueger & Carsrud, 1993). This was supported by meta-analytic studies (Armitage & Conner, 2001; Kim & Hunter, 1993; Notani, 1998; Randall & Wolff, 1994; Shepherd et al., 1988). For example, Kim and Hunter (1993) analyzed more than 100 studies and found that attitude explained over 42% (r=0.65) of variance in intention, and intention explained over 20% (r=0.46) in behavior. Further, Armitage and Conner (2001) analyzed 185 studies and found that attitudes accounted for 39% (r=0.624) of the variance in intention and 27% (r=0.52) in behavior. Other meta-analyses also reported significant relation between intention and behavior, such as 0.47 (Notani, 1998), 0.53 (Shepherd et al., 1988) and 0.45 (Randall & Wolff, 1994). The significant correlations between the two variables were also confirmed by studies in specific behavioral domains, such as voting choice in election, donating blood and attending church, with a value ranging from 0.75 to 0.9 (see in Ajzen (2005)).

Research on entrepreneurship also evidenced that entrepreneurial intention significantly predicts entrepreneurial behavior. For example, in terms of venture growth, Orser et al. (1996) studied 112 SME owners to predict their entrepreneurial growth. Their chi-square test results showed that intention to pursue growth significantly related to subsequently growth within 4 years. This was confirmed by their latter study (Orser et al., 1998) that the intention of 139 small business owners and managers to grow their business was a key factor in actual growth at the end of a four-year period. Another study by Kolvereid and Isaken (2006) considering the entrepreneurial intention and subsequent business entry also reported similar findings. They studied 297 Norwegian business founders and found that intention to start up determined actual entry into self-employment by explaining about 40% of variance in subsequent entry.

Other studies on venture creations also reported that entrepreneurial intention significantly predicts subsequent start-ups. Cater et al. (1996) investigated the start-up rate of 71 US adults who had entrepreneurial intention. The authors argued that 48% of the respondents actually started a business 6-18 months later and 30% of them were trying. Using a large sample of 2025 adults, Chrisman (1999) found that 60-78% of individuals who had intention to create own business actually created their

businesses within 2 years. These figures are much more significant compared with the entrepreneurship rate (3-8%) of general adult population (Dennis, 1997; Reynolds & Miller, 1992).

Further, the GEM (Global Entrepreneurship Monitor) Report (Bosma et al., 2008) studying people aged between 18 and 64 from 34 countries presented similar findings. The authors found that individuals who have taken entrepreneurship education were significantly more likely to create a new venture in the next three years (39.9%) than the non-educated group which only accounts for 8.8%. That is, the entrepreneurship educated people have higher level of entrepreneurial intention than the non-entrepreneurship educated. This was also true for the engagement in entrepreneurship activities. For example, the GEM report also showed that among the fore-mentioned population, 22.4% of people who engaged in entrepreneurship activities had received entrepreneurship education (either voluntary or compulsory), while only 5% who engaged in entrepreneurship activities did not received the entrepreneurship education. That is, higher ratio of entrepreneurship activities is performed by those who have taken an entrepreneurship education program or course than the non-educated group.

Therefore, entrepreneurial intention is an important factor to determine entrepreneurial behavior. The relationship between these two variables is valid and logic (Carter et al., 1996; Chrisman, 1999; Krueger et al., 2000). Studying entrepreneurial intention provides significant insight into the emergence of entrepreneurial behavior (Chrisman, 1999). The major stream of entrepreneurship research thus focuses on entrepreneurial intention (Autio et al., 1997; 2001; Gird & Baraim, 2008; Fayolle et al., 2006a; 2006b; Fayolle & Gailly, 2004; Kolvereid & Moen, 1997; Luthje & Franke, 2003; Peterman & Kennedy, 2003; Raichaudhuri, 2005; Tkachev & Kolvereid, 1999). These studies have shown that entrepreneurial intention is appropriate to be used as the dependent variable and key attitudes or beliefs robustly predict intentions. These key attitudes and intentions are perceptions-based and learnable (Krueger & Brazeal, 1994). Therefore, in order to promote entrepreneurship, it is crucial for entrepreneurship education to investigate the factors that may affect the formation of entrepreneurial intention and nurture it in an effective way.

Moreover, by studying the entrepreneurial intention of students it is possible to offer more reliable and accurate insights into entrepreneurship education, since students being on campus are less likely to be engaged in actual entrepreneurship. Investigating their attitudes and intentions toward entrepreneurship is more reasonable than their actual entrepreneurial behaviors. Further, proving the link between entrepreneurial behavior and education requires a large number of resources and a long period of time, for example, 5 to 10 years. In terms of feasibility and practicability, entrepreneurial intention is generally used as the dependent variable in entrepreneurship education research (Autio et al., 1997; Davidsson, 1995; Souitaris et al., 2007). Therefore, in this thesis, use of entrepreneurial intention is temporarily superior to the use of entrepreneurial behavior.

1.3.1.2. A focus on engineering students

This study focuses on the influence of education components on the entrepreneurial intentions of engineering students. There are several reasons for choosing the target group.

First, most of the studies on entrepreneurship focus on business students (Kolvereid, 1996a; Krueger et al., 2000). Actually, business students and engineering students are different regarding entrepreneurship (Craig & Johnson, 2006; Kirzner, 1979; Kirzner, 1997). Business students perceive that they are more market-oriented to sense business opportunities and that they even have abilities to generate the opportunities given their professional business training that enhances their confidence to act entrepreneurially. On the other hand, engineering students are less confident in their capability to respond or produce entrepreneurial opportunities (Craig & Johnson, 2006). Further, business students and engineering students also see innovation differently. Business students tend to recognize themselves as entrepreneurs while engineering students are more likely to consider themselves as “inventors” (Craig & Johnson, 2006). Consequently, the results of business students regarding their entrepreneurial attitudes and intentions can be different from those of engineering students.

Second, the behavior of engineering students is interesting, as their technical training provides them the potential to engage in technological entrepreneurship. Researchers, for example, Wheeler (1993) and Wu and Wu (2008) have found that

engineering students have higher tendency to create new businesses than business students. Wheeler's (1993) survey reported that science majors had a higher propensity to become entrepreneurs (47%) than business majors (35%). The results were supported by Wu and Wu (2008) that engineering students had higher entrepreneurial intentions than business administration, economics students and other non-business related students (such as those majored in history, medicine, psychology, geography & law). Therefore, it is valuable to pay more attention to engineering entrepreneurship education and investigate what factors influence the entrepreneurial intention of these students and how these factors should be considered in curriculum design.

Third, the entrepreneurial attitudes and intentions of engineering students are unlikely to have been "infected" by prior business courses that are related to entrepreneurship (Souitaris et al., 2007). Hence we can receive more "genuine" and reliable responses for studying the effectiveness of the entrepreneurship education program or courses in this thesis.

1.3.2. Aim and objectives

The aim of this study is to propose an entrepreneurship education model by empirically investigating how specific education components influence the entrepreneurial intention of engineering students. The assumption of this study is that entrepreneurial knowledge and skills are learnable and they will positively influence the entrepreneurial intention of students (Donckels, 1991; Peterman & Kennedy, 2003).

In order to achieve this aim, **the first objective** of this study is to identify a theoretical approach and develop a conceptual model for studying the impact of entrepreneurship education on entrepreneurial intention of engineering students. Accordingly, a theoretical approach to entrepreneurship research explaining the impact of entrepreneurship education on entrepreneurial intentions will be first identified through an extensive review on different approaches to entrepreneurship. Then a conceptual model of education-entrepreneurial intention will be developed based on the theoretical approach.

The second objective is to test the effectiveness of entrepreneurship education in terms of entrepreneurial intention. This will reveal if education on entrepreneurship effectively influences the intentions of students to start up. This objective can be achieved by comparing two groups of students who have completed an entrepreneurship course and those who have not.

The third objective is to study the influence of education components on entrepreneurial intentions by empirically testing the conceptual education model that links education components and three antecedent attitudes of entrepreneurial intention, namely, attitude toward entrepreneurship, subjective norm (i.e., social influence) and perceived behavioral control (i.e., self-efficacy or capability).

The fourth objective is to develop an entrepreneurship education model and provide guidelines for entrepreneurship education. This objective will be achieved by exploring the results (cf. objective 3) from theoretical and practical perspective. We will develop an education model and teaching guidelines for entrepreneurship. Those guidelines include the design of teaching contents, teaching methods and procedures as well as assessment methods. Such a guideline will be useful for entrepreneurship teachers to design and deliver a course or program.

In order to achieve the objectives above, the following research questions are required to be addressed:

RQ1. Which theoretical approach is suitable for studying the impact of entrepreneurship education on entrepreneurial intention of students?

RQ2. What are the differences in terms of entrepreneurial intention between those who take an entrepreneurship course and those who do not?

RQ3. What are the influences of entrepreneurship education components on the entrepreneurial intentions of engineering students?

RQ4. What teaching guidelines can be developed for entrepreneurship education for engineering students?

The **first** question is answered by a review of literature on entrepreneurship. Different approaches to entrepreneurship research will be discussed and compared, in order to identify the most suitable one to study the entrepreneurial intentions of students. For example, both trait models and intention-based models will be discussed.

Moreover, the evolution of key intention-based models in entrepreneurship research will be presented and evaluated in terms of applicability to explaining entrepreneurial intentions and empirical support. A conceptual model will be developed based on the theoretical approach identified.

The **second** question is achieved by a comparison study between those engineering students who are exposed to an entrepreneurship course and those who are not. The entrepreneurial attitudes and intentions of the two groups of students will be compared. Further the effects of demographic factors on these entrepreneurial factors will also be discussed between these two groups.

In order to answer the **third** question, the conceptual education model will be tested. We will perform a survey among engineering students and collect their responses to their entrepreneurial attitudes and intentions as well as learning on entrepreneurship. SEM (Structural Equation Modeling) path analysis will be adopted to test the model.

The **fourth** question is reached by exploring the results obtained from the previous step (RQ 3) from both the theoretical and practical perspectives. **Table 1** summarizes the four objectives and their respective research questions.

Table 1. Objectives and research questions

	Objectives		Research questions
1.	To identify a theoretical approach and develop a conceptual model for studying the impact of entrepreneurship education on entrepreneurial intention of engineering students	RQ1.	Which theoretical approach is suitable for studying the impact of entrepreneurship education on entrepreneurial intention of students?
2.	To test the effectiveness of entrepreneurship education in terms of entrepreneurial intention	RQ2.	What are the differences in terms of entrepreneurial intention between those engineering students who take an entrepreneurship course and those who do not?
3.	To empirically test the influence of entrepreneurship education components on entrepreneurial intention	RQ3.	What are the influences of entrepreneurship education components on the entrepreneurial intentions of engineering students?
4.	To develop an entrepreneurship education model and provide guidelines for entrepreneurship education	RQ4.	What teaching guidelines can be developed for entrepreneurship education for engineering students?

1.4. Significance of the Study

Entrepreneurship has a positive effect on the economy due to the growth in innovation and competition accompanied (Birch, 1989; Jack & Anderson, 1998; Zimmerer & Scarborough, 2005). In the competition intensified global economy, entrepreneurship is recognized as an effective tool to deal with the economic dynamism, by introducing innovative products and services, exploiting technological frontiers, providing new jobs, and creating new markets (Nandram & Samsom, 2006).

Entrepreneurial spirit and abilities are critical for nurturing entrepreneurial activities. These elements are the driving force of business enthusiasm and growth, innovation and competition. Accompanying the importance of entrepreneurship has been the rapid development of entrepreneurship education, especially in the past few years (Katz, 2003). Researchers have indicated a positive impact of entrepreneurship education and training on entrepreneurial activity (Honig, 2004; Robinson & Sexton, 1994) through strengthening students' attitudes, behavioral characteristics and desirability (Peterman & Kennedy, 2003; Hansemark, 1998) as well as their entrepreneurial and small business management skills (Clark et al., 1984; Charney & Libecap, 2000; 2003; Ronstadt, 1987). Therefore, entrepreneurship education is important to facilitate entrepreneurial activities and performance and hence the economic development.

However, how to design an effective entrepreneurship education program is still challenging for educators because there is a lack of consensus on the contents or methods to teach the subject (Bennett, 2006; Fiet, 2001a; 2001b; Henry et al., 2005a; 2005b; Katz, 1991). For example, in terms of teaching content, some researchers suggested increasing theoretical content of an entrepreneurship course (Fiet, 2001a; 2001b), while others argued for more practically focused and active-based teaching approach (Hostager & Decker, 1999; Plaschka & Welsch, 1990). Some researchers suggested problem-based learning for entrepreneurship education, whereas others suggested the project method for teaching entrepreneurship (Preshing, 1991) or case method (James & Clare, 2004).

Understanding the impact of entrepreneurship education on students' intention to start up (especially the influence of specific education components) is the key to designing an effective entrepreneurship education program. Without considering the

specific effect of education components, it is difficult to establish a systematic way to nurture the entrepreneurial attitudes and intentions of students. It is questionable for the teaching of entrepreneurship to be based on the teachers' intuition and experience. An effective entrepreneurship education program should be developed based on a model describing how the specific education components influence entrepreneurial attitudes and intention. Such a model should be developed based on a valid theoretical approach to entrepreneurship. Therefore, this study aims at investigating the specific influence of education components on entrepreneurial attitudes and intentions and will provide important implications for the teaching of entrepreneurship.

Theoretically, this study will identify a robust approach to entrepreneurship from a pool of entrepreneurship approaches and verify its applicability to explain the entrepreneurial intention of students. Researchers in the field of entrepreneurship claimed that more studies are required to verify the appropriateness of intention model to entrepreneurship (Krueger, 1993; Krueger et al., 2000). This study will provide empirical evidence that entrepreneurial intention can be effectively explained by attitudinal factors. Further, this study will go deeper by investigating the inter-dependent relationships among the antecedent attitudes of intention, identifying how each attitudinal factor acts in the formation process of entrepreneurial intention. Thus, this study will shed a new light on the intention theory to entrepreneurship, providing more detailed information for researchers to thoroughly disclose how entrepreneurial intention is formed.

Moreover, this thesis studies how specific education components influence the attitudes and intentions of students toward entrepreneurship. It will reveal how to improve theses entrepreneurial factors through education and training. Thus, this study will provide significant implications for the teaching theories of entrepreneurship. For example, it will explain which components should be taught to develop a favorable attitude toward entrepreneurship and why, which one can improve perceptions about social norm on entrepreneurship, and which one can enhance ability to control over the entrepreneurial behavior. These will be very useful for educators and teachers to design effective entrepreneurship programs and courses to enhance the entrepreneurial intention of students.

The practical significance of this thesis will reflect on its implication for entrepreneurship education practice. The empirical results of this study on the effect

of education components on entrepreneurial attitudes and intentions will provide useful guidelines for educators to design effective entrepreneurship courses/programs and establish teaching strategies for the subject. For example, what teaching contents should be included in an entrepreneurship program/course, what should the teaching procedures be (i.e., which components should be taught first, which one should be the last), what effect will be induced on the entrepreneurial attitudes and intentions through the development of a particular component, what teaching methods should be used for different components, as well as the assessment methods to be used in the entrepreneurship course. A guideline for all these teaching issues can be derived from the findings of this study.

1.5. Overview of the Study

This thesis is organized in 6 substantive chapters in addition to the present (Ch 1 Introduction) including: Ch 2 Entrepreneurship Education and Theories; Ch 3 Conceptual Model and Hypotheses; Ch 4 Methodology; Ch 5 Results; Ch 6 Discussion and Implications; and Ch 7 Conclusions. A summary of each chapter is described next.

To achieve the aim and objectives, **Chapter 2** presents a review of the existing literature on entrepreneurship and entrepreneurship education. This chapter strengthens the justifications of this study by reviewing the origins of the research field in an attempt to clarify the concepts of entrepreneurship, entrepreneurial intention, and entrepreneurship education. The findings of existing studies on entrepreneurship education and specific education components of an entrepreneurship program or course are also reviewed. Further, different theories of entrepreneurship are discussed and evaluated in terms of the applicability to explaining entrepreneurial intentions and empirical support. Accordingly, the first research question (RQ1: Which theoretical approach is suitable for studying the impact of entrepreneurship education on entrepreneurial intention of students?) is answered in this chapter. Four main sections are included in this chapter, excluding the summary section. They are (1) Definition of key terminologies, (2) Review on entrepreneurship education, (3) Entrepreneurship education components, and (4) Entrepreneurship theories.

The **first** section introduces various definitions of entrepreneurship and identifies the best definition of this phenomenon to fit the purpose of this thesis. Further, the definitions of entrepreneur, entrepreneurial intention, and entrepreneurship education are also discussed in this section. The **second** section moves on to depicting the existing findings on entrepreneurship education. Although entrepreneurship appears to be taught, there is a lack of a consensus on what to teach and how to teach the subject. This section reviews the teaching of entrepreneurship and discusses the teaching contents and methods, the effectiveness and different levels of entrepreneurship education.

The **third** section is about the specific entrepreneurship education components of an entrepreneurship program/course. Four key components of entrepreneurship education are discussed. They are know-what (entrepreneurial knowledge), know-why (values and motives), know-who (interaction or communication with entrepreneurial referents), and know-how (skills and abilities). How these components fit the purpose of this thesis is also presented in this section.

In the **fourth** section, literature review lays the theoretical foundation for our empirical work by examining different approaches to entrepreneurship research (trait models and intention-based models). It details the reasons for using intention-based models rather than others. Further, the evaluation of different intention-based models is also discussed and these models are compared in order to select the best one as the theoretical basis of this thesis. Consequently, the theory of planned behavior (TPB) is selected because of its robustness and validity. This chapter is expected to make a useful contribution to the existing entrepreneurship theories by reviewing the traditional approaches (e.g., trait models) that emphasize entrepreneurial personalities, setting these in context alongside emerging theories (i.e. intention-based models), and hence facilitating a better understanding of the entrepreneurial process.

Chapter 3 is about conceptual model and hypotheses of this study. The chapter begins with a preliminary conceptual model that comprises two general parts: (1) entrepreneurial intention (containing TPB variables), and (2) entrepreneurship education (containing specific education components). The linkage between each of the research questions and the preliminary model is discussed. RQ1 and RQ2 link with the first part of the preliminary model, while RQ3 and RQ4 concern the whole model. As mentioned previously, the RQ1 has been addressed in chapter 2. RQ2 will

be solved through a comparison study between the entrepreneurship group and control group students. RQ3 and RQ4 will be answered by testing the conceptual model.

Based on the preliminary model, an education-entrepreneurial intention model is developed in this chapter. Totally 8 variables are covered in the model including four entrepreneurial or TPB variables (entrepreneurial intention, attitude toward entrepreneurship, subjective norm and perceived behavioral control) and four education variables (know-what, know-why, know-who, and know-how). Ten sets of hypotheses are developed in the model based on theoretical support. Four hypotheses are to test the TPB model in the context of this study, in which, H1a, H1b, and H1c respectively describe the direct impact of the antecedent attitudes (attitude toward entrepreneurship, subjective norm and perceived behavioral control) on entrepreneurial intention; H2, H3 and H4 present the inter-relations among the three attitudes. Three sets of hypotheses are put forward to describe the relationship among the four education components: H5a, H5b, and H5c state the influence of know-what on the other three components; H6 illustrates the effect of know-why on know-who; and H7 describes the effect of know-who on know-how. The last three hypotheses (H8, H9 and H10) describe the relationship between entrepreneurship education and TPB. For example, H8 presents the influence of know-why on attitude toward entrepreneurship; H9 describes the impact of know-who on subjective norm; and H10 reflects the impact of know-how on perceived behavioral control.

The contribution of this chapter is to demonstrate a conceptual model of education-entrepreneurial intention which has **two** merits. *First*, the model elaborates the specific components of entrepreneurship education in terms of what, why, who and how as well as their interrelationships. This provides systematic relationship between entrepreneurship education and entrepreneurial intention. *Second*, the model considers the inter-relationships among the three antecedents of entrepreneurial intention rather than solely on their direct impact. Thus it provides more details about the formation process of entrepreneurial intentions and contributes to the use of TPB in the field of entrepreneurship education research.

Chapter 4 describes the research method of this thesis that explains the issues involved in research design, data collection and analysis methods. This chapter contains 7 main sections: (1) Research design, (2) Procedures to reduce survey errors,

(3) Participants and Scenario of the entrepreneurship course, (4) Questionnaire development, (5) Measures, (6) Data collection, and (7) Data analysis methods.

The chapter firstly discusses the quantitative design of this research and then the procedures used to reduce survey errors. Further, the scenario of the entrepreneurship course studied in this research is presented. Next, the description of a survey is presented. A survey was performed among 594 engineering students from three universities in Hong Kong. The participants included two groups: the entrepreneurship group (294) and control group (300). The former group was the engineering students who had completed an entrepreneurship course while the latter group students had not been exposed to the entrepreneurial course. A questionnaire developed based on the education-entrepreneurial intention model was administered to the engineering students. Totally 411 completed questionnaires were collected with a general response rate of 69.19%. Among the participants, 201 were entrepreneurship group students and 210 were control group students.

Data analysis was performed by 6 steps. The *first* step was data screening which is to check if the missing data significant or not or if the data is randomly distributed. *Second*, data collected from different sources (e.g., different universities) were verified for statistical homogeneity and the control group students were tested if they had homogeneous demographical backgrounds to entrepreneurship students. *Third*, reliability and validity of the measurements used in the survey were tested. *Fourth*, some statistical remedies for common method variance were discussed. *Fifth*, the descriptive information (e.g., means and standard deviation) of the variables of the conceptual model was calculated before ANOVA and T-test which were used for the comparison study between the entrepreneurship group and control group. *Sixth*, the hypotheses of the conceptual model were tested with SEM (structural equation modeling) path analysis. In data analysis, two statistical tools were used: SPSS 15.0 and Amos 18.0. The former tool was used for step 1 to step 5 and the latter on was used for the last SEM path analysis.

Chapter 5 presents the results of this thesis. For a better understanding, the major findings are presented in three sections. The *first* section presents the description of data. It includes the profiles of the participants and the descriptive results of the two groups (entrepreneurship group and control group), such as means and standard deviations of the variables and their simple correlations.

The *second* section illustrates the comparison results of the two groups regarding their entrepreneurial attitudes and intentions. The results showed that students who were exposed to the entrepreneurship course had more positive perceptions about entrepreneurship than did those who were not. This indicates that the entrepreneurship course was effective to improve the attitudes and intention of students toward engaging in entrepreneurial behaviors. Thus, further analysis on how the specific education components influence the entrepreneurial variables of the students is meaningful. Furthermore, the effect of demographic factors (age, gender, year of study, work experience, and exposure to role model) on the entrepreneurial variables was also presented across the two groups. Three factors (age, year of study and work experience) had no significant effect on the entrepreneurial variables across the two groups (entrepreneurship group and control group), while gender and role model showed certain significant effect. The results will offer useful insights into designing an effective entrepreneurship course or program.

In the *third* section, results of model testing are presented. Since TPB model was the theoretical basis of our conceptual model, before examining the conceptual education-entrepreneurial intention model, the TPB model was firstly tested. The results showed that TPB was fitted across the entrepreneurship group and control group, suggesting the model is valid in the context of this study and it is appropriate to be applied to study the entrepreneurial intention of the engineering students regardless whether they have been exposed to entrepreneurial training. Finally, the results of the education model are illustrated. The model was found to be supported at a significance level of 0.05. Attitude toward entrepreneurship, subjective norm and perceived behavioral control were significantly related to entrepreneurial intention; know-what significantly influenced know-why, know-who, and know-how, which respectively influenced the three attitudinal antecedents of entrepreneurial intention. In addition, the inter-relationships among the three antecedents as well as the inter-relationship among the education components were also confirmed. Therefore, the specific education components significantly influenced the antecedent attitudes that determine entrepreneurial intention.

Chapter 6 is discussion and implications. This chapter is presented according to the main findings obtained in the previous chapter (**Chapter 5**). The *fi*rst section elaborates on the findings obtained, compares the results with those of the previous

studies and discusses the possible causes for the findings. Thus, this section includes three subsections: discussion on the finding related to the effectiveness of the entrepreneurship course, the impact of demographic factors, and the findings of the conceptual model. The *second* section discusses the implications of this study. Both theoretical and practical implications are discussed. Of special importance are those implications associated to entrepreneurship research and the teaching of this subject. **Theoretically**, this study identifies a robust approach to entrepreneurship from various entrepreneurship approaches and verifies its applicability to explain the entrepreneurial intention of engineering students. Further, this study goes deeper in that it investigates the inter-dependent relationships among the attitudinal antecedents of intention, identifying how each attitudinal factor acts in the formation process of entrepreneurial intention. Thus, it provides greater details about intention theory to entrepreneurship, providing important information for researchers to thoroughly disclose how entrepreneurial intention forms. Moreover, the findings derive an intention-focus approach to entrepreneurship education. This approach shows how to improve the antecedent attitudes and entrepreneurial intentions through the development of four key education components, and thus provides significant implications for the teaching theories of entrepreneurship. **Practically,** the findings derive teaching strategies for an entrepreneurship course centered at a target-shooting curriculum template and a teaching model for entrepreneurship. For example, what should be included in an entrepreneurship course, which methods should be used, how to assess the course and what effect will be induced on the entrepreneurial attitudes and intentions through the development of particular components.

Chapter 7 presents the conclusion of the thesis. It firstly concludes the research process and summarizes the main findings before discussing the innovation and features of this thesis. Next, the contributions of this study are presented. The **theoretical** contributions include: (1) contribution to the reliability of the TPB in the entrepreneurial research and offering a new insight into the model in explaining entrepreneurial intention by providing more information on how the three antecedent attitudes affect intention, (2) suggesting an intention-focus education approach to nurturing students' entrepreneurial intentions in a systematic way by opening possibilities that entrepreneurial knowledge, skills and acumen are learnable and these learning can change the entrepreneurial attitudes and intentions. The **practical**

contributions mainly concern educators, trainers, and teachers in the field of entrepreneurship. Our findings shed a new light on delivering an effective entrepreneurship course/program by offering a target-shooting curriculum template and a teaching model. The core target of the entrepreneurship course is to foster the entrepreneurial intention of students. Anchoring to this target, key education components (know-what/-why/-who/-how) must be developed. Finally, the limitations of this study and avenues for future research on entrepreneurship education are discussed.

Chapter 2: Entrepreneurship Education and Theories

This chapter provides an extensive review on literatures on entrepreneurship and education. The review includes four main parts: (1) definitions of key terminologies, (2) review on entrepreneurship education, (3) entrepreneurship education components, and (4) entrepreneurship theories. This chapter first discusses the definitions of three key concepts: the entrepreneurship phenomenon, entrepreneurial intention and entrepreneurship education, and then shifts the focus to the main findings of existing studies on entrepreneurship education, including the teaching contents and methods for entrepreneurship, the effectiveness (or outcome) of entrepreneurship education, and levels (or objectives) of current entrepreneurship programs/courses. Next, the specific entrepreneurship education components are discussed. They are know-what (entrepreneurial knowledge), know-why (values and motives), know-who (interaction with entrepreneurial referents or models), and know-how (entrepreneurial skills and abilities). In addition, the key theories of entrepreneurship are reviewed. For example, the traditional trait models and more recent intention-based models are discussed and evaluated in order to choose a robust and valid theoretical approach as the basis of this thesis. A **map of review** on entrepreneurship and education is illustrated in

Figure 1. The findings of the existing studies reviewed are linked to the purpose of this thesis (investigating the influence of specific education components on entrepreneurial intention).

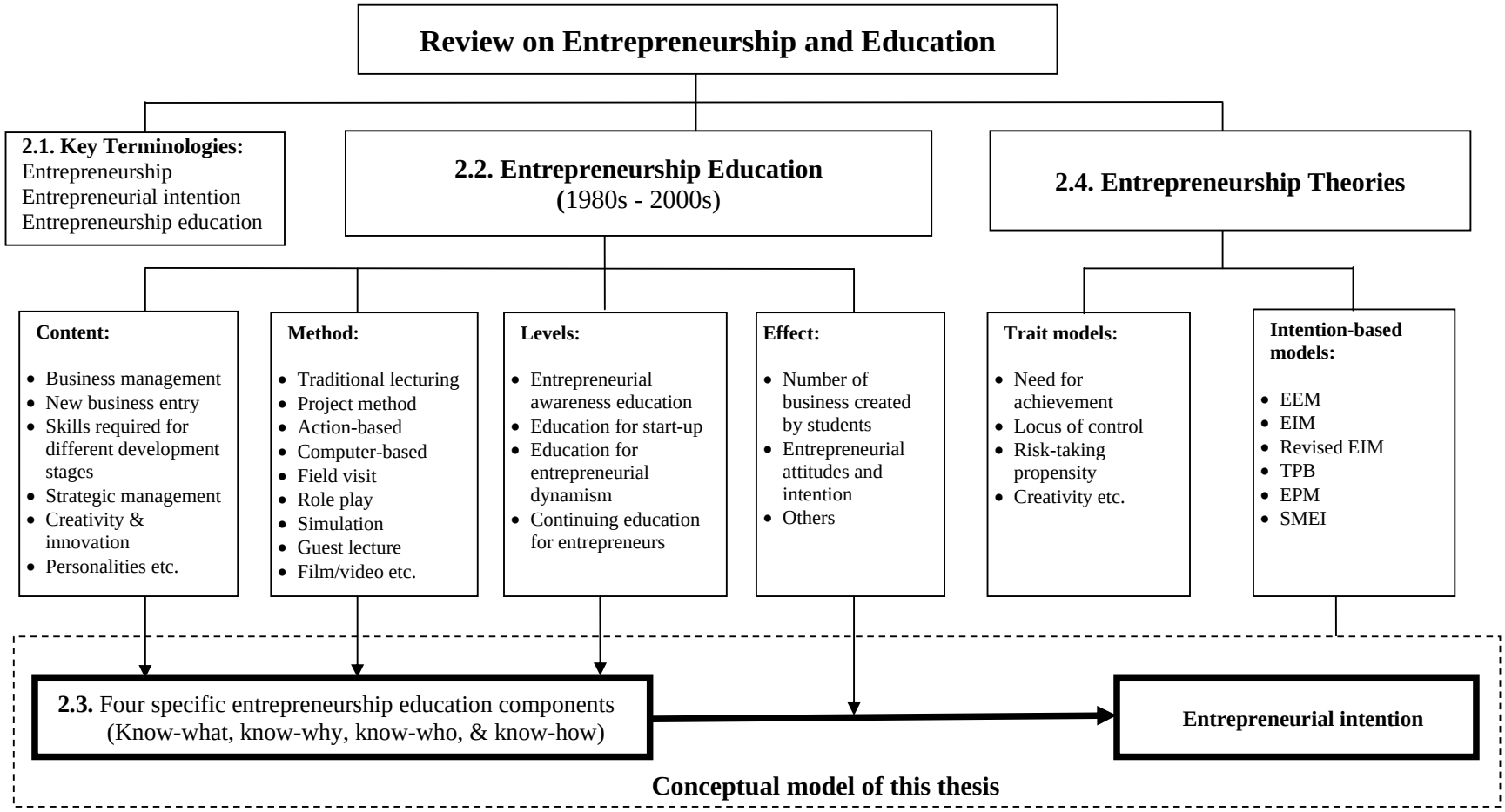

Figure 1. A map of entrepreneurship literature review

2.1. Definition of Key Terminologies

This section discusses the definitions of three key terminologies of this thesis. They are entrepreneurship, entrepreneurial intention and entrepreneurship education.

2.1.1. Defining entrepreneurship

Research on entrepreneurship has been ongoing for decades. There is, however, a lack of a universally accepted definition of this phenomenon. To fully understand the entrepreneurship notion, it is necessary to take off from the starting point-definition. By defining entrepreneurship, we can discover its essence, concerns and objectives which are the basis for conceptually aligning entrepreneurship education with appropriate target audience, course contents and teaching methodologies.

Despite many studies on entrepreneurship, no consensus has been reached for the definition of this phenomenon. According to Schumpeter (1934), entrepreneur is an innovator who breaks an existing state of equilibrium to create progress. Innovation is the driving force to create new products, new production and operations methods, new sources, new business models and new markets. In this sense, entrepreneurship is highly related to the ability to produce something new (Timmons,1989). The ability to recognize an opportunity overlooked by others is thus crucial for entrepreneurs. Other commentators, for example, Cunningham and Lischeron (1991) understood entrepreneurship in terms of a variety of activities including setting up, raising funds, sourcing, and managing a new company. Vesper & Gartner (1997) perceived entrepreneurship as a business entry through creating a new firm or acquiring an existing one.

Cromie (2000) understood entrepreneurship as a process aiming at starting a new company, while Kuratko (2005) considered that entrepreneurship is not only to generate new business, but a continuous innovation process. Despite different concerns of the phenomenon, the hub of the entrepreneurial process is the recognition of business opportunities. In this way, Shane and Venkataraman (2000) argued that identification and exploitation of business opportunities by whom and its outcomes are the key to entrepreneurship.

On the other hand, Tan et al. (2005) perceived entrepreneurship from the social aspect, such as the creation of wealth for the individual and value to the society. Based on this, Kao (1993) defined that entrepreneurship is "the process of doing new and or something different for the purpose of creating wealth for the individual and adding values to society" (p.69). This understanding reflects the social function of entrepreneurship that provides benefits to the public rather than merely pursuing individual profits. This links to the concept of social entrepreneurship, which refers to innovative activity with a social objective in either for-profit sector or in non-profit sector, or in hybrid structural forms mixing these two sectors (Dees, 1998). Moreover, Hisrich and Peters (2002) claimed that entrepreneurship is highly linked to some common aspects such as creativity, independence and risk taking.

In short, the above understandings on entrepreneurship are mainly surrounded by the concepts of innovation, business identification and exploitation, and the benefits and values to the society. The concept of entrepreneurship related to innovation and business opportunity identification is highly linked with entrepreneurship education. Thus in this thesis which aims to investigate the impact of entrepreneurship education, both the concepts of innovation and business opportunity are emphasized. This thesis defines entrepreneurship as an **innovation process** to exploit a **business opportunity** by applying **entrepreneurial learning** (knowledge and skills)**.** In accord with this definition, entrepreneur is the individual who utilizes own entrepreneurial learning (knowledge and skills) to exploit a business opportunity.

Consequently, through entrepreneurship education, individuals are expected to learn to exploit business opportunities and values for entrepreneurship, to generate creative ideas, to deal with risks and uncertainties, to solve problems in innovative ways and to build up capabilities and confidence. That is, in entrepreneurship education, students should develop interest in entrepreneurship, entrepreneurial knowledge and skills as well as entrepreneurial attitudes and motivation. Therefore, this thesis posits that understanding the effect of specific education components is important to design an effective entrepreneurship course or program because this will provide students an entrepreneurial sense in the learning process and improve their perceptions about entrepreneurship. The basis of this argument is that entrepreneurial knowledge, skills, attitudes as well as intention are learnable through education.

2.1.2. Defining entrepreneurial intention

Intentions play a key role in explaining human behaviors (Tubbs & Ekegerg, 1991). Many social behaviors, such as creating a new business, are volitionally controlled and these behaviors have been found to be best predicted by intentions (Ajzen, 1991; 2005; Bagozzi et al., 1989).

Similar to entrepreneurship, different understandings of entrepreneurial intentions have been observed. Katz and Gartner (1988) defined entrepreneurial intention in terms of looking for information and other resources to start up. Bird (1988; 1992) defined that intention as a state of mind that emphasizes personal attention and experience to accomplish new venture creation. Focusing on cognitive representation, Tubbs and Ekeberg (1991) stated that an intention is a representation of actions planned to perform an entrepreneurial behavior. Other researchers, for example, Reynolds and Miller (1992) understood entrepreneurial intention as the personal commitment of the potential entrepreneur to start up. In the same way, Krueger (1993) and Krueger et al. (1995) argued that entrepreneurial intention is the commitment to performing entrepreneurial behavior.

Based on the above definitions, we define entrepreneurial intention in accord with the concept of cognitive representation and the understanding of the entrepreneurship phenomenon that we have defined in previous section. In this thesis, entrepreneurship intention is a **cognitive representation of actions** for exploiting a **business opportunity** by applying **entrepreneurial learning** (knowledge and skills).

Entrepreneurial intention has proven to be a basic construct and frequently used in research on entrepreneurship (Bird, 1988; Carr & Sequeira, 2007; Krueger et al., 2000; Wilson et al., 2007) and it has been used as a dependent variable in many studies (Autio et al., 1997; Davidsson, 1995; Kolvereid, 1996b; Tkachev & Kolvereid, 1999; Souitaris et al., 2007). Researchers have confirmed that entrepreneurial intention effectively predicts entrepreneurial behavior, and entrepattitudes toward entrepreneurship, in turn, predict entrepreneurial intentions (Ajzen, 1991; 2005). That is, factors influence the entrepreneurial behavior through influencing intention, which is derived from attitudes. As attitudes and intentions are perceptions-based, they are learnable (Krueger & Brazeal, 1994). Therefore, nurturing the entrepreneurial attitudes and intentions through entrepreneurship education is important to promote the entrepreneurship.

2.1.3. Defining entrepreneurship education

Interest in entrepreneurship education has grown rapidly since 1950s. During the past years, entrepreneurship has become an important domain of business education (Solomon & Fernald, 1991). However, there has been a lack of general agreement on the definition of entrepreneurship education, given the various definitions of the entrepreneurship phenomenon (Fones & English, 2004).

There are different understandings of entrepreneurship education. According to Hood and Young (1993), entrepreneurship education is to teach people to start new businesses successfully and operate the businesses profitably, and thus facilitates the economic growth. Bechard and Tolohous (1998) argued that entrepreneurship education is a program or course that aims to introduce business knowledge and new business creation and to train individuals to start up. While Gottleib and Ross (1997) comprehend entrepreneurship education in terms of education for creativity and innovation, Kourilsky (1995) understood entrepreneurship education in relation to the identification of business opportunity, resources allocation, risk management, and new venture creation.

Some researchers considered the differences between entrepreneurship education and business education (Henry et al., 2005a; Hindle, 2007). They claimed that entrepreneurship education is different from and business administration and management. Entrepreneurship education focuses on the specific activities that entrepreneurs perform, underlining innovation and business growth. Conventional business education emphasizes general business management related to business administration aspects (Klandt, 1998). Thus, to be specific to new venture creation, entrepreneurship education should focus on the aspects of business entry (Gartner et al., 1992), such as identifying new business opportunities and running a new business.

Moreover, entrepreneurship education can be defined by focusing on the concept of business opportunities. According to Davidsson (2004), entrepreneurship education is to teach students how business opportunities are identified, evaluated and pursued by whom and with what approaches. This concerns the teaching contents, the target audience, and competencies to deal with entrepreneurial activities.

From the understandings above, it is possible to summarize that entrepreneurship education is to increase the awareness of entrepreneurship (basic concepts and knowledge related to entrepreneurship) (Bechard & Tolohous, 1998)

and develop necessary skills and competences to deal with entrepreneurial activities (Davidsson, 2004; Gottleib and Ross, 1997; Hood & Young, 1993; Kourilsky, 1995), which are different from traditional business education (Henry et al., 2005a; Hindle, 2007; Klandt, 1998). Based on these, in this thesis, we define entrepreneurship education as the process of **transmitting entrepreneurial knowledge and skills** to students to help them exploit a business opportunity. In sense of this, students are expected to improve their attitudes (desirability or interest) toward entrepreneurship and develop knowledge and skills required to solve complex problems and risks or uncertainties inherent in the entrepreneurial process.

This is relevant for both those who are aiming to become entrepreneurs and those who may not be interested in becoming entrepreneurs. The former group is a typical target group of entrepreneurship education (Klandt, 1998). The latter group of who may not be interested in being entrepreneurs can also join the entrepreneurship courses and programs. It is because that entrepreneurship education may offer them the basic knowledge about entrepreneurship, enhance their entrepreneurial skills and innovative skills, improve their attitudes toward entrepreneurship and stimulate their interest in the phenomenon.

Therefore, entrepreneurship education should be offered to not only the entrepreneurship interested group, but also those who have not developed their interests in entrepreneurship. Entrepreneurship education programs/courses should emphasize both on (1) equipping students with entrepreneurial knowledge and skills, and (2) developing their entrepreneurial attitudes and intentions. In accord with this, we argue that it is important to identify what kinds of competence (knowledge and skills) should be offered by an entrepreneurship program/course as well as their effect on changing the entrepreneurial perceptions of students. These will offer important insights into designing effective strategies and guidelines for entrepreneurship education.

2.2. Review on Entrepreneurship Education

In the previous section, the conceptual issues of entrepreneurship, entrepreneurial intention, and entrepreneurship education were addressed, leading to the discussion on the existing research on entrepreneurship education. It is increasingly convinced that entrepreneurship can be taught and entrepreneurs are made, not born. The review of Gorman et al. (1997) covering literature on entrepreneurship education during 1985 and 1994 showed that "most of the empirical studies surveyed indicated that entrepreneurship can be taught, or at least encouraged, by entrepreneurship education" (p.63). Accordingly whether entrepreneurship can be taught is becoming obsolete (Ronstadt, 1987) and what we should pay attention to is what should be taught and how it should be taught (Kuratko, 2003). This section reviews the contemporary studies on entrepreneurship education including the teaching contents and methods, effect of entrepreneurship education, levels of entrepreneurship education, and key entrepreneurship education components.

Although the rapid growth in numbers of entrepreneurship course or programs across the globe (Katz, 2003), researchers and educators are challenged with designing effective entrepreneurship course or program (Fiet, 2001a; 2001b; Gibb, 1993; Henry et al., 2005a; 2005b) because of the widely varied entrepreneurship curricula in content and approach (Charney & Libecap, 2003; Gorman et al., 1997; Solomon et al., 2002). For example, what should be included in an entrepreneurship course? What pedagogies are most appropriate to deliver entrepreneurial knowledge and skills? Over 70 key studies on entrepreneurship education (covering research on teaching contents and methods and effect of entrepreneurship education) during 1980s - 2000s are reviewed in this thesis, as summarized in **Table 2, Table 3** and **Table 4.**

Table 2. Key articles on entrepreneurship education (1980s)

Author	Year published	Description	Content	Method	Effect
Root and Gall	1981	attitudinal training	v		
Sexton and Upton	1984	individual activities over group activities		v	
Rice	1985	psychological set, traits, values, and attitudes	v		
Knight	1987	opportunity identification, strategy development, resource acquisition, and implementation	v		
McMullan and Long	1987	• different skills needed at various stages of the firm's development • skill-building aspects in negotiation, leadership, communication, new product development, creative thinking, and exposure to technological innovation	v		
Ronstadt	1987	• barriers to initiating their entrepreneurial careers • various methods: lectures, case studies and feasibility plans	v	v	
Zeithaml and Rice	1987	• entire scope of business administration • entrepreneurship and small business management are closely associated	v		
Hills	1988	• awareness of entrepreneur career options • project method	v	v	
Klatt	1988	field trips and use of video		v	
Vesper and McMullen	1988	• sources of venture capital • project method	v	v	
Curran and Stanworth	1989	importance of evaluation of entrepreneurship programs			v

"v": covered in the studies

Table 3. Key articles on entrepreneurship education (1990s)

Author	Year published	Description	Content	Method	Effect
Clouse	1990	entrepreneurship program has a positive impact on one's decision to start a new venture			v
Garnier and Gasse	1990	entrepreneurship program has a positive impact on one's decision to start a new venture			v
Plaschka and Welsch	1990	ambiguity tolerance or the challengers associated with each stage of venture development	v		
Ronstadt	1990	training on unstructured and uncertain nature of entrepreneurial environments		v	
Davies and Gibb	1991	traditional education methods (e.g., lectures) are inappropriate		v	
Donckels	1991	awareness of entrepreneur career options	v		
McMullan and Boberg	1991	compare the case method of teaching with the project method		v	
Preshing	1991	project method		v	
Robinson and Hayes	1991	• mentoring • "depth" and "breadth" of entrepreneurship education programs		v	
Stumpf, Dunbar, and Mullen	1991	behavioral simulations		v	
Block and Stumpf	1992	• knowledge acquired in different business school courses • importance of evaluation of effectiveness of entrepreneurship education	v		v
Gartner, Bird, and Starr	1992	equivocal nature of business entry	v		
Price and Monroe	1992	entrepreneurship training has a positive relationship with venture growth and development			v
Gibb	1993	• not compatible to employ the curriculum of business school in an entrepreneurial situation • traditional teaching method is not suitable • role of the teacher is that of guide and partner in the learning process	v	v	
Hood and Young	1993	four primary elements: content, skills and behavior, mentality, and personality	v		

Table 3. Key articles on entrepreneurship education (1990s) (Cont.)

Author	Year published	Description	Content	Method	Effect
Gartner and Vesper	1994	• business entry differ from ongoing businesses - project method • "live" cases • student entrepreneurship clubs	v	v	
Solomon et al.	1994	interviews with entrepreneurs, environmental scans		v	
Mitchell and Chesteen	1995	experiential pedagogy		v	
Hynes	1996	focus and delivery methods ought to vary in accordance with the specific requirements and needs of students		v	
Shepherd and Douglas	1996	criticize the use of the less traditional case study		v	
Brawer	1997	computer simulations		v	
Vesper and Gartner	1997	18 evaluation criteria			v
Young	1997	experience and practical skills used by entrepreneurs are possibly not something that can be acquired through conventional teaching methods		v	
Hisrich and Peters	1998	skill-building aspects in negotiation, leadership, communication, new product development, creative thinking, and exposure to technological innovation	v		
Johannisson, Landstrom, and Rosenberg	1998	active-based approach	v		
McMullan and Gillin	1998	entrepreneurship courses increased entrepreneurial intention			v
Hostager & Decker	1999	active-based approach	v		
Jack and Anderson	1999	art and science of entrepreneurship education	v		

"v": covered in the studies

Table 4. Key articles on entrepreneurship education (2000s)

Author	Year published	Description	Content	Method	Effect
Charney and Libecap	2000	Entrepreneurship courses increased entrepreneurial intention			v
Ehrlich et al.	2000	entrepreneurship education has a positive impact on self-efficacy			v
Rae and Carswell	2000	approaches for personal development		v	
Shane and Venkataraman	2000	opportunity identification and its role in entrepreneurship education	v		
Fiet	2001a;2001b	theory-based activities	v		
Gartner	2001	opportunity identification and its role in entrepreneurship education	v		
Ireland, Hitt, Camp, and Sexton	2001	active-based approach	v		
McMullan, Chrisman and Vepser	2001	measuring effectiveness in terms of new venture creation			v
Noel	2001	entrepreneurship students have higher self-efficacy and intention to start up			v
Upton, Teal, and Felan	2001	business plan		v	
Varela and Jimenez	2001	universities invested most in entrepreneurship education had the highest start up rate			v
Zahra and Dess	2001	opportunity identification and its role in entrepreneurship education	v		
Solomon, Duffy, and Tarabishy	2002	• opportunity identification and its role in entrepreneurship education • most popular teaching methods in entrepreneurship education are creation of business plans, case studies, and lectures	v	v	
Peterman and Kennedy	2003	evaluating the effectiveness of entrepreneurship program			v
Shepherd	2003	emotion and learning from failure	v		
DeTienne and Chandler	2004	opportunity identification and its role in entrepreneurship education	v		
Honig	2004	business plan		v	
James & Clare	2004	case method		v	
Shepherd	2004	emotion and learning from failure	v		
Wee	2004	problem-based learning		v	

Table 4. Key articles on entrepreneurship education (2000s) (Cont.)

Author	Year published	Description	Content	Method	Effect
Hanke, Kisenwether, and Warren	2005	problem-based learning		v	
Hartshorn and Hannon	2005	role of the teacher is that of guide and partner in the learning process		v	
Henry, Hill, & Leitch	2005a;2005b	entrepreneurship course is different from typical business course	v		
Kuratko	2005	entrepreneurship course is different from typical business course	v		
Binks, Starkey, and Mahon	2006	entrepreneurship process and operational context	v		
Co and Mitchell	2006	interactive methods such as role playing and simulation		v	
Collins, Smith, and Hannon	2006	collaborative learning between participants		v	
Fayolle et al.	2006	entrepreneurship education increased entrepreneurial intention			v
Heinonen and Poikkikjoki	2006	opportunity identification and its role in entrepreneurship education	v		
Cooper	2007	computer-based learning		v	
Hindle	2007	entrepreneurship course is different from typical business course	v		
Souitaris et al.	2007	inspiration	v		
Anderson and Jack	2008	a theoretical and practical input	v		
Plumly et al.	2008	skill-building aspects in negotiation, leadership, communication, new product development, creative thinking, and exposure to technological innovation	v		
Richardson and Hynes	2008	information communication technology	v		
Verduyn, Wakkee, & Kleijn	2009	producing films by students to “captures” real-life entrepreneurship phenomenon		v	
Mwasalwiba	2010	role of the teacher is that of guide and partner in the learning process		v	

“v”: covered in the studies

2.2.1. Teaching contents of entrepreneurship

Different opinions on the teaching of entrepreneurship have been observed in the literature. Some researchers suggested that entrepreneurship education should stress theories and principles of entrepreneurship because these are useful to develop cognitive skills of students (Fiet, 2001a; 2001b). However, other commentators argued that practically focused and action-based approaches are more valid (Hostager & Decker, 1999; Ireland et al., 2001; Johannisson et al., 1998). In a balanced view, Anderson and Jack (2008) argued that the teaching of entrepreneurship should highlight both the theoretical and practical aspects of entrepreneurship.

Knight (1987) suggested that opportunity identification, strategy development, and resource allocation are key elements of entrepreneurship and all these should be emphasized in entrepreneurship courses or programs. Considering management education, Zeithamil and Rice (1987) argued that education in entrepreneurship should cover the entire scope of business administration. In the same line, Block and Stumpf (1992) proposed that entrepreneurship education should contain typical business management knowledge, including market analysis and planning, pricing strategies, financial analysis, leadership, human resources, and other management theories and skills.

Of the opinions of other researchers, entrepreneurship course is different from typical business courses (Henry et al., 2005a; 2005b; Hindle, 2007; Kuratko, 2005) and it should address the issues related to business entry (Gartner, Bird, & Starr, 1992), entrepreneurship process and industry environment (Binks et al., 2006). Specifically, McMullan and Long (1987) proposed that entrepreneurship has different stages and thus education of entrepreneurship should include the knowledge and skills needed at theses stages. Based on this, Gartner and Vesper (1994) claimed that skills and knowledge required for entrepreneurial start up is different from the conventional business management. By comparing the learning focus of business school and entrepreneurship education, Gibb (1993) stressed that it is not appropriate to adopt the whole business curriculum in entrepreneurship education.

However, Zeithaml and Rice (1987) posted the warning that it is improper to teach entrepreneurship without touching upon the knowledge about business management given a strong relationship between the two domains. In this sense, entrepreneurship education should include both business management and new

business entry knowledge and skills. Ronstadt (1987) argued that entrepreneurship education should include barriers to starting a new business and possible solutions. In this way, entrepreneurship education should equip students with different skills, including leadership skills, communication skills, new product development, innovation (Hisrich & Peters, 1998; McMullan & Long, 1987; Plumly et al., 2008) and information communication technology (Richardson & Hynes, 2008). Moreover, Hood and Young (1993), based on the opinions of 100 entrepreneurs and chief executive officers, proposed four main aspects for entrepreneurship education, including content (e.g., finance/cash management, engineering &accounting), skills (leadership, communication, and human relations) and behavior, mentality (e.g., creativity & opportunistic thinking) and personality (e.g., self-motivation and risk-taking). On the other hand, Jack and Anderson (1999) suggested both the art and science of entrepreneurship education. The authors claimed that entrepreneurship education not only equips students with multi-functional management skills (the science), but also creativity and innovation skills to deal with the uncertainties and risks in the entrepreneurial process (the art). Based on above, entrepreneurship courses should emphasize a series of business management knowledge and skills (such as marketing, accounting, new business planning, new product development, financing and operating), new business entry and innovation.

On the other hand, some researchers contended that entrepreneurship education should focus on introducing entrepreneurship as an alternative career choice (Donckels, 1991; Hills, 1988), while others stressed that entrepreneurship education should center around the sources of venture capital (Vesper & McMullan, 1988), the challenges associated with the venturing process (Plaschka & Welsch, 1990), and business opportunity exploitation (DeTienne & Chandler, 2004; Gartner, 2001; Heinonen & Poikkijoki, 2006; Shane & Venkataraman, 2000; Solomon et al., 2002; Zahra & Dess, 2001).

Additionally, some researchers suggested attitudinal preparation of participants. For example, Root and Gall (1981) emphasized training students to be attitudinally independent outside regular-classroom settings. Rice (1985) highlighted the training of psychological characteristics related to entrepreneurship, values and attitudes which help students deal with risks and uncertainties. More recently, Souitaris et al. (2007) emphasized developing inspiration (emotional element) of

students through entrepreneurship courses, while Shepherd (2003; 2004) underlined educating entrepreneurship students about emotion and learning from failure.

2.2.2. Teaching methods of entrepreneurship

Various ways to deliver the entrepreneurship courses/programs have been observed. According to Ronstadt (1990), students should be trained to make decisions in the "unstructured and uncertain nature of entrepreneurial environments" and hence the entrepreneurship education should focus on the practical training on how to set up and manage a new business.

Sexton and Upton (1984) argued that individual activities should be highlighted more than group activities in entrepreneurship education. The authors also promoted unstructured entrepreneurship courses where students are required to give "novel solution under conditions of ambiguity and risk" (p.24). However, Collin et al. (2006) encouraged collaborative learning approaches between students. Co and Mitchell (2006), based on different teaching approaches, explained that it is necessary to examine whether the current teaching methods achieve the course objectives. They advised using "more interactive methods such as role playing and simulation for students to practice analytical and decision making skills" (p.358).

A study by Solomon et al. (2002) noted that traditional lecturing methods are popular in entrepreneurship education. However, some commentators criticized using the traditional methods and argued that the teaching of entrepreneurship should be based on innovation and practice (Davies & Gibb, 1991; Gibb, 1993; Hartshorn & Hannon, 2005; Mwasalwiba, 2010). The researchers argued that traditional methods which focus on theory and concepts are not appropriate to teach entrepreneurship, and instead the learning should be more proactive with teachers acting as guides or facilitators. This is supported by Young (1997) who argued entrepreneurship education requires experienced-based and practical learning settings and these are difficult to be obtained through traditional teaching attempts. Nonetheless, Shepherd and Douglas (1996) criticized the less traditional methods for entrepreneurship, such as case study, role play, simulation and problem solving, arguing that these methods actually promote logical rather than creative or entrepreneurial thinking.

On the other hand, some scholars suggested problem-based learning for entrepreneurship education, where learning is student-centered (Hanke et al., 2005; Wee, 2004). Other researchers advised the project method for teaching entrepreneurship (Gartner & Vesper, 1994; Hills, 1988; Preshing, 1991; Vesper & McMullan, 1988) with business plan as a major tool (Honig, 2004; Upton et al., 2001), experiential pedagogy (Mitchell & Chesteen, 1995) and case method (James & Clare, 2004).

In the study of McMullan and Boberg (1991), case method and project method were compared. Based on a survey among MBA students and alumni, the authors found that case method was effective to develop "analytical skills and ability to synthesize information", while the project method was suitable for developing knowledge and understanding of entrepreneurship and the ability to assess business opportunities. They argued that project method was more appropriate for entrepreneurship education. On an integration basis, Ronstadt (1987) advised combining different methods (lectures, case studies and feasibility plans) while delivering an entrepreneurship course given the structured-unstructured nature of entrepreneurship course.

Other approaches to entrepreneurship education include computer simulations (Brawer, 1997) and other forms of computer-based learning (Cooper, 2007), behavioral simulations (Stumpf et al., 1991), interviews with entrepreneurs & environmental scans (Solomon et al., 1994), "live" cases (Gartner & Vesper, 1994) or life-story approach (Rae & Carswell, 2000), mentoring (Robinson & Hayes, 1991), field trips, use of video (Klatt, 1988), and even producing films by students to "captures" real-life entrepreneurship phenomenon (Verduyn et al., 2009).

Apart from the teaching content and methods, some studies on entrepreneurship education investigated the duration of entrepreneurship programs. For example, most entrepreneurship programs or courses lasted as short as a few days (Curran & Stanworth, 1989), while others ranged from several days to several months or even several years (Garavan & O'Cinneide, 1994). Some studies concerned the "depth" and "breadth" of entrepreneurship education programs. For example, Robinosn and Hayes (1991) claimed that "depth" relates to the quality of program, while "breadth" refers to the number of entrepreneurship programs available. The

authors proposed that quality of the entrepreneurship education depends on the support of teachers, students and institutes.

Developing a quality entrepreneurship course or program is challenging for entrepreneurship educators (i.e., “depth”). From the review above, the major barrier to developing quality or effective entrepreneurship programs/courses is the lack of a solid theoretical basis for setting out education strategies. It has been witnessed that there are different opinions about the contents and methods of entrepreneurship education, and there is absent of agreement on what approaches should be used to teach the subject? What should be taught? What should be the focus of entrepreneurship education? This could be problematic. Although Hynes (1996) argued these education issues could be designed specifically to fit different requirements and resources of institutes, the present diversity is unusually broad (Matlay, 2005; 2006) leading to a lack of consensus on the educational issues at both the theological and pedagogical levels (Fayolle & Gailly, 2008). This was also observed by Fiet (2001a) who argued that the diversity “is not solely a reflection of different ways of teaching a topic, nor is it the natural result of pursuing academic freedom” (p.4). Instead, it is a signal that there is not a theory-driven framework of entrepreneurship education. Such a framework should be developed based on a robust theory in the field of entrepreneurship research and able to explain how education of entrepreneurship achieves the expected objectives (e.g., improving entrepreneurial knowledge & skills, attitudes and intentions). It should also provide guidelines for educators to design effective entrepreneurship programs/courses and arrive at a consensus on dealing with the teaching of the subject. The need of this framework just fits the purpose of this thesis that aims to develop an entrepreneurship education model providing an in-depth insight into how specific education components influence entrepreneurial attitudes and intentions. Our model will offer useful guidelines for entrepreneurship education by addressing what key components should be included in an entrepreneurship course, what effect these components will produce on students’ entrepreneurial perceptions, and what teaching methods should be used.

2.2.3. Effectiveness of entrepreneurship education

Entrepreneurship researchers have stressed that evaluation of entrepreneurship education and training is important for policy makers and educators to develop effective entrepreneurship education courses (Block & Stumpf, 1992; Curran & Stanworth, 1989). However, there has been lack of empirical research on the effectiveness of entrepreneurship education, and the directions of the existing studies are varied and inconsistent (Honig, 2004; Peterman & Kennedy, 2003).

Some researchers measured the effect of entrepreneurship education in terms of how much entrepreneurship programs or courses benefit the society, such as in terms of technology transfer, new jobs opportunity, or assistance to local entrepreneurs (Henry, 2004). Others measured the impact through participants' satisfaction with the entrepreneurial programs or courses regarding innovation and their business performance (Henry, 2004). Further, some studies measured students' academic performance (e.g., GPAs) (Charney & Libecap, 2000; Hynes, 1996).

In the study of Vesper and Gartner (1997), the authors tried to cover possible indicators to measure the effectiveness of entrepreneurship education. They reported 18 possible evaluation criteria for ranking the quality of entrepreneurship programs. These criteria included courses offered, faculty publications, impact on community, exploits of alumni, innovations, alumni start-ups, outreach to scholars, competitions and awards won, years of activity, size of MBA program, Halo of school or university, magnitude of resources, alumni comments years later, size of undergraduate program, incoming student qualities, size of doctoral program, faculty start-ups and location. However, these findings were based on the subjective opinions of academics that may lack scientific reliability.

Focusing on new venture creation, many researchers argued that there is a positive relationship between entrepreneurship education and start-up actions (Chrisman, & Vesper, 2001; Henry, 2004; McMullan, Kuratko 2003; 2005). Many studies have showed that entrepreneurship education affects the career choice of students and facilitates them to start up (Fleming, 1994). Clark et al. (1984) reported that university students who had completed an entrepreneurship course demonstrated higher level of intention to create a new firm. According to the authors, most of the entrepreneurship students (nearly 80%) had entrepreneurial intention after studying the course and over 70% of them later on created own companies. These showed that

entrepreneurial education was effective to enhance the entrepreneurial intention of the students and to facilitate their subsequent start-ups. Similarly, in the study of McMullan et al. (1985), the higher start-up rate of MBA students who had completed three or more courses related to entrepreneurship was reported.

Further, Charney and Libecap (2000) investigated the impact of entrepreneurship education on venture creation. They studied 511graduates (105 entrepreneurship graduates and 406 non-entrepreneurship graduates) during 1985-1999 in a university. The authors confirmed that entrepreneurship graduates had significantly higher start-up rate (27%) than their counter parts (9%). That is, entrepreneurship education significantly relates to new venture creation. They also found evidence that entrepreneurship education had positive impact on the graduates' propensity to create own businesses (i.e., entrepreneurial intention) and wealth generation in their regression analysis.

In a similar way, Dutta et al (2010) surveyed 221 entrepreneurship alumni in a university from 1988 to 2008. The authors assessed the impact of entrepreneurship education on venture creation and wealth generation. They revealed that specialization of entrepreneurship education had a significant positive impact on venture creation; it together with the diversity of education experience (e.g., exchange study & international residency) facilitated their businesses success (e.g., increased wealth). In this study, entrepreneurship was considered as a general independent variable that links to venture creation and wealth creation (dependent variables) in a logit regression. The specific effects of education components were not explored.

Similar findings have been supported in the literature. McMullan and Gillin (1998) for example, claimed that individuals who took entrepreneurship courses processed stronger intention to set up an own company at some point in their life than those who did not attend the courses. This was confirmed by others that entrepreneurship program facilitates individuals to start up (Clouse, 1990; Garnier and Gasse, 1990) and improves the venture growth and development (Price & Monroe, 1992). In the same line, Vesper and McMullan (1997) argued that entrepreneurship education has a positive impact on alumni's likelihood to initiate entrepreneurship and improves their decision making. Providing further support to this, Botha et al. (2006) and Del Valle and Castillo (2009) provided further evidence on the positive relationship between small business performance and training.

Additionally, Varela and Jimenez (2001) reported that the highest entrepreneurship rates were achieved in the universities that had invested most in entrepreneurship education.

Despite of the positive effect of education on new venture creation and entrepreneurial performance, only a small number of students will create own businesses shortly after completing the entrepreneurship education and training. In fact, evaluating the effectiveness of entrepreneurship is complicated. It is not appropriate to confine to the start-up measure that may exclude the measurement of entrepreneurial knowledge, skills, attitudes and intentions. Further, the goal of entrepreneurship education is not necessarily for all participants to create new businesses in a short term. It seems questionable to measure the outcome of entrepreneurship education program merely with the number of business created by the graduates. The evaluation of the effectiveness of entrepreneurship education may surpass such start-up measure and emphasize on the delayed effects (Block & Stumpf, 1992). Considering that entrepreneurship is under volitional control of individuals and it is a planned behavior, intention is the best predictor of entrepreneurial behavior (Krueger , 1993; Krueger et al., 2000; Luthje & Franke, 200) and it is the first step in the venture creation process (Shook et al., 2003). In recent years, some researchers (Fayolle et al., 2006a; Noel, 2001; Peterman & Kennedy, 2003) have suggested that the effectiveness the entrepreneurship education is measured in terms of the predictors of entrepreneurship action, such as entrepreneurial attitudes and intentions (Ajzen, 1991; 2005; Bird , 1988).

In the study of Peterman and Kennedy (2003), an entrepreneurship program, Youth Achievement Australia (YAA) was studied. The authors measured the effectiveness of the entrepreneurship program in terms of the perceptions of desirability and feasibility of the students to create new businesses. Their research was based on the Entrepreneurial Event Model (EEM) of Shapero and Sokol (1982). The variables of participation in the YAA program, breadth and positives of prior experience, desirability and feasibility were considered in the study. The results showed that students who completed the YAA program reported a significantly higher level of desirability and feasibility to start up than those who did not join the program. **It is important to note that** although the YAA program lasted five months (similar to an entrepreneurship course/program offered in a university), these findings

were limited for secondary students aged between 15 and 18. University students may have different perceptions about entrepreneurship from secondary students. Also the YAA program was off-school. The results might differ from university-leveled courses/programs as the setting or arrangement of the course/program may affect the learning of participants.

On the other hand, Fayolle et al (2006a), based on the theory of planned behavior, developed a model to measure the effectiveness of an entrepreneurship education program in terms of entrepreneurial attitudes and intentions. The model considered the characteristics of an entrepreneurship education program, such as institutional setting, audience, type of programs, objectives, contents, teaching and training methods and approaches. The study reported that after completing the entrepreneurship program the participants had significantly higher level of entrepreneurial intention, although the increase in perceived behavioral control was not significant. The authors concluded that the program was effective to increase the intention of students to start up. **However,** the entrepreneurship education program considered in the study was a one-day program and only 20 students were involved. A regular entrepreneurship course/program may have different findings from one-day training. Further, the study although mentioned the characteristics of the education program, it provided little information on how to measure and how to test the effect of these characteristics. Moreover, in the empirical study, the authors ignored the effects of education on attitude toward entrepreneurship and subjective norm which directly determine the level of entrepreneurial intention. According to Ajzen (1991; 2005), the entrepreneurship education and training, as an external factor, is likely to influence entrepreneurial intention through its three antecedents (attitude toward entrepreneurship, subjective norm and perceived behavioral control).

Other studies focused on the relation between entrepreneurship education and self-efficacy. Ehrlich et al. (2000) contended that entrepreneurship education significantly increases one's self-efficacy and facilitates the emergences of entrepreneurial activities. Noel (2001) studied different groups of students: graduates in entrepreneurship, graduates in management, and graduates in other disciplines. All the students completed an entrepreneurship education program. The author found that entrepreneurship graduates had higher level of propensity to act as an entrepreneur, entrepreneurial intention and entrepreneurial "self-efficacy" than those of the other

two groups. Self-efficacy is indeed very similar to the term of perceived behavioral control, which is an attitudinal factor of entrepreneurial intention (Krueger & Brazeal, 1994; Krueger et al., 2000). Thus, the effectiveness of entrepreneurship education in the studies of Ehrlich et al. (2000) and Noel (2001) is related to the attitudinal antecedents of entrepreneurial intention.

In summary, the literature showed that entrepreneurship education has a significant impact on participants' decision on engaging in entrepreneurship and their future business performance, but merely measuring the effectiveness of entrepreneurship programs/courses with the number of business created by students is not appropriate. Being limited to the venture creation measure may exclude the measure of entrepreneurial skills, attitudes, and intentions that may be developed throughout the learning process. The entrepreneurship programs/courses do not necessarily aim at new venture creation for all students. There are programs for nurturing entrepreneurial spirits and interest of students. It has been observed that various types of entrepreneurship education programs/courses are offered in institutes. They have different education levels, objectives, and target audience. As will be described in next section, some programs are designed for participants to create businesses shortly, while others may be for awareness education of entrepreneurship, dynamic entrepreneurial behaviors after the star-up phase, or continuous improvement of existing entrepreneurial abilities (Linan, 2004). These programs are at different levels and target for different participants. The "start-up" level is for those who have entrepreneurial intention and are preparing to create a small business; the "awareness" level aims to deliver entrepreneurial knowledge and skills to participants and develop their entrepreneurial attitudes and intentions; the "dynamic" and "continuous" levels are advanced education for those who have already owned a business. As a result, evaluation of the effectiveness of the entrepreneurship programs/courses should be adjusted accordingly. For university students who may not have entrepreneurial intentions, the primary level or "awareness" education is suitable (Linan, 2004). Therefore, in this thesis, we focus on awareness education of entrepreneurship. Considering that the students are on campus that they are less likely to be engaged in actual entrepreneurial behavior, it seems not feasible to measure new business creation of the students which may take 5-10 years of time (Fayolle et al., 2006a; 2006b; Henry et al., 2005a). Thus, measuring the entrepreneurial intention, the

predictor of entrepreneurial action is more reasonable. In our study, a framework that bridges specific education components and entrepreneurial intentions will be developed, demonstrating how the education components influence participants' intention toward performing entrepreneurial behaviors. Such a framework can be useful to measure the effectiveness of the entrepreneurship programs/courses and offer guidelines for teaching the subject.

2.2.4. Levels of entrepreneurship education

To develop an education model, we need to consider different levels (or objectives) of entrepreneurship education. This section summaries various levels of entrepreneurship education and discusses which one this thesis concerns.

Different types of entrepreneurship programs/courses have been emerged in the past years. It seems difficult to make a universal objective for the entrepreneurship programs/courses because the target audience and teaching settings are different. Jamieson (1984) summarized entrepreneurship education into three levels: education *about* entrepreneurship, education *for* entrepreneurship and education *in* entrepreneurship. The first level of education is about awareness education which aims to instil entrepreneurial theories to students. The second level of education was to train students to set up a new business. Learning of practical skills for business setup and management is emphasized at this education level. The third level is to improve the management skills of established entrepreneurs.

Based on Jamieson's work, Co and Michell (2006), Kirby (2004) and Hytti and O'Gorman (2004) again highlighted entrepreneurship education programs into three levels: educating *about* entrepreneurship, educating *for* entrepreneurship, and educating *through* entrepreneurship. The first two education levels are basically the same as Jamieson's (1984). They claimed that educating *about* entrepreneurship is to give a general understanding about entrepreneurship (Hytti & O'Gorman, 2004). Education *for* entrepreneurship is to transform participants into entrepreneurs. The central element of this education level is the creation of a new company. Potential entrepreneurs are expected to acquire useful tools to initiate the entrepreneurial endeavor (Co & Mitchell, 2006). Educating *through* entrepreneurship is a bit different from Jamieson's (1984) education *in* entrepreneurship which aims at making

individuals become more entrepreneurial or innovative in their existing firms. Educating *through* entrepreneurship is to instil students a set of business knowledge and skills through working in new ventures (Kirby, 2004).

However, these three levels of education have been claimed they are not clearly distinguishable. Dreisler et al. (2003) argued that difference between education *about* and education *for* is not clear. Education *for* entrepreneurship includes all the aspects coved in other two levels. For example, students are usually taught the entrepreneurial knowledge and theories (i.e., education about) at the beginning of the entrepreneurship course or program. During the education process, the students gradually learn more advanced entrepreneurial strategies and innovation and have chances to practice their entrepreneurial skills, which are also covered in education *in (or through)* entrepreneurship.

In a more specific way, Garavan and O'Cinneide (1994) suggested four levels of education for entrepreneurship: 1) small business awareness education, 2) education and training for small business ownership, 3) entrepreneurial education, and 4) continuing small business education. This categorization mainly distinguishes *entrepreneurship education* and *education and training for small business owners*. The first level of awareness is similar to the education about entrepreneurship which aims to introduce basic theories and concepts of entrepreneurship to students. The second level of education for small business ownership is to teach practical knowledge and skills to set up a new company. This is usually for those who are interested in owning a small company, not organizational employment. The third one, entrepreneurial education, is more than the second one for small business ownership. It aims not only to deliver the knowledge and skills for creating a small business, but also the theories, skills, techniques, and practical opportunities for students to grow a business innovatively and successfully. The last one is typical business education for adults to update their business skills.

Based on the research works mentioned above, Linan (2004) summarized four levels of entrepreneurship education covering the introductory level for introducing the entrepreneurship phenomenon to the advanced level for improving the abilities of established entrepreneurs. The four levels of entrepreneurship education are: (1) entrepreneurial awareness education, (2) education for start-up, (3) education for entrepreneurial dynamism, and (4) continuing education for entrepreneurs.

(1) Entrepreneurial awareness education

Entrepreneurial awareness education aims to “increase the number of people having enough knowledge about small enterprises, self-employment and entrepreneurship, so that they consider that alternative as a rational and viable option” (Linan, 2004). Accordingly, this level of education does not directly emphasize on the number of business created by students after completing the entrepreneurship program or course. Rather, it delivers entrepreneurial knowledge and skills to students and gradually develops their entrepreneurial attitudes and intentions. Referring to TPB (Theory of Planned Behavior), this level of entrepreneurship education would exert impact on the factors that influence entrepreneurial intention, such as attitude toward entrepreneurship, subjective norm, and perceived behavioral control. That is, entrepreneurial awareness education indirectly influences the intention of students to start up through its three antecedent attitudes.

According to Linan (2004), the entrepreneurship courses offered at universities can be considered as entrepreneurial awareness education. These courses are usually offered in different disciplines such as business, engineering, social science and art. In the awareness education, the basic entrepreneurial knowledge and skills, understanding of the values and importance of entrepreneurship, and meeting entrepreneurs or other professionals in the field should be stressed. Teachers or instructors during the learning process do not attempt to turn students to new business owners upon the completion of the entrepreneurship course, but they try to develop students’ interest in entrepreneurship and encourage the students to pursue their entrepreneurial career in the future. In this sense, the awareness entrepreneurship course is suitable for general university instruction (Linan, 2004).

(2) Education for start-up

Education for start-up is to train students to start own business (Linan, 2004). Different from the awareness education where participants may be totally new to the entrepreneurship phenomenon, the participants in the start-up education course or program are usually highly motivated about the entrepreneurship. So, they tend to have strong enthusiasm to learn more about entrepreneurship. According to Linan (2004), the selection criteria of the start-up education highly recommends that the participants have prepared own business ideas. Thus, the start-up courses are to

strengthen the entrepreneurial intention of participants and help them to launch a new business. It is very often that the start-up programs or courses attract the participants who are motivated to start up. The courses focus on the practical issues for setting up a company. Accordingly, start-up education would be centered on the concrete practical aspects related to the start-up phase, including raising finance, marketing problems, legal regulations, taxation and other activities required for new business entry. On top of these, the start-up education has to develop the ability of participants to sense entrepreneurial opportunities and sense the right time to take action (i.e., when/what is the best situation to start your business?). Accordingly, this level of education is to educate people to start up their own business. Business start-up schemes and starting the participants' own business programs are the examples of this level of entrepreneurship training (Jamieson, 1984).

(3) Education for entrepreneurial dynamism

Education for entrepreneurial dynamism is more advanced than previous start-up education. This level of education is to encourage entrepreneurial behaviors after setting up a new venture (Linan, 2004). Therefore, the participants of this level of education are usually those who have already established own businesses.

The objective of the dynamism education is to ensure the growth and future development of the business. This level of education stresses not only enforcing participants' entrepreneurial skills and practices but also raising their intention to develop dynamic behaviors when their companies are running. The participants are expected to develop skills, knowledge and attitudes to create their own futures and solve problems they may encounter when their businesses proceed (Jamieson, 1984). Accordingly, this level of education is considered as the general training of business management, where business related elements are taught, including management development, growth training, new product and marketing development.

(4) Continuing education for entrepreneurs

This is the last level of entrepreneurship education beyond the start-up and initial growth. Similar to general adult education, but specialized to entrepreneurship, it is to improve the entrepreneurial and management skills of the established entrepreneurs (Linan, 2004). Therefore, the participants of this education level are usually the business owners who wish to refresh their mindset and update their

entrepreneurial skills. In this level of education, learning of updated entrepreneurial theories and skills, relationship development among participants, innovation training, and information or idea sharing should be emphasized. One-day modules and workshops offered in business school are the examples of this level of entrepreneurship training (Garavan & O'Cinneide, 1994).

In practice, the challenge of the continuing education is to attract established entrepreneurs to join these programs. This is because the entrepreneurs are practical and experiential, and the education contents and activities offered by the entrepreneurship education are not easy to help them to solve business difficulties. As suggested by Linan (2004), to attract participants, educators could promote this level of learning at start-up programs or dynamism program, because participants who experienced these two levels of training would be “more receptive” to the continuing training (Linan, 2004).

In this thesis, entrepreneurship education is considered as the **first level**, entrepreneurial awareness education. The entrepreneurship education is considered as an entrepreneurship course offered at universities for students in different disciplines, such as engineering. The purpose of the entrepreneurship course is to introduce the concept and knowledge of entrepreneurship to students, not directly pursuing the creation of more entrepreneurs immediately. As such, students are expected to develop their knowledge and skills and to improve their attitudes and intention to toward entrepreneurship. There has been found that entrepreneurship education has positive effect on entrepreneurial attitudes and intentions (Fayolle et al., 2006; Peterman & Kennedy, 2003), therefore, the focus of our entrepreneurship education model will be on how entrepreneurship education helps nurture the entrepreneurial attitudes and intentions of students.

In line with this, the target group for entrepreneurship education is not necessarily those who are interested in entrepreneurship, those who may not yet be interested in the phenomenon would also benefit from such a course/program. It is because the entrepreneurship course or program will deliver them the concept of entrepreneurship, the values and benefits of entrepreneurship, principles and theories as well as practical skills required for creating a new firm. Being exposed to the entrepreneurial training, the students are expected to increase their capabilities and likelihood to pursue an entrepreneurial career.

2.3. Entrepreneurship Education Components

As discussed in **Section 2.2**, different teaching contents were used in entrepreneurship education. Some researchers emphasized the theoretical aspects of entrepreneurial learning, such as opportunity identification, business strategy, resource allocation (Knight, 1987), business management (Zeithamil & Rice, 1987), accounting, financial analysis, market analysis, general management (Block & Stumpf, 1992), nature of business entry (Gartner et al., 1992), entrepreneurship process and industrial environment (Binks et al., 2006), barriers to setting up a new business and possible solutions (Ronstadt, 1987). Others emphasized the practical aspects (Hostager & Decker, 1999; Ireland et al., 2001; Johannisson et al., 1998), such as communication, negotiation, leadership, new product development, creativity and innovation (Hisrich & Peters, 1998; McMullan & Long, 1987; Plumly et al., 2008).

These diverse opinions mainly concentrated on entrepreneurial "knowledge" and "skills", which could be categorized into "know-what" and "know-how". With these two broad learning dimensions, the researchers failed to clarify which learning aspect influences students' personal interest in entrepreneurship (or how knowledge influences the students' personal values about entrepreneurship, which links to the attitudes toward entrepreneurship), and which aspect reflects the learning from the social environment that is a key feature of entrepreneurship. Distinguishing learning at personal level (that reflects the students' personal attitude toward entrepreneurship) and at social level (that reflects learning from social interaction with entrepreneurship related people) is important, because educators can easily identify what teaching efforts are required to draw the attention of students to the entrepreneurship world and to stimulate their interests in entrepreneurship. These would help improve the entrepreneurial attitudes of students. It could be problematic if we teach students entrepreneurship without attracting them the entrepreneurship phenomenon or catching their interest in learning entrepreneurship.

Further, in reality, social learning is very important for entrepreneurs (Gibb, 1998). Usually, entrepreneurs need to interact with different parties to get updated information, resources and other support necessary for their businesses. Knowing the important people and acquiring useful information, skills and support from them are

critical for entrepreneurial success. A social environment that encourages meaningful interaction and share of information is an important source of innovation and supports. Thus, social learning is recognized as an essential part of entrepreneurship education. This is confirmed by many researchers who emphasized that interaction with significant people in relation to entrepreneurship is a critical requisite for long term entrepreneurial success (Honig, 2004; Raichaudhuri, 2005; Rae & Carswell, 2000). In the context of entrepreneurship education, the social learning may focus on social interaction between students and entrepreneurship related people. These people include entrepreneurship teachers, guest lecturers and speakers such as successful entrepreneurs, graduate entrepreneurs, and other experts in the field. An effective entrepreneurship course or program should offer opportunities for students to interact with entrepreneurs or other entrepreneurial professionals (Gibb, 1987a). Therefore, the learning aspects related to social environment is a key feature of entrepreneurship education and should be clearly identified, and by doing so, educators can better allocate resources to provide a supportive context that encourages learning of students from the entrepreneurial experts. So, the general categorization of “knowledge” and “skills” that the previous studies concerned is not specific enough to present the features of entrepreneurship education contents.

More interestingly, Jack and Anderson (1999) considered that entrepreneurship learning as a combination of “art” and “science”. Art refers to innovation and creativity, while science refers to multiple management functions. Actually the authors did not intentionally classify entrepreneurial learning, and what they emphasized was that “art” of entrepreneurship was not teachable. However, other researchers have found that innovation and creativity could be developed through training on problem redefinition, mind mapping, morphological analysis, brainstorming, lateral thinking, and idea evaluation through a range of creative problem-solving methods (Brown, 2000; Charney & Libecap, 2003; Jones & English, 2004; Porter, 1994). Innovation and creativity is actually one kind of skills that entrepreneurs require to identify business opportunity and solve problems during the entrepreneurial process (Brown, 2000; Gottleib and Ross, 1997). Moreover, the “science part” is too general. It merges business and entrepreneurial knowledge (theoretical aspect), practical skills (practical aspect) as well as learning at all levels (personal and social) together. Thus, the art-science classification is not clear and, to

some extent, is quite ambiguous to combine all the learning (theoretical & practical learning at all levels) into a general domain.

Differently, Johannisson (1991) classified entrepreneurial learning into specific categories: know-what (entrepreneurial knowledge), know-why (values and motives), know-who (social interaction), know-how (entrepreneurial skills and abilities), and know-when (intuition, the right time to start up). Johannisson's study is the only one that provides such specific classification of the learning aspects of entrepreneurship. The author clearly identified that "know-why" reflects personal values and interest in learning and performing entrepreneurial behaviors and "know-who" reflects learning at social level by interacting with entrepreneurial people, such entrepreneurship professors or teachers, business project mentors, successful/local/young/graduate entrepreneurs, and classmates, in addition to basic knowledge (i.e., know-what) and skills (i.e., know-how). "Know-what" refers to the "theoretical part" of entrepreneurship, including definitions and basic concepts of entrepreneurship, knowledge of business management and new venture creation. "Know-how" is the practical part of entrepreneurial learning. It refers to the practice or application of entrepreneurial knowledge and skills.

Therefore, Johannisson's (1991) learning dimensions are clearer and more specific, hence can better describe the learning aspects of entrepreneurship. These learning dimensions fit the intention-based models (e.g., theory of planned behavior, which will be detailed in **section 2.4**) that best explain the formation of entrepreneurial intention (Ajzen, 1991; 2005). In the theory of planed behavior, entrepreneurial intention is determined directly through entrepreneurial attitudes at personal level and social level and personal capability. Accordingly, the learning dimensions including learning at both personal and social level can easily link with the entrepreneurial attitudes related to personal interest, social influence, and personal capability, and thus help to explain how to nurture entrepreneurial intention in a systematic and logic way. Therefore, Johannisson's learning dimensions fit our research objective: how specific education components influence entrepreneurial intention.

Empirically, Johannisson's learning dimensions have been adopted by researchers in entrepreneurship education in recent years. For example, Fayolle et al. (2006a; 2006b) and Souitaris et al. (2007) used these learning dimensions in their

studies and argued that these dimensions are appropriate to describe the learning aspects of entrepreneurship. The authors found that students who had completed an entrepreneurship course or program had significantly higher level of attitudes and intention toward entrepreneurship. Therefore, in our study, Johannisson's learning dimensions are considered as the basis of representing the learning contents of entrepreneurship.

According to Johannisson (1991), the five learning dimensions (know-what, know-why, know-who, know-how, and know-when) constitute the foundation of entrepreneurship education: understanding the purpose of an action, self-confidence and ability to influence personal environment and develop supportive relationship with related parties.

These dimensions are considered as important components of entrepreneurship education. As Johannisson (1991) noted, entrepreneurship is complex and innovative in nature and it is difficult to instruct entrepreneurs how they should behave in specific situations, but they can be told what they may avoid doing. Therefore, the teaching of entrepreneurship must facilitate the students' (potential entrepreneurs) learning processes. The learning of students should comprise the five aspects designed to develop the attitudes, skills, tools and knowledge required for entrepreneurship.

Johannisson (1991) conducted a survey of Swedish universities. The author argued that many entrepreneurship programs or courses offered in university stressed the training of technical skills, which being over emphasized may decrease the entrepreneurial intention of potential entrepreneur. The author also proposed some difficulties for entrepreneurship education in facilitating potential entrepreneurs to establish competence strategy and obtain business skills, and making university as an "energizer for local and regional development".

Johannisson's classification is generally adopted as the entrepreneurship education components in this thesis. But, the last category, know-when, is not applied in this thesis because it links to the questions: "When is the right time to act?" In this sense, know-when relates to intuition and opportunity management. The teaching of this competence is to train students to achieve the sharp intuition to act at the correct moment. In order to exploit business opportunities that have been overlooked by others, people must trust their intuition. As argued by Johannisson (1991), such

intuition can be trained through concrete experience of entrepreneurship. The author also claimed that know-when will accumulate when entrepreneurs experience successfully and unsuccessfully creating a firm. Since know-when is enhanced by concrete entrepreneurship experiences, it is difficult to be taught to the students, who may have no entrepreneurial experience or interest in the subject, at the primary level of entrepreneurship education (i.e., awareness education). This study focuses on such entrepreneurial awareness education, not education for start-up (Linan, 2004). Thus, know-when is not applicable in this thesis. Therefore, the education components in our conceptual model include only four dimensions: know-what, know-why, know-who and know-how.

In the context of awareness education of entrepreneurship, these four components comprise the central parts of entrepreneurship education. Fiet (2001a; 2001b) have argued the importance of know-what. The author claimed that know-what is the most fundamental part of entrepreneurship programs/courses, as without knowledge and theory it is difficult to teach students the subject, especially in the awareness education, where the students may know nothing about entrepreneurship. Thus, it is necessary to develop know-what. Ronstadt (1985) complemented that entrepreneurial programs should include know-how competences in addition to know-what competences.

However, knowledge, skills and their application are not sufficient for instilling the entrepreneurial attitude and intention in students. Entrepreneurship education must include elements that interest and inspire students (Rabbior, 1990). In this sense, the competences of know-why and know-who should be considered. Ronstadt (1985) and Gibb (1987a) have claimed that both know-why and know-who are essential for success in the learning and practice of entrepreneurship. Therefore, when implementing entrepreneurship education, it is important that the programs/courses should develop all these four education components. The detailed description of these components is presented in the following subsections.

2.3.1. Know-what

Know-what refers to the concepts and knowledge of entrepreneurship. Extensive research effort has been made on developing different concepts and knowledge as the content of entrepreneurship courses/programs, as discussed in previous sections. This component is considered as the fundamental part of the entrepreneurship courses/programs, as all other skills or techniques should be built based upon theoretical basis. A fundamental goal of any entrepreneurship education program should be to promote awareness of entrepreneurial knowledge. Also, students should understand entrepreneurship as an alternative career choice (Kent, 1990). It is important to teach students to acquire the knowledge and sources needed for new business creation.

Gartner and Vesper (1994) argued that entrepreneurial skills and knowledge required for business entry is different from typical business management. The values and abilities stressed by business education could decrease entrepreneurial intention (Gibb, 1993). This was supported by Kao (1994) who argued that the teaching of business management is not appropriate for entrepreneurship. However, Zeithaml and Rice (1987) warned that entrepreneurship education should cover both business management and entrepreneurial start up knowledge as they are highly related. According to them, entrepreneurship education should contain the elements of start-ups as well as business administration management.

Therefore, know-what should encompass specific domains of business and commercial knowledge, including functional areas: resources marshalling and finance, marketing and salesmanship, idea generation and opportunity discovery, business planning, team building, new venture creation, risk management, legal issues, and organizational management. Further, entrepreneurship requires a greater knowledge of business creation (Gartner, 1989), as well as an understanding of how to act entrepreneurially (Bailey, 1986). Knight (1991) claimed that the entrepreneurship course should include opportunity identification, strategy development, resource acquisition & implementation. In addition, Plaschka & Welsch (1990) suggested the inclusion of negotiation, leadership, creative thinking and exposure to technological innovation and new product development.

2.3.2. Know-why

Know-why links to a series of questions: Why there is entrepreneurship? Why entrepreneurs start their businesses? Why should we study entrepreneurship? What are the benefits of entrepreneurship (such as, money, social status, interest, excitement, challenges or contribution to the society)? How do entrepreneurial knowledge and skills benefit one's career or job performance? This component is spiritual that it reflects how students identify themselves in pursuing an entrepreneurial endeavor. Such identification may relate to personal profile and characteristics regarding entrepreneurship (Fayolle & Gailly, 2008). Know-why reflects the values and motives of initiating entrepreneurial events and one's attitudes toward the events. In this sense, developing the right attitudes and motivation for start-up is very important for entrepreneurship education. According to Johannisson (1991), an individual must be personally motivated and believed his or her capability to create new business. Thus, know-why competences are generally innate, influenced by environment, and can be trained (Johannisson, 1991).

The know-why component includes two parts: (1) understanding the importance of entrepreneurship at the level of society as well as the individual level; (2) understanding the students' own profiles related to entrepreneurship. For the former, it is important to understand the importance of entrepreneurship to the economy and society as well as to individuals. The importance to economy is reflected by the growth in number of entrepreneurial activities, product/technology innovation and job creations. The significant statistics have been reported by the GEM (Global Entrepreneurship Monitor) report (Bosma & Levie, 2009). The national level of entrepreneurial activity is highly associated with the national level of economic growth (Bosma & Levie, 2009). According to Schumpeter's (1934) creative destruction theory, entrepreneurs develop new products and technologies that substitute the old ones. These advanced products change customer demand and provide new innovation to social and economic development (Schumpeter, 1994).

For the latter, it is important to understand the reasons or values of performing entrepreneurial activities. Entrepreneurship is popular all over world. It is common for people to engage in entrepreneurship. The reasons for people to start a new business could be different. For example, many entrepreneurs were attracted by personal wealth, such as to become rich (financial rewards). Others might just want to

earn a living or feed the family. Some people might be obsessed with being own boss, while others might want to seek changes from the traditional jobs that they feel tedious.

There are also people who long for independence of creating own companies. Others may want to exploit, pursue and realize their new business ideas or realize their dreams. Some people may want to contribute to the society. This reflects the relevance of social entrepreneurship, which aims to solve social problems and create wealth for the society, instead of pursuing personal profits. Whatever reasons to be an entrepreneur, it is important to note that pursuing an entrepreneurial endeavor is not easy. Potential entrepreneurs have to keep energetic with innovative ideas and persist for a long time. During the challenging process, knowing what to do is not enough, but also why to do.

Thus, an entrepreneurship program should develop the know-why competence that encourages entrepreneurial attitude. More important than teaching the knowledge behind creating a business, the courses should instil an entrepreneurial spirit in students. Teaching students that entrepreneurs come from all backgrounds and giving the students a positive outlook on their future opportunities is an important aspect of an entrepreneurship course. Additionally, it is important to note that entrepreneurship is not just about starting a business. Entrepreneurial skills can be used in all occupations, especially in today's ever changing society. The entrepreneurial skills and abilities can help people solve problems in more innovative ways and better deal with risks and uncertainties inherent in their jobs (Henry et al., 2005a). Therefore, understanding how entrepreneurship is important to them is crucial for students to develop a right attitude toward entrepreneurship.

2.3.3. Know-who

Know-who refers to social interaction. According to Lundvall (1998), know-who "involves the social capability to cooperate and communicate with different kinds of people and experts" (p.417). In reality, entrepreneurs need to interact with different parties to get information, resources, and other supports for creating and managing their new businesses. Knowing the important people and acquiring useful information, skills and support from these people are critical for entrepreneurship. A

good social relationship is the key to entrepreneurial success. Although know-who may be related to personal traits, still it can be developed through practice. A supportive environment that facilitates social interaction and share of knowledge and information will facilitate entrepreneurship. Thus, know-who is recognized as an essential part of entrepreneurship education. Researchers have emphasized that interaction with people significant to entrepreneurial start-up is a critical requisite for long term entrepreneurial success (Johannisson, 1991; Raichaudhuri, 2005; Ronstadt, 1987).

In the context of this study (awareness education), know-who focuses on social interaction between students and entrepreneurship referents. These referents include teachers, guest lecturers and speakers such as successful entrepreneurs, graduate entrepreneurs, and other experts in the field. An important function of entrepreneurship education is to offer opportunities for participants to interact with entrepreneurs or other entrepreneurial professionals (Gibb, 1987a). Entrepreneurship teachers should develop a good entrepreneurial network and invite the “right guest speakers” to their entrepreneurship courses or programs (Hegarty, 2006). Thus, it is appropriate to invite the entrepreneurial experts or practicing entrepreneurs or professionals to conduct guest lecture or seminars to the students (Fiet, 2001a; 2001b; Hegarty, 2006), as such, students are expected to obtain a real image of entrepreneurial profession and practice.

The significant referents of students may significantly influence the students’ perception about entrepreneurial behaviors. Thus, exposure to entrepreneurial people will provide models and images showing that entrepreneurship is attractive and achievable. Further, being closer to entrepreneurs, students may feel that entrepreneurship is possible. Successful entrepreneurs could influence potential entrepreneurs. Through evaluating others’ entrepreneurial success, a person may ascertain that he/she can also do it believing in their comparable or stronger capabilities. That is, the entrepreneurial referents can help students to realize that entrepreneurship is possible for the students. In addition, interaction with the entrepreneurial referents provides useful information and knowledge to evaluate the entrepreneurial process (Gib, 1987b; Scherer et al., 1991).

Therefore, an effective entrepreneurship education program should provide opportunities for students to interact with practicing entrepreneurs and other

entrepreneurial professionals, and establish connections. Interaction with those referents can offer emotional and practical support to the entrepreneurship students (Histrich et al., 2010).

2.3.4. Know-how

Know-how refers to the questions: “How to take entrepreneurial actions?” and “How to deal with a given situation?” For example, how to allocate resources, how to identify the risks involved in decision makings, how to deal with those risks, how to check the adequacy between an entrepreneurial action and personal profile, and other questions related to entrepreneurial techniques and skills. That is, the know-how component emphasizes the skills and techniques essential for entrepreneurial success.

Entrepreneurial skills reflect the abilities to recognize opportunities, develop new products, and evaluate risks involved in the entrepreneurial process. More specifically, these skills include creativity, decision-making, leadership, communication skills, the team building skills, organization, marketing, management, risk-taking, logical and analytical skills, goal-setting skills, and abilities and techniques to prepare and present a business plan (Henry et al., 2005a; Lazear, 2004; Michelacci, 2003; Ronstadt, 1985; Vesper & McMullan, 1988)

These skills are crucial to solving problems effectively based on entrepreneurial knowledge acquired. Thus, know-how links to application of the entrepreneurial knowledge and practice. Rabbior (1990) suggested one important function of entrepreneurship education is to provide students practice opportunities to learn through experience. This was supported by other researchers who argued that know-how should be developed through active-learning (Hostager & Decker, 1999; Ireland et al., 2001; Johannisso et al., 1998). For example, field experience (which depends on the resources of institutes) or experiences of entrepreneurial projects are the basis for such abilities. In the review study by Solomon et al. (2002), business plan is one of the common methods used in entrepreneurship education. Entrepreneurship students are usually required to prepare a business plan, create a new product which is different from those available in the market, and get the feedback of teachers, class, and guest lecturers (successful entrepreneurs, local

business owners or managers). Further, an environment that allows students to practice related activities is important to develop know-how (Johannisson, 1991).

Effective entrepreneurship courses/programs must also encourage students to solve problems in different ways. Entrepreneurship courses or programs should cover the industry environment and challenges encounter by entrepreneurs. Creativity and innovation are the important aspects of know-how for entrepreneurs who have to sense the world from different perspectives. In this sense, entrepreneurship courses or programs must equip students with creative thinking and problem-solving skills. Moreover, the ability to work with a team in the learning process is a necessary skill for entrepreneurs. Thus, entrepreneurship education should include some team-based activities, projects or exercises (Rabbior, 1990).

In addition to the skills and techniques required to take entrepreneurial action, entrepreneurship students also need to learn to accept failure and be self-motivated. Confidence is highly associated with entrepreneurial success. Thus, the education programs must teach students how to deal with challenges, difficulties and building up confidence (Rabbior, 1990).

2.4. Entrepreneurship Theories

Acknowledging the importance of entrepreneurship to economic development, researchers focus on the decision to become an entrepreneur. In this respect, different theories have emerged in recent years. In the field of entrepreneurship research, early researchers argued that some personal, sociological, demographic factors (Reynolds et al., 1994; Storey, 1994) influenced the decision to become an entrepreneur (i.e., trait models) (Cunningham & Lischeron, 1991; Herron & Robinson, 1993; Sexton & Bowman, 1985). They claimed that personality traits of entrepreneur were a significant element of an overall model of entrepreneurship. Personality of entrepreneurs exerted significant effect on business creation and management as it may govern one’s decision making (Chandler & Jansen, 1992). However, the trait models were criticized by some researchers who argued that entrepreneurship was a process to create a new company and it should be understood by studying the individual activities, processes and outcomes rather than personal characteristics

(Gartner, 1988; Van de Ven, 1984). Consequently, the research focus was shifted to other perspectives. Entrepreneurship is planned (Krueger et al., 2000), it is appropriate to investigate how the entrepreneurial decision is adopted. In sense of this, it is natural to pay attention to entrepreneurial intention, which is the predictor of entrepreneurial behavior. Thus, intention-based models (Ajzen, 1987; 1991; Bird, 1988; Boyd & Vozikis, 1994; Shapero & Sokol, 1982) have recently been adopted to explain entrepreneurial behaviors. The researchers believe that while exploiting a business opportunity, people need to concentrate on the cognitive processes that influence their perception of self-capability, control and intentions. And thus, the intention-based models can better explain the entrepreneurship process than traditional trait models do. The following section describes these models and examines their problems and appropriateness for entrepreneurship education research.

2.4.1. Trait models

A trait model assumes that personality traits are the basis for individual differences. Personality traits are defined as "characteristics of individuals that exert pervasive influence on a broad range of trait-relevant responses" (Ajzen, 2005, p2). In the trait model, personality traits are as the determining factors of behavior that make a person perform in a relatively consistent way across various circumstances.

The trait model was probably developed from Schumpeter's innovation theory. Schumpeter (1934) argued that creation of new combination which is innovative in nature is the main function of entrepreneur. The author claimed that "entrepreneurs differ from non-entrepreneurs not by differences in knowledge or perception but by the performance of the innovative act itself" (p.88). Believing this, Schumpeter suggested that motivational differences influence one's engagement in entrepreneurial action. The author identified a set of "traits" that may influence one's motivation to act entrepreneurially, such as self-centeredness, and joy of creating.

The viewpoint of Schumpeter's (1934) was supported and further developed by some psychologists, such as McClelland (1961) and Hagen (1962), who investigated why entrepreneurs are more risk-taking. These psychologists, based on the economic contribution of entrepreneurship, identified the motives to carry out entrepreneurial activities.

During the 1980s and 90s, the trait theory about entrepreneurship was booming in the field. Psychological traits of entrepreneurs were recognized as an important element of an overall model of entrepreneurship (Herron & Robinson, 1993; Mueller & Thomas, 2000), and the traits are significantly associated with entrepreneurial motivation and intentions (Bird, 1988; Grant, 1996; Learned, 1992). The trait model basically relies on the assumption that entrepreneurs possess certain traits that distinguish them from others. A great number of personality traits were identified to examine the difference between entrepreneurs and non-entrepreneurs. These psychological traits, also called entrepreneurial traits/characteristics, include achievement motivation, locus of control, risk-taking propensity, tolerance of ambiguity, self-confidence, innovation, energy level, need for autonomy and independent, etc. In this thesis, we reviewed 75 publications on the subject of entrepreneurial personality and identified four most frequently confirmed personality traits, namely, need for achievement (42 times), risk-taking propensity (36 times), locus of control (33 times) and creativity (30 times). Other traits such as action orientation and perception of opportunity have been stated a few times (the details are shown in **Appendix 1**).

Need for achievement is the driving force for pursuing success (Sagie & Elizur, 1999). Risk-taking propensity is the perceived probability of attaining rewards or benefits regarding success prior to taking an action may result in failure (Brockhaus, 1980). Locus of control refers to the perceptions of people about the control over their lives. Rotter (1966) reported that locus of control is internal or external. Internally controlled individuals are more self-motivated than those who are externally controlled. This is because that for the former group, events happen in their lives are determined by their decisions and efforts, while for the later group, what happen to them is determined by fate, luck or others. Lastly, creativity relates to perceiving and acting in new and unique ways (Robinson et al., 1991b). The trait model illustrating the relationships between the four most salient personality traits is shown in **Figure 2**. We can see that this model assumes that people with the higher the level of need for achievement, risk-taking propensity, locus of control, and creativity are intended to engage in entrepreneurial activities. The ultimate goal of the trait model is to identify persons with an entrepreneurial profile or the successful entrepreneurs who can realize entrepreneurial success.

It should, however, be pointed out that the trait models has **several weaknesses** due to the assumptions of the theory per se, leading to many researchers questioning the robustness of the theory. Some even have proposed to give up the research on this topic. The criticism of the trait models is explained in next section.

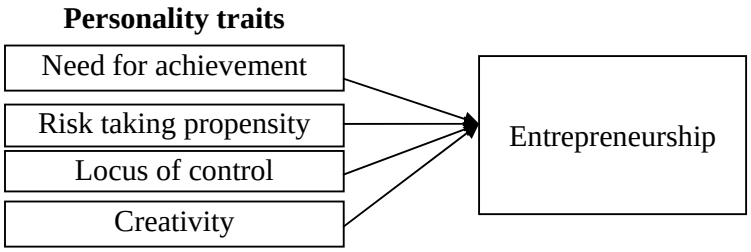

Figure 2. A trait model (containing the four most salient traits)

2.4.2. Criticism of trait models

As has been demonstrated, in the trait model, the entrepreneur is determined by certain personality traits. However, some commentators criticized this assumption by claiming that entrepreneurship should focus on the interaction of entrepreneurs with the environment (Drucker 1985; Gartner, 1988; McCarthy, 2000; Van de Ven et al., 1984).

Drucker (1985) criticized the trait models and contended that entrepreneurship is a behavior and should be understood through behavior patterns, instead of personality traits. The author emphasized that practical training of entrepreneurship in an entrepreneurial company is important to train potential entrepreneurs to perform entrepreneurial behaviors. Further, Schultz (1975) argued that dealing with disequilibrium is the principal function of entrepreneurs. In this sense, anyone who possesses control ability and resources to perform the entrepreneurial action can be viewed as entrepreneur.

More severely, Gartner (1988; 1989) criticized the trait model that personality traits of entrepreneurs should not be included while considering business creation. He suggested a behavioral approach that considers how a new company is set up, instead of who set it up. That is, entrepreneurs are those who create a new business, not who they are. In this sense, entrepreneurship should focus on the entrepreneurial activities,

processes and results, not personality traits what are invisible (Chell, 1985; 2001). Based on the arguments, the trait model has two main problems (Gartner, 1988). First, the trait model emphasizes “ex-post situations” where entrepreneurs have started a business. Trait model concerned the established entrepreneurs’ personality traits and related those traits and entrepreneurial attitudes and start-up actions. In this way, the trait model assumed that the personality traits were the same before and after the entrepreneurial establishment. However, as Gartner (1988) noted that people rarely perform exactly the same across different situations. Thus, personality traits are not reliable predictors of behavior. Second, the causal impact of personality traits on entrepreneurial action is unconvinced. In the trait model, given the stability of personality traits, individuals could be considered as the “prisoners of their own personality traits” (Gartner, 1989). This assumption might ignore the influence of other factors, such as social and economic situations that may affect one’s decision making (Gartner, 1988; 1989). Thus the trait model does not reflect the actual concerns associated with initiating an entrepreneurial endeavor.

Therefore, Gartner (1988; 1989) contended that a behavioral approach which deals with what entrepreneurs do is more suitable to explain the entrepreneurship behavior compared with the trait model that emphasizes who the entrepreneurs are. In this sense, entrepreneurs are viewed in terms of entrepreneurial activities required for creating a new venture (Gartner, 1989). Thus, the focus of entrepreneurship is to understand how behaviors, attitudes, skills and intentions altogether influence the entrepreneurial success.

Due to the criticism of trait model, the “trait line” of research has begun to lose ground in 80’s. Based on Gartner’s (1988; 1989) work, researchers have tried to explain the entrepreneurial behavior from the perspective of cognition, arguing that cognition process plays an important role in the entrepreneurial process. In this way, cognitive perception is considered appropriate to explain entrepreneurial behavior. Thus, theories that related to cognitive concepts have received increasing attention in entrepreneurial research. For example, the entrepreneurial event model (Shapero & Sokol, 1982), Bird’s (1988) entrepreneurial intention model and Ajzen’s (1991) theory of planned behavior have gained increasingly support in explaining entrepreneurial behavior. The intention models emphasize the entrepreneurial process with a focus on entrepreneurial intention which is a more reliable predictor of

entrepreneurial behavior (Bird, 1988; Boyd & Vozikis, 1994). Next section will discuss the evolution of entrepreneurial intention models and make a comparison among these models.

2.4.3. Intention models

In recent years, intention models (Ajzen, 1991; Bird, 1988) that capture the link between individuals and their behaviors have emerged as an important approach to explaining the entrepreneurship phenomenon.

Psychologists have claimed that intentions are effective to predict the subsequent behavior (Ajzen, 1991; Ajzen & Fishbein, 1980). For example, researchers have found that intentions are a significant predictor of job search activities (Van Ryn & Vinokur, 1990) and career choice (Kolvereid, 1996b). Intentions toward a behavior reflect the motivation and enthusiasm of a person to perform that behavior. As noted by Ajzen (1991), the stronger the intentions, the higher likelihood that the intended behavior will happen. It is evidenced that intention explains about 30% of variance in behavior and this figure is much higher compared with only 10% provided by personality traits (Ajzen, 1987).

In the entrepreneurial process, entrepreneurial intention will transform business concepts or ideas into a course of entrepreneurial actions. It has been shown that entrepreneurial behavior is the product of entrepreneurial intention (Bird, 1988; Krueger & Brazeal, 1994). Examining entrepreneurial intention will clearly offer significant insights into business creation. In fact, the intention models have been the basis of many studies (both empirical and conceptual) on entrepreneurship. In the following paragraphs, we will summarize the key entrepreneurial intention models and present the evolution of these models. In addition, we will conduct a comparison among these models, in order to choose the most appropriate one for our research.

2.4.3.1. Summary of entrepreneurial intention models

The entrepreneurial intention models reviewed are shown in **Figure 3**. Since 1980s, there have been 6 major models developed in the research field. They are (1) Entrepreneurial Event Model (EEM) (Shapero & Sokol, 1982), (2) Entrepreneurial Intention Model (EIM) (Bird, 1988), (3) revised EIM with self-efficacy (Boyd &

Vozikis, 1994), (4) Theory of planned behavior (TPB) (Ajzen, 1991), (5) Economic-Psychological Model (EPM) (Davidsson, 1995), and (6) Structural Model of Entrepreneurial Intention (SMEI) (Luthje & Franke, 2003). These intention models provide more complete understanding of the entrepreneurship compared with the trait models, as they exhibit how the cognition of entrepreneurs are put into an entrepreneurial behavior via intention.

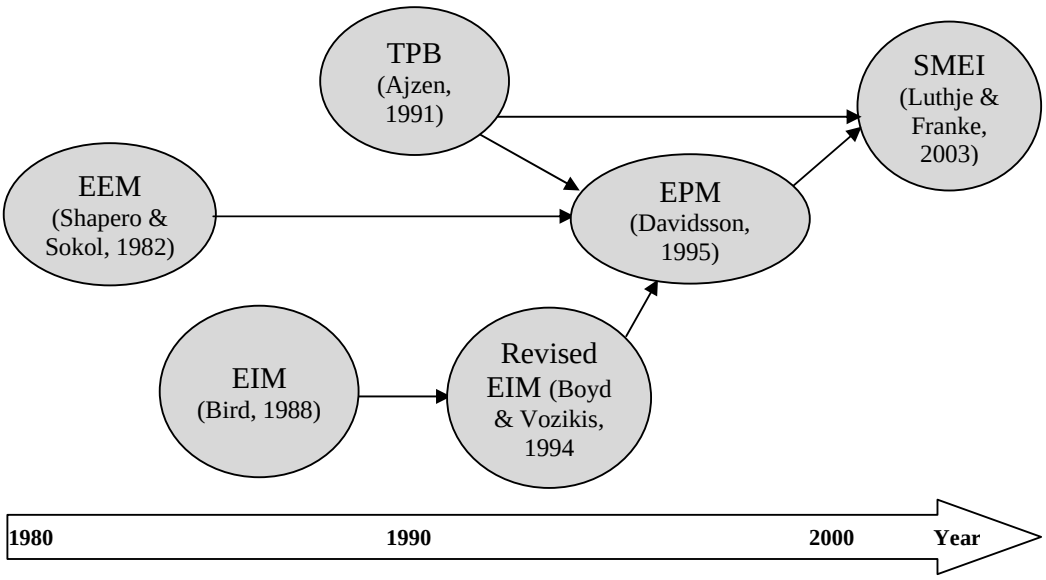

Figure 3. Evolution of entrepreneurial intention model

(1) Entrepreneurial Event Model (EEM)

In 1982, Shapero and Sokol developed the first entrepreneurial intention, the entrepreneurial event model, as shown in **Figure 4**. This model assumes that entrepreneurial intention is influenced by three main factors: perceived desirability, perceived feasibility, and propensity to act upon opportunities. A displacement event then affects the relationship between entrepreneurial intention and action.

1. ***Perceived desirability*** is the extent to which a person feels attractive to create own businesses.
2. ***Perceived feasibility*** is the extent to which the person feels capable to start a business. This factor essentially reflects self-efficacy (i.e., a person's perceived ability to execute some target behavior) (Krueger & Brazeal, 1994).

3. ***Propensity to act*** is the personal disposition to act on one's decisions. This factor relates to the question: "Will I actually do it?" (Krueger et al., 2000, p.419). Shapero and Sokol (1982) argued that propensity to act is relevant; otherwise, an individual may not take action. The authors considered this factor as a stable personality characteristic that links strongly to locus of control (i.e., the perception of control over one's life).

According to the EEM, one's perception of desirability and feasibility determines his or her response to an external event. These perceptions, in turn are derived from cultural and social factors. In this sense, external factors influence intention indirectly through desirability and feasibility. Further, some precipitating/triggering events or changes can also impact the emergence of an entrepreneurial behavior. Such events include job loss, graduation, and inheritance etc. (Katz, 1992).

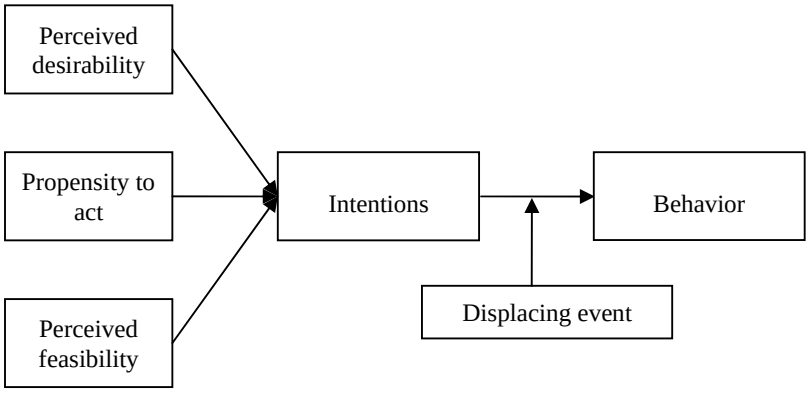

Figure 4. Entrepreneurial event model (EEM)

Application of EEM

The EEM has been tested by many empirical studies on entrepreneurial practice (Audet, 2002; 2004; Krueger, 1993; Krueger et al., 2000; Segal et al., 2005; Vecianne et al., 2005; Walstad & Kourilsky, 1998) and evaluation of entrepreneurship education program (Peterman & Kennedy, 2003).

Walstad and Kourilsky (1998) investigated the attitudes and understanding of ethnic entrepreneurship based on the EEM. Their results showed that African-American young people were more desired to perform entrepreneurial activities. Further, these respondents were more desired to receive entrepreneurship training. Peterman and Kennedy (2003) studied the effect an entrepreneurship program (Young

Achievement Australia, YAA). They found that the students had higher perceived desirability and feasibility to create a new business after finishing the YAA program. Further, the desirability and feasibility of the students were significantly related to the positiveness of previous experience.

Furthermore, Krueger (1993) tested the EEM and the results showed that feasibility and desirability perceptions and propensity to act significantly predict entrepreneurial intentions. In addition, perceived feasibility was found to be significantly associated with the breadth of prior exposure, while perceived desirability was significantly related to the positiveness of that prior exposure. In the study of Krueger et al. (2000), the authors tested the EEM and TPB (Theory of Planned Behavior) with a sample of university business students. Their results showed that both models are valid and provide a valuable insight into entrepreneurial process. In a similar way, Audet (2002) adopted a longitudinal design to investigate the entrepreneurial intention of undergraduate business students with both TPB and EEM. They found that some factors had positive effect on entrepreneurial attitudes and intentions. These factors included money, freedom, opportunity recognition and more mature. However, corporate orientation and reality shock had negative effect. More recently, Vecianne et al. (2005) also used TPB and EEM to investigate the entrepreneurial intention of university students. Their results revealed that the effect of background factors on entrepreneurial intention varied across different countries. Finally, Segal et al. (2005) studied undergraduate business students based on EEM. Their results showed that changes in desirability to start up significantly increased entrepreneurial intention.

(2) Entrepreneurial Intention Model (EIM) and the revised EIM

<1> EIM

In 1988, Bird developed an entrepreneurial intention model (EIM), as shown in **Figure 5,** according to cognitive theory that elucidates human behavior. Bird concerned intention as “a state of mind directing a person’s attention toward a specific object or path in order to achieve a goal” (Bird, 1988, p.442). The author developed the EIM by interviewing 20 entrepreneurs. This model provides guidance for entrepreneurs to start and manage a business. According to EIM, entrepreneurial

intention is predicted by personal and contextual factors. Personal factors include prior entrepreneurial experiences, personalities, and abilities. The contextual factors comprise social, political, and economic variables such as displacement, changes in markets, and government deregulation. The background factors derive both rational and intuitive thinking which then determine entrepreneurial intention. These thought processes involve preparation of business plans, opportunity evaluation and other goal-directed activities required for setting up a new company. The entrepreneurial intentions in this model reflect a state of mind that guides entrepreneurs implement business ideas.

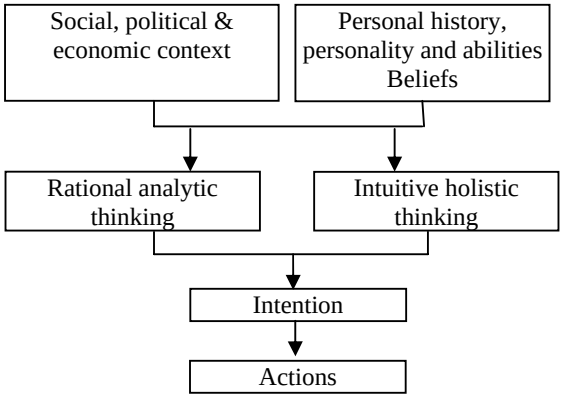

Figure 5. Entrepreneurial intention model (EIM)

<2> Revised EIM

Bird's (1988) EIM model was later extended by Boyd and Vozikis (1994) by including the self-efficacy belief construct. The revised EIM is shown in **Figure 6**. Self-efficacy (Bandura, 1986) captures individual capability to take an action and affects goal achievement. Boyd and Vozikis argued that self-efficacy is important to predict entrepreneurial intentions and behavior. The additional effect of self-efficacy provides more information on how intention forms in the cognitive process.

In the revised model, entrepreneurial intentions are determined by rational-analytical thinking that derives one's attitude toward a goal-directed behavior and intuitive holistic thinking that derives self-efficacy. In this model, self-efficacy is a product of the cognitive thought processes and moderates the relationship between the entrepreneurial intentions and actions (Boyd & Vozikis, 1994).

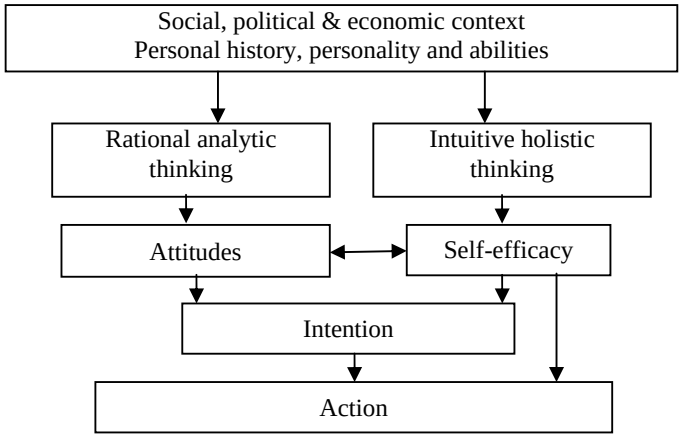

Figure 6. Revised entrepreneurial intention model (Revised EIM)

Application of EIM and revised EIM

The EIM of Bird (1988) has been widely used to explain entrepreneurial intention theoretically. Surprisingly, no empirical study testing the EIM has been found. This probably relates to methodological issues. For example, it may be difficult to develop measures for the constructs of "rational analytic thinking" and "intuitive holistic thinking". Consequently, there is also a lack of empirical test on the whole revised EIM model (covering all constructs). Researchers tended to employ part of the revised EIM model ("self-efficacy") in the field of entrepreneurship practice. The revised EIM model has been applied by Zhao et al. (2005) who proposed that self-efficacy plays a critical mediating model linking background factors (e.g., perceptions of formal learning in entrepreneurship courses, pervious entrepreneurial experience, risk propensity, & gender) and entrepreneurial intention. The authors used structural equation modeling (SEM) with a sample of 265 master of business administration students across 5 universities to test the model. Their results showed that the effects of perceived learning from entrepreneurship-related courses, previous entrepreneurial experience, and risk propensity on entrepreneurial intentions were fully mediated by entrepreneurial self-efficacy. Although gender was not mediated by self-efficacy, it showed a direct effect on intention.

Further, Chen et al. (1998) argued that self-efficacy is useful to distinguish entrepreneurship students and entrepreneurs from non-entrepreneurship students and

non-entrepreneurs. The authors also found that self-efficacy positively influences entrepreneurial intention. More recently, Wilson et al. (2007) investigated the impact of gender on entrepreneurial self-efficacy and entrepreneurial intentions. Both adolescents and MBA students were involved. The authors found that gender significantly affected self-efficacy and self-efficacy significantly predicted intention to start up. The mediating role of self-efficacy between background factors and entrepreneurial intention was further tested by the studies on entrepreneurial decisions (De Noble, 1999; Li, 2008).

(3) Theory of Planned Behavior (TPB)

TPB is illustrated in **Figure 7**. TPB is an extension of the theory of reasoned Action (TRA). Ajzen (1991) extended TRA (Fishbein & Ajzen, 1975) to include an additional factor, perceived behavioral control. According to Ajzen (1991), TPB is suitable to explain any behavior which requires planning, such as entrepreneurship. In the TPB, intention is determined by 3 attitudinal antecedents.

1. ***Attitude toward the behavior*** is the degree to which a person has a favorable or unfavorable evaluation of a behavior. It depends on the person's assessment of the expected outcomes of the behavior. This factor captures the beliefs about the possible outcomes of the behavior (i.e., behavioral beliefs). For example, a person who believes that it is beneficial to perform a given behavior will have a positive attitude toward that behavior, otherwise, will hold a negative attitude.

2. ***Subjective norm*** refers to the social pressures perceived by individuals to perform or not to perform the behavior. It relates to the beliefs that other people encourage or discourage to carry out a behavior. An individual is likely to perform a behavior if significant others who the person is motivated to comply approve of going for it. Conversely, the person will suffer a subjective norm that forces them to avoid performing the behavior.

3. ***Perceived behavioral control*** is the perception of easiness or difficulty in the performing a behavior. It relates to the beliefs about the availability of supports and resources or barriers to performing an entrepreneurial behavior (control beliefs).

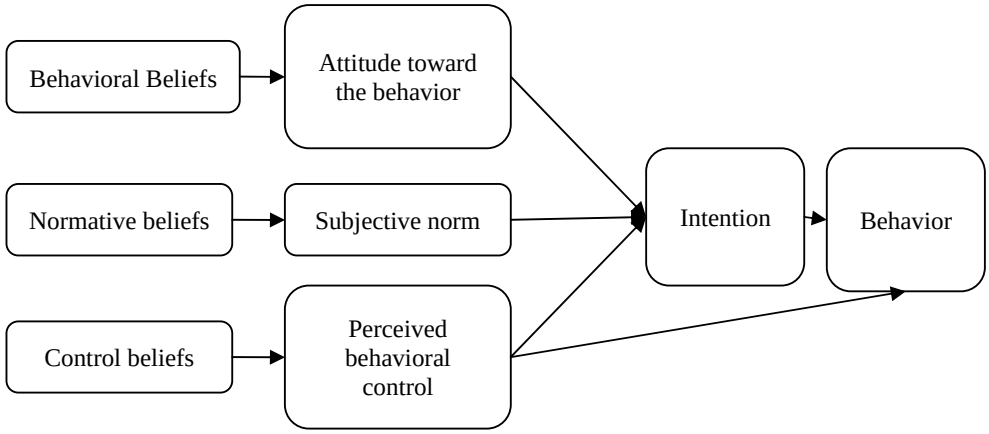

Figure 7. Theory of planned behavior (TPB)

Application of TPB

The TPB probably can be applied to any behavior that requires certain amount of planning. The model has been consistently proved robust in predicting behavior and intentions in various fields of research, such as health care (weight loss, quitting smoking), safety (seat belt usage), marketing (coupon usage) (Ajzen, 1987; Ajzen & Fishbein, 1980; Sheppard, Hartwick, & Warshaw, 1988), and career choice (Kolver Kolvereid, 1996).

In entrepreneurship, it is increasingly popular to use TPB to study the entrepreneurial intention (Audet, 2002; Autio et al., 2001; Fayolle et al., 2006; Gelderen et al., 2008; Gird & Bagraim, 2008; Kolvereid, 1996; Krueger et al., 2000; Souitaris et al., 2007; Tkachev & Kolvereid, 1999; Veciana et al., 2005). For example, Kolvereid (1996b) adopted the TPB to predict the employment choice of 128 Norwegian undergraduate business students. Their results showed that attitude toward entrepreneurship, subjective norm, and perceived behavioral control significantly influence entrepreneurial intention, and demographic factors impact intention indirect through its three antecedents. Similar results were obtained by Tkachev and Kolvereid (1999) who surveyed 512 Russian university students and examined their entrepreneurial intentions. The authors found that the three antecedents (attitude toward entrepreneurship, subjective norms and perceived behavioral control) significantly influence the students' entrepreneurial intentions. Further, applying the TPB, Autio et al. (2001) analyzed the factors influencing entrepreneurial intention among university students from Finland, Sweden, USA and the UK. Their results

revealed that TPB was robust across the samples from multiple countries and perceived behavioral control was the most important determinant of entrepreneurial intention.

More recently, Fayolle et al. (2006a) used the TPB to evaluate the effect of an entrepreneurship program. They found that through the entrepreneurship program, students had significantly improved their entrepreneurial attitudes and intentions. In the same line, Souitaris et al. (2007) measured the effect of an entrepreneurship course in terms of entrepreneurial attitudes and intentions of science and engineering students. The results showed that the programs raised the attitudes and intentions of the students. Also inspiration was found to be the most influential benefit of entrepreneurial education. Gird and Bagraim (2008) tested TPB among final-year commerce students at two universities in the Western Cape. The authors found that TPB significantly explained the entrepreneurial intentions of the students and previous entrepreneurial experience significantly influence intention through its three antecedents. In addition, Gelderen et al. (2008) investigated the entrepreneurial intentions of business students. They found that the two most important variables to explain entrepreneurial intentions were entrepreneurial alertness and the importance attached to financial security.

(4) Economic-Psychological Model (EPM)

Davidsson (1995) proposed an economic-psychological model of factors influencing individuals' intentions to create own businesses. The model is shown in **Figure 8**. In the model, Davidsson tried to combine relevant parts of previously published models and develop a model specifically to capture the entrepreneurial intention of students. The major change compared to previous models was the central role of conviction as the primary determinant of intentions. In Davidsson's model, personal backgrounds are assumed to impact both general attitudes and domain attitudes. General attitudes refer to general psychological dispositions, while domain attitudes are specifically attitudes toward entrepreneurship. Further, situational or contextual factors are also concerned in Davidsson's model. For example, the current employment status was assumed to influence both conviction and intention.

According to the author, general attitudes and domain specific attitudes can strengthen one's conviction reflecting that entrepreneurship is appropriate. This

construct is similar to the self-efficacy of the revised EIM (Boyd & Vozikis, 1994) and perceived behavioral control of TPB (Ajzen, 1991). The model was tested by Davidsson (1995) using a random sample of 1313 Swedes aged between 35 and 40. The results largely supported the model. The author reported that general attitudes and domain attitudes significantly explained conviction, which significantly influenced intention.

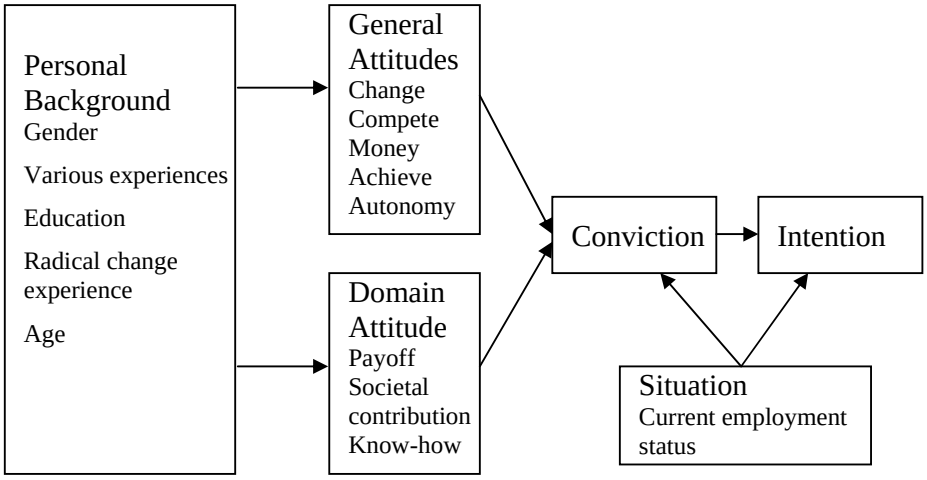

Figure 8. An economic-psychological model of entrepreneurial intentions (EPM)

The EPM was extended and applied by Autio et al. (1997) to investigate the entrepreneurial intention of university environments. The authors tested the model on students of technology from four countries: Finland, Sweden, USA, and South-East Asia. The purpose of their study was to test the model and to compare the entrepreneurial intention of students from different countries. Their results showed that the model was supported and entrepreneurial conviction was considered as the most important determinant of entrepreneurial intention.

(5) Structural Model of Entrepreneurial Intention (SMEI)

Considering the influence of attitude (Ajzen, 1991; Ajzen & Fishbein, 1980; Davidsson, 1995; Robinson & Hayes, 1991) on entrepreneurship, Luthje and Franke (2003) developed a structural model of entrepreneurial intention, as shown in **Figure 9**. The model suggests that attitudes moderate the relationship between general personality traits and specific entrepreneurial behavior. It is assumed that the personality traits (e.g., risk-taking propensity and internal locus of control) indirectly

influence intention to create a new business through affecting entrepreneurial attitudes. The model also emphasizes the effect of contextual factors. It proposes a direct impact of the contextual factors (both support and barriers) on entrepreneurial intentions.

Luthje and Franke (2003) tested this model by surveying 512 students at the MIT School of Engineering. Their results supported the model that both the personality traits (risk-taking propensity and internal locus of control) and contextual factors (perceived barriers and support) had significant effect on intention to start a new venture.

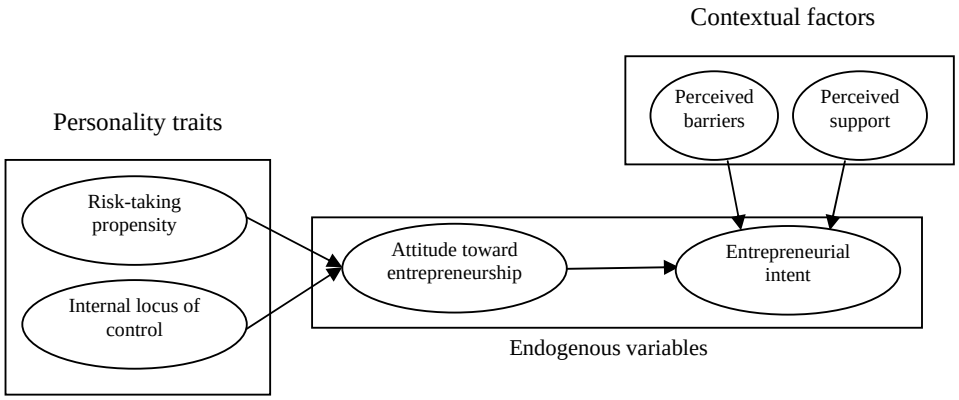

Figure 9. Structural model of entrepreneurial intention (SMEI)

2.4.3.2. Comparison of the entrepreneurial intention models

As can be seen, various intention models have been developed in the field of entrepreneurship research. These entrepreneurial intention models are compatible. All of them emphasize the pre-entrepreneurial event, rather than the ex-post situation that the trait model concerns. Further, these models are developed based on attitude and behavior theory (Ajzen, 1991) and self-efficacy theory (Bandura, 1986). External factors are considered to influence intention indirectly through attitudinal factors (Bird, 1988; Boyd & Vozikis, 1994; Luthje & Franke, 2003). These intention models seem to vary little in explaining entrepreneurial intention, although they use different approaches (Krueger et al., 2000).

We can see that, from the evolution of the entrepreneurial intention models (as shown in **Figure 3**) and empirical studies on entrepreneurial intentions (as shown in **Table 5),** the development of entrepreneurial intention models has been guided primarily by thee models: EEM (Shapero & Sokol, 1982), EIM (Bird, 1988), and

TPB model (Ajzen, 1991). Other recently developed models are produced based on these models. For example, Boyd and Vozikis (1994) revised the EIM by adding the construct of self-efficacy. Further, based on the findings of EEM, revised EIM, and TPB, Davidsson (1995) developed the economic-psychological model focusing on individual attitudes, conviction (self-efficacy) and situational factors. The findings on the effect of attitude on entrepreneurial intention attracted Luthje and Franke (2003), who developed the structural model of entrepreneurial intention. The three main models (EEM, EIM, and TPB) that consider both personal and external factors influencing entrepreneurial intention have provided the theoretical foundation for many studies on entrepreneurship.

Which intention model is more appropriate to be used to explain the entrepreneurial intention of students in the context of entrepreneurship education? That is, which model can serve as the theoretical basis of this study to investigate the influence of entrepreneurial education on students' intentions about new venture creation? These questions lead to the comparison of the intention models.

Table 5 summarizes the comparison of the entrepreneurial intention models. All these models are meant to explain the entrepreneurial intention. EIM (Bird, 1988) and two newly developed models, EPM (Davidsson, 1995) and SMEI (Luthje & Franke, 2003), show a certain degree of compatibility to other intention models. However, they provide less information about how the entrepreneurial intention acting as the predictor of entrepreneurial behavior is formed at the personal level or social level. For example, EIM focuses on the rational and intuitive thinking. It does not include the constructs of attitude, social norm, or perceived self-capability in the model. Further, SMEI and EPM mainly focus on attitude toward entrepreneurship and external or situational factors. They do not consider the effect of social norm on the formation of entrepreneurial intention. In addition, SMEI does not provide any information on the effect of individual perception of capability to perform entrepreneurial behaviors.

Compared with other models, EIM, EPM and SMEI obviously lack empirical tests of entrepreneurial studies. EEM, revised EIM and TPB have been the dominant intention models in the field of entrepreneurship research. Therefore, EIM, EPM and SMEI are not considered to be the theoretical basis of our study. This leads to shifting our focus to the evaluation of EEM, revised EIM and TPB.

Table 5. Comparison of the entrepreneurial intention models

Perspectives	**EEM (Shapero & Sokol, 1982)**	**EIM (Bird, 1988)**	**Revised EIM (Boyd & Vozikis, 1994)**	**TPB (Ajzen, 1991)**	**EPM (Davidsson, 1995)**	**SMEI (Luthje & Franke, 2003)**
Intention	V	V	V	V	V	V
Underlying theory	Intention theory	Goal-setting theory	Goal-setting theory & self-efficacy theory	Intention theory	Intention theory	Intention theory
Individual perception: attractiveness/ desirability	Perceived desirability	X	Attitudes	Attitude toward entrepreneurship	Attitude: general and specific	Attitude toward entrepreneurship
Individual perception: Capability	Perceived feasibility	X	Self-efficacy	Perceived behavioral control	Conviction	X
Social norm or social pressure	X	X	X	**Subjective norm**	X	X
Personality characteristics	External factors influencing intention indirectly through effect on attitudes	External factors influencing intention indirectly through effect on attitudes	External factors influencing intention indirectly through effect on attitudes	External factors influencing intention indirectly through effect on attitudes	X	External factors influencing intention indirectly through effect on attitudes
Propensity to act	Propensity to act	X	X	X	X	X
Situation/ contextual factors	Precipitating (displacing) event	Social, political & economic context	Social, political & economic context	Perceived behavioral control (influence both intention and behavior)	Current employment status	Perceived barriers and support
Application areas/scope	Entrepreneurial (1) practice & (2) education	Entrepreneurship practice	Entrepreneurship practice	Entrepreneurial (1) practice & (2) education	Entrepreneurial (1) practice & (2) education	Entrepreneurial Education
Empirical studies on entrepreneurial intentions	Audet (2002), Krueger (1993), Krueger et al. (2000), Peterman & Kennedy (2003), Segal et al. (2005), Veciana et al. (2005), Walstad & Kourilsky (1998)	-	* Chen et al., (1998); De Noble et al. (1999), Li (2008), Wilson et al., (2007), Zhao et al. (2005)	Audet (2002); Autio et al. (2001), Fayolle et al.(2006), Gelderen, et al. (2008), Gird and Bagraim (2008), Kolvereid (1996), Krueger et al. (2000), Souitaris et al. (2007), Tkachev and Kolvereid (1999), Veciana et al. (2005)	Autio et al. (1997), Davidsson (1995)	Luthje & Franke (2003)

"v": considered; "x": not considered; *: only the effect of "self-efficacy" was tested, not the entire model

Compatibility of EEM, revised EIM, & TPB

The EEM, revised EIM and TPB demonstrate a high degree of compatibility. This can be reflected by their underlying theories, intention, and goal-setting theory and self-efficacy theory respectively. The EEM and TPB are pinpointed by the intention theory, while the revised EIM is developed based on goal-setting theory and self-efficacy theory.

The intention theory states that intentions are the determinant of a behavior that is planned and volitionally controlled (Ajzen, 1991; Shapero & Sokol, 1982). Intention bridges individuals and their actual behaviors. External factors (such as background factors and personalities) influence intentions through their effect on entrepreneurial attitudes. These attitudes indicate the attractiveness of the behavior and control of a person perceived over the behavior. Further, external factors also exert a significant impact on the formation of intentions (Ajzen & Fishbein, 1980; Krueger, 1993; Shapero & Sokol, 1982).

The goal-setting theory states the relationship between goals and action, or goals and task performance (Locke & Latham, 1990). According to this theory, a well-defined goal (as specific and achievable with efforts) will enhance one's performance (Locke & Latham, 1990). A goal which is too easy to achieve will have a negative effect on performance. Further, goal commitment (the extent to which a person persist in pursuing a goal) and self-efficacy will also affect the relationship between goals and performance.

Self-efficacy theory is the central part of social cognitive theory, which states that social behavior occurs through the proactive engagement of people who make the behavior happen by their own actions (Bandura, 1986). According to Bandura, a person's attitudes, abilities, and cognitive skills constitute the self-system. This system governs how people perceive situations and how people behave in response to different situations.

These theories are similar in meaning although they may be applied to different domains. For example, a **goal** may represent the extent which a person wants to achieve some outcomes through tackling some barriers. As noted by Locke and Latham (1990), a goal indicates desired outputs as the level of performance. In the goal-setting theory, attitudes are derived from group norms (normative information) and considered to affect the desirability of performance goals. Ajzen

(1991) contended that every behavior can be considered as a goal and to achieve the goal, a course of specific actions will be taken. Thus, goal and intention is largely homologous. Moreover, self-efficacy is an important concept for all these three models. Self-efficacy has significant impact on goal performance. The higher self-efficacy, the higher goal performance and commitment will be (Locke & Latham, 1990; Seijts & Latham, 2001). Perceived behavioral control or feasibility is similar in meaning to self-efficacy. Self-efficacy is a significant component of intention theory that it basically reflects the perceived behavioral control over an entrepreneurial behavior (Krueger, 1993; Krueger et al., 2000).

Given the compatibility of their underlying theories and the function of self-efficacy, the EEM, revised EIM, and TPB are therefore complementary in that they are related to different domains but adopt similar approaches. The three models also show consistency in considering the concepts of individual attitude or desirability and perceived capability to take entrepreneurial actions. For example, the "perceived desirability" of EEM, "attitudes" of revised EIM, and "attitude toward entrepreneurship" of TPB are used to describe the perceptions about entrepreneurship (i.e., attractiveness or desirability of starting up). Also, these three models use perceived feasibility, self-efficacy or perceived behavioral control to describe the effect of perceived capability on entrepreneurial intention.

The three models also consider personality traits and contextual factors on decision making on entrepreneurial behaviors. In these modes, personality traits are external factors influencing intention indirectly through their effect of attitudes. This is because the personality factors catch certain beliefs and perceptions about behaviors (Ajzen, 2005). For example, locus of control relates to one's control beliefs, which refer to one's perceived capability to take an action (Ajzen, 1991). In the EEM, propensity to act is the disposition to act upon one's decisions. Shapero and Sokol (1982) considered this factor as a stable personality trait which is highly related to locus of control. The EEM suggests that internally controlled people are more likely to engage in entrepreneurial activities. In fact, propensity to act in EEM has been empirically found to affect perceived desirability and feasibility (Krueger, 1993).

In terms of situational or contextual factors, the EEM considers the precipitating (or displacing) events, including job loss, an inheritance etc. Entrepreneurial decision would be affected by some external changes (Shapero &

Sokol, 1982). The revised EIM considers the contextual factors of social political and economic context affecting the thought process entrepreneurs (Bird, 1988; Boyd & Vozikis, 1994). While the TPB uses the construct of perceived behavioral control to reflect effect of contextual factors (i.e. difficulties or easiness) such as resources, support or constrain received (Ajzen, 1991).

Selecting the best model—TPB

Among the three models (EEM, revised EIM, and TPB), the revised EIM has received least empirical support. The whole revised EIM has yet to be validated empirically (Drnovsek & Erikson, 2005), while the EEM and TPB models have been well tested. Although the mediating role of self-efficacy between the background factors and intention has been well tested (Chen et al., 1998; De Noble et al., 1999; Li, 2008; Wilson, et al., 2007; Zhao et al., 2005), the entire revised EIM model has not been empirically tested. Therefore, the revised EIM is less appropriate to be used in this study compared with the other two models.

While considering the factor of **subjective norm,** the revised EIM and EEM lack information on this factor. In the revised EIM and EEM, attitude toward creating a new business is considered as a broad concept that factors at both personal and social levels influencing one's desirability or willingness are merged altogether. Differently, TPB clearly distinguishes attitude pertaining to personal interest or attraction regarding the entrepreneurial behavior (personal level), and attitude due to social influence (i.e., social level). Such separation of the attitudinal antecedents is meaningful and necessary as it provides more detailed information compared with the other two models.

In fact, not only the personal assessment of entrepreneurship is important, but also the opinions of other people who are important to the person (Ajzen, 1991; 2005). Those significant people may include a person's parents, spouse, close friends, co-workers, teachers, classmates and experts in the field. Therefore, subjective norm which refers to how significant others view the person engaging in entrepreneurship is an important influencing factor of entrepreneurial intention. The person will be more likely to perform the entrepreneurial behavior if significant people think that they should do so. Otherwise, the person would avoid entrepreneurship if those people disapprove. Subjective norm is especially important for students on campus,

since they usually lack confidence and experience to make decisions on their career choice. Thus, they can be easily influenced by their teachers, parents and friends.

Among these intention models, only TPB extends the antecedents of entrepreneurial intention to a social level. The model includes the factor of subjective norm that reflect one's attitude due to the opinions of significant others. This factor has a direct impact on entrepreneurial intention. Thus, TPB provides a clearer picture of how the entrepreneurial intention forms. The TPB provides a more detailed basis for us to investigate the entrepreneurial intention of students in the context of entrepreneurship education. In this sense, we can study how entrepreneurship education influences intention through affecting one or more of the attitudinal antecedents.

Finally, the EEM is most homologous to TPB. Both models contain the concept of perceived self-efficacy (i.e., perceived behavioral control in TPB; perceived feasibility in EEM). TPB's other two attitudinal antecedents (attitude toward entrepreneurship and subjective norm) are similar to EEM's perceived desirability. According to Krueger et al. (2000), EEM can be considered as a particular application of TPB that provides more detailed information about intention.

In sum, the discussion above shows that TPB is superior to other models to study the entrepreneurial intention of students because it provides more detailed information about the formation of entrepreneurial intention and has received wide range of empirical support. Thus, the TPB model is appropriate to be used as the theoretical basis of this thesis.

2.5. Summary of Literature Review

This chapter discusses the definitions of three key terminologies: entrepreneurship, entrepreneurial intention, and entrepreneurship education. Entrepreneurship is defined as an innovation process to exploit a business opportunity by applying entrepreneurial learning (knowledge and skills). Entrepreneur is an individual who utilizes own entrepreneurial learning (knowledge and skills) to exploit a business opportunity. Entrepreneurial intention is a cognitive representation of actions for exploiting a business opportunity by applying entrepreneurial learning

(knowledge and skills). Entrepreneurship education is a process of transmitting entrepreneurial knowledge and skills to students to them exploit a business opportunity.

This chapter then moves forward to the review of studies on entrepreneurship education. Although many studies have been done on entrepreneurship education, there is a lack of a consensus on the fundamental questions (what should be taught and how it is being taught). This probably indicates that entrepreneurship discipline lacks a theory driven education framework to arrive at a consensus on designing an effective entrepreneurship programs/courses. To develop the entrepreneurship education model, we need to consider the objectives of entrepreneurship education. We thus summarize different levels of entrepreneurship education. In our thesis, entrepreneurship education is considered at the primary level-entrepreneurial awareness education. It is considered as a course launched in university aiming at delivering the concept and knowledge of entrepreneurship to students, not directly pursuing the creation of more entrepreneurs immediately. As such, students are expected to develop their knowledge and skills, and to change their attitudes to toward entrepreneurship, and finally, foster their entrepreneurial intention. Therefore, the focus of our entrepreneurial education model will be on how entrepreneurship education helps nurture the entrepreneurial attitudes and intentions of students.

Under the awareness education of entrepreneurship, this thesis discusses the specific education components of an entrepreneurship program/course. Drawing on Johannisson's (1991) education elements of entrepreneurship, the aspects of entrepreneurial learning acquired during an entrepreneurship program/course can be categorized into five dimensions: know-what, know-why, know-who, know-how and know-when. Know-what refers to the concept and knowledge of entrepreneurship; know-why is about the values and motives of initiating entrepreneurial events and attitudes toward the events; know-who concerns the social interaction, that is, the interaction with teachers, successful entrepreneurs and experts in the research field; know-how represents the abilities, techniques and skills; and know-when concerns experience and intuition. Johnanisson's classification is the conceptual base for the specific education components of this thesis, however, the last dimension, know-when, is not applied in our model, because it links to the question "When is the right time to act?" which focuses on intuition. This intuition competence is best enhanced

by concrete entrepreneurial experiences, thus it is difficult to be taught to the students, who are on campus and may have no entrepreneurial experience or interest in the subject at the primary level of entrepreneurship education (awareness education). Therefore, this study, which focuses on the entrepreneurial awareness education, includes only four basic components: know-what/- why/-who/-how.

The chapter also reviews the major theories of entrepreneurship. Major lines of research on entrepreneurship are centered by two theories: the trait models and intention-based models. The trait models draw on the personality traits of the individual trying to establish a relationship between traits and entrepreneurial behavior. The trait models have been criticized based on two major problems: (1) it focuses on ex-post situations of entrepreneurs, and (2) it assumes a causal effect of personality traits on entrepreneurial behavior. That was why researchers were not able to find enough evidence to support this theory and it was gradually replaced by intention theories. Six major entrepreneurial intention models are identified and the evolution of these models is discussed. The six models are (1) EEM, (2) EIM, (3) revised EIM, (4) TPB, (5) EPM, and (6) SMEI. The development of entrepreneurial intention models basically has been guided primarily by thee models: EEM, EIM and TPB. For example, Boyd and Vozikis (1994) revised the EIM by adding the construct of self-efficacy. Further, based on the findings of EEM, EIM, and TPB, Davidsson (1995) developed EMPM focusing on individual attitudes, conviction (self-efficacy) and situational factors. The findings on the effect of attitude on entrepreneurial intention attracted Luthje and Franke (2003), who developed SMEI.

Which intention model is more appropriate to explain the entrepreneurial intention of students? In order to answer this question, we conducted a comparison among these models. EIM, EPM, and SMEI provide less information about how the entrepreneurial intention acting as the predictor of entrepreneurial behavior is formed at the personal level or social level. Also, they lack empirical tests of entrepreneurial studies. Therefore, these three models are not considered to be the theoretical basis of our study. This leads to shifting our focus to the evaluation of the EEM, revised EIM and TPB. Although the three models show certain degree of compatibility, TPB is considered superior to others because it provides more details about intention and has been proved valid to explain entrepreneurial behavior. The TPB model is employed as the theoretical basis of the study.

Chapter 3: Conceptual Model and Hypotheses

This chapter describes the development of the entrepreneurship education of this study based on TPB. It discusses the *preliminary conceptual model* of this thesis, which generally represents the relationship between entrepreneurship education and TPB. Discussion on how the four research questions of this thesis are related to the conceptual model is also discussed. Based on the preliminary conceptual model, a detailed model of education-entrepreneurial intention is developed. The *education-entrepreneurial intention model* explains the specific effect of entrepreneurship education components on entrepreneurial attitudes and intentions. A total of 10 sets of hypothesis are formulated to present the relationships among the variables of the education-entrepreneurial intention model. A summary of the education model is finally presented.

3.1. The Preliminary Conceptual Model

The aim of this thesis is to study the impact of specific education components on entrepreneurial intention. In other words, we consider how the entrepreneurial intentions of students are formed through entrepreneurship education. The preliminary conceptual model of this thesis, as shown in **Figure 10**, comprises two main parts: (I) entrepreneurial intention and (II) the entrepreneurship education. Part I includes the TPB model and part II comprises specific entrepreneurship education components.

According to the TPB (Ajzen, 1991; 2005), intention is the best predictor of a planned behavior, even there may be time lags, e.g., career choices (Lent et al., 1994). That is, intentions predict behavior; attitudes (regarded self-interest, social norm, and individual capability) predict intention. External factors influence intention through attitudes (Ajzen, 1987). The external factors include personality, demographic factors,

situational and environmental factors. These factors may influence attitudes or moderate the link between intentions and behavior (Ajzen, 2005; Krueger & Carsrud, 1993). In this sense, entrepreneurship education, as an external factor, is likely to have an indirect impact on entrepreneurial intention, through its effect on the three attitudinal antecedents: attitude toward entrepreneurship, subjective norm and perceived behavioral control.

The effect of entrepreneurship education on entrepreneurial intention has been confirmed by many studies on entrepreneurship education. The GEM (Global Entrepreneurship Monitor) Report (Bosma et al., 2008) covering global data (34 countries) showed that entrepreneurship education is highly linked with entrepreneurial intention. For example, individuals who have taken entrepreneurship programs or courses had higher intention to create own businesses than the non-trained group. This was supported by other empirical studies. The study of Clark et al. (1984) on entrepreneurial intention of university students presented that students who had completed an entrepreneurship course had higher level of intention to start up and the intention of the students were significantly liked with their subsequent entrepreneurial actions. Further, Tkachev and Kolvereid (1999) claimed that education enhances the decisions of students on being an entrepreneur. Focusing on attitude related to personal capability, Chen et al. (1998) found that entrepreneurship students compared with those who did not take an entrepreneurship course had significantly higher self-efficacy (i.e., perceived behavioral control) that significantly determine entrepreneurial intention. In the same line, Luthje and Franke (2002) argued that students who studied entrepreneurship in undergraduate or graduate curriculum were more likely to create a new firm.

In the longitudinal study of Varela & Jimenez (2001), the entrepreneurship courses/programs which had received large support from the universities would produce high entrepreneurship rate. Further, Peterman and Kennedy (2003) studied 109 students who had participated in an entrepreneurship program. The authors claimed that after completing the entrepreneurship program, the students' desirability (i.e. attitude toward entrepreneurship and subjective norm) and feasibility (i.e., perceived behavioral control) were significantly improved.

Fayole et al. (2006a) examined the impact of an entrepreneurship program in terms of attitudes and intentions of students. The authors found that entrepreneurship

education as a general factor positively influenced the entrepreneurial attitudes and intentions of students. This was generally confirmed by another study of them involving 275 business students (Fayolle et al., 2006b). Souitaris et al. (2007) also supported the results. They studied 452 students (232 entrepreneurship students and 220 non-entrepreneurship students) and found that after completing an entrepreneurship course, the students significantly increased their entrepreneurial attitudes and intention. Similar findings were obtained by Lee et al. (2005) who assessed the impact of entrepreneurship education on entrepreneurial intention of students. Among the 162 US students and 217 Korean students, the authors found that that knowledge and ability of venture creation and recognition of importance of entrepreneurship education significantly linked with entrepreneurial intention. They also confirmed that entrepreneurship course-takers had higher levels of intention and entrepreneurial knowledge and ability required for start-up than non-takers.

Charney and Libecap (2000) studied 511graduates during 1985-1999 in a university regarding their entrepreneurial intention and behavior. The authors confirmed that entrepreneurship education was a significant independent variable in their regression model and entrepreneurship graduates had significantly higher propensity to create own businesses (i.e., entrepreneurial intention) and start-up rate (27% for entrepreneurship students while 9% for non-takers). Adopting very similar research settings, Dutta et al (2010) surveyed 221 entrepreneurship alumni in a university from 1988 to 2008. Their results showed that specialization of entrepreneurship education had a significant positive impact on venture creation; it together with the diversity of education experience (e.g., exchange study & international residency) facilitated businesses success (e.g., increased wealth). The link between entrepreneurship education and new business creation was also supported by other researchers (Brown, 1990; Cho, 1998; McMullan et al., 1985).

However, all the above studies only concerned the *general* impact of entrepreneurship education on entrepreneurial intentions and/or attitudes (i.e., the consequence or outcome) through (1) testing the relationship between entrepreneurship education and intention using cross-sectional survey (Autio et al., 1997; Brown, 1990; Clark et al., 1984; Tkachev & Kolvereid; McMullan et al., 1985) or longitudinal study (Varela & Jimenez, 2001), (2) measuring the changes in entrepreneurial intentions and/or attitudes before and after exposing to an

entrepreneurship course/program using t-test (Fayolle et al., 2006a; 2006b) or considering entrepreneurship education as a general independent variable in the data analyses (Charney & Libecap, 2000; Dutta et al., 2010; Lee et al., 2005; Perterman & Kennedy, 2003; Souitaris et al., 2007), or (3) comparing the differences between entrepreneurship participants and non-entrepreneurship participants (Bosma et al., 2008; Chen et al., 1998). These studies were at a relatively general level that they focused on "what are the impact of entrepreneurship education on intention" by only reporting the outcomes of entrepreneurship education (e.g, yes or no, significant impact or not significant), but failed to answer "why" and "how" these outcomes or changes were attained. Such general findings seem to provide ***little*** implications for how to teach entrepreneurship in order to stimulate or enhance the attitudes and intentions of students toward entrepreneurship. As noted by Littunen and Virtanen (2006), more work needs to be done to reveal how exactly entrepreneurship education influences entrepreneurship. Therefore, understanding how entrepreneurship education specifically impacts entrepreneurial intention is necessary. Unfortunately, non-of the existing studies has investigated the specific impact of entrepreneurship education. To fill the gap in the knowledge required for fostering students' entrepreneurial attitudes and intention through formal academic training, this thesis is proposed to bridge entrepreneurship education and entrepreneurial intention based on a robust intention model (i.e., TPB) by elaborating the specific effect of entrepreneurship education components on entrepreneurial intention. Thus, this thesis focuses on "how" education influences entrepreneurial intention, not only "what" its impact is. Understanding the specific impact of education components will offer clearer education objectives, more appropriate course contents and teaching methods, and hence help to design an effective entrepreneurship course or program and promote an effective learning process in entrepreneurship.

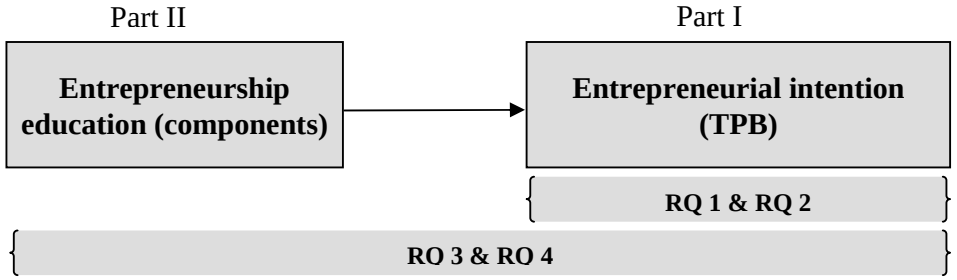

Figure 10. Preliminary conceptual model

In order to achieve the aim of this thesis, we have 4 objectives which can be achieved respectively by a corresponding research question. The objectives are (1) to identify a theoretical approach to develop a conceptual model for studying the impact of education on entrepreneurial intentions, (2) to test the effectiveness of entrepreneurship education in terms of entrepreneurial intention, (3) to empirically test the influence of entrepreneurship education components on entrepreneurial intention, and (4) to develop an entrepreneurship education model and provide guidelines for teaching the subject.

As shown in **Figure 10**, the first research question, RQ1, is related to identifying a theoretical approach to entrepreneurship which can be used to explain the formation of entrepreneurial intentions through entrepreneurship education, and this theoretical approach will be considered as the theoretical basis of our education-entrepreneurial intention model. Thus RQ1 links to part I. This research question is achieved through evaluation of the key entrepreneurship theories (e.g., trait models and intention-based models) and it has been done in previous chapter (**Chapter 2**), where we conducted an exhaustive review of the literature on entrepreneurship and education. We also examined the problems of the trait models and discussed the evolution of the key entrepreneurial intention models. The **TPB** was found most appropriate to study the impact of education components on students' entrepreneurial intentions because it provides detailed information on the formation process intention. Further, entrepreneurship is a planned behavior that it is best predicted by intention. According to the TPB, we note that exposing people to entrepreneurial knowledge and information can change their attitudes and intentions toward entrepreneurship. Thus, in this chapter, we will develop the entrepreneurship education model of this thesis based on TPB.

RQ2 is to identify the differences between the entrepreneurship students and the control group students regarding their entrepreneurial intentions. This research question will be answered by a comparison study between these two groups. Thus, RQ2 links to part I. Further, RQ3 seeking the influences of education components on entrepreneurial intention links to part I and part II. It will be achieved by testing the conceptual model. The last research question, RQ4, is to develop teaching guidelines for entrepreneurship. This research question is answered by exploring the results

obtained from the previous step (RQ 3) from both the theoretical and practical perspectives. Thus RQ 4 is also pertinent to the whole conceptual model.

As the interest of this thesis is the impact of education on entrepreneurial intention, the dependent variable of our education model is entrepreneurial intention. In previous chapter, we have discussed that entrepreneurial intention is effective to predict and understand the entrepreneurship tendencies and it is appropriate to be used as a dependent variable in entrepreneurial studies (Autio et al., 2001; Kolvereid, 1996a; Luthje and Franke, 2003). Also, we have emphasized that this thesis focuses on awareness education of entrepreneurship rather than pursuing the number of businesses they create. Thus, the entrepreneurial action/behavior is not the focus of this study, but the entrepreneurial intention and its attitudinal antecedents. Accordingly, we investigate how the education components affect all these variables.

In short, in the preliminary conceptual model, we seek to explain how entrepreneurship education components influence students' intention toward entrepreneurship. The model relies on the assumption that the learning from entrepreneurship courses and programs has significant impact on the students' entrepreneurial attitudes and intentions. The following section will discuss how to develop a detailed education model and hypotheses based on this assumption.

3.2. Hypotheses Formulation and the Education-Entrepreneurial Intention Model

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, entrepreneurial intention, is developed based on the TPB that consists of four variables: entrepreneurial intention, attitude towards entrepreneurship, subjective norm, and perceived behavioral control. The second part focuses on specific entrepreneurship education components, which include 4 different learning variables: know-why, know-who, know-how, and know-what (Johannisson, 1991). Thus, there are totally 8 variables considered in the education-entrepreneurial intention model (the detailed model). This section presents how the relationships among these

variables are hypothesized. It can be divided into 3 parts: (1) hypotheses related to TPB, (2) hypotheses among entrepreneurship education components; and (3) hypotheses between entrepreneurship education and TPB.

3.2.1. Hypotheses related to Theory of Planned Behavior (TPB)

3.2.1.1. Verifying the effect of the three antecedents of entrepreneurial intention

A lot of empirical studies on entrepreneurship have confirmed the relationship between the three attitudinal antecedents (attitude toward entrepreneurship, subjective norm and perceived behavioral control) and entrepreneurial intentions (Kolvereid, 1996a; Krueger et al., 2000). However, the findings of existing literature on the direct relationship between subjective norm and entrepreneurial intention are relatively inconsistent. Some researchers found subjective norm to significantly explain entrepreneurial intention (Kolvereid, 1996a; Kolvereid & Isaksen, 2006; Tkachev & Kolvereid, 1999), while 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 entrepreneurial intention (Ajzen, 1991; 2005), more empirical evidences on the effect of subjective norm on entrepreneurial intention are required (Krueger et al., 2000). Thus, 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 entrepreneurial intention of engineering students.

H1b: Subjective norm regarding entrepreneurship has a positive effect on the entrepreneurial intention of engineering students.

H1c: Perceived behavioral control regarding entrepreneurship has a positive effect on the entrepreneurial intention of engineering students.

3.2.1.2. The interrelationship among the three antecedents

Empirical studies (see in Ajzen (2005)) showed that the three antecedent attitudes of intention (attitude toward entrepreneurship, subjective norm, and perceived behavioral control) are not equally important to intention for all situations.

For some intentions, attitude toward entrepreneurship is more important than other antecedents, while for other intentions, normative beliefs or behavioral controls are more important. According to Ajzen (2005), the three attitudinal antecedents of intention can compensate one another. 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 (Chang, 1998; Taylor & Todd, 1995). This subsection discusses the relationships among the three antecedents.

Subjective norm and attitude toward entrepreneurship

Subjective norms are assumed to influence attitude toward entrepreneurship. That is, one's attitude towards a behavior is possible to be affected by others. The causal effect of subjective norm on attitude toward entrepreneurship can be explained by persuasion theory (Eagly & Chaiken, 1993) and cognitive dissonance theory (Festinger, 1957).

Persuasion theory assumes that persuasive communication influences one's existing beliefs and attitudes by producing new beliefs (Eagly & Chaiken, 1993). In this sense, people can internalize the opinions and advice of others and gradually change their original attitude toward a behavior. Such messages and information received from others do not necessarily prompt immediate decision of a person, but they will affect the person's future decision or action by being part of memory.

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 a behavior in order to feel affiliated with people who are significant to this person. In the context of entrepreneurship, a person may have a negative attitude toward creating own businesses. When the person believes that significant referents (e.g., parents, teachers, & friends) think an entrepreneurial career should be pursued, he or she may change attitude to be positive toward entrepreneurship so as to feel affiliated with the referents. This is especially true for students as most of them lack confidence and experience in making decision on their career choices.

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 affect one's decision making. Accordingly, in the context of entrepreneurship education, students' attitude toward entrepreneurship is likely to be influenced by significant others, including their parents, teachers, friends, and successful entrepreneurs/entrepreneurial experts. Therefore, in this study, we postulate the following hypothesis:

H2: Subjective norm influences the attitude of students toward entrepreneurship.

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 will succeed" could help a person build confidence and achieve a goal. Such encouragement could help people to remove self-doubt and concentrate on their effort on performing 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. Based on the discussion, this study postulates that the more positive comments of significant people on the students' decision on engaging in entrepreneurial behaviors, the stronger capability beliefs to perform well these behaviors the students will perceive.

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

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).

A person who believes that the entrepreneurial action will succeed (i.e., positive outcomes) will hold a favorable attitude toward performing the entrepreneurial action. In other words, when positive outcomes of the entrepreneurial action is evaluated or expected, a favorable attitude toward the entrepreneurial action will be attained. This is supported by the expectancy theory that when outcomes of a behavior are expected, positive evaluation or attitude will be produced (Eagly & Chaiken, 1993; Feather, 1982). In this sense, the higher perceived control over the entrepreneurial behavior, the more favorable attitude toward the entrepreneurial behavior because of the higher expectancy of the outcomes. Therefore, we propose that perceived behavioral control has a positive relationship with attitude toward entrepreneurship.

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

3.2.2. Hypotheses among entrepreneurship education components

As discussed in **Chapter 2**, there have been diverse opinions of researchers on the characteristics of entrepreneurship programs/courses (including various education objectives, course contents, and ways to deliver entrepreneurial knowledge). Balance of the diversity of education components is important to entrepreneurship education programs/courses (Ghosh & Block, 1993; Gibb, 1988). Based on Johannisson's (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 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.

These components stress the essential of entrepreneurial knowledge and skills for fostering entrepreneurial motivation and intention: understanding why there is entrepreneurship (i.e., the motives, values, reasons, as well as the importance of entrepreneurship) not just understating what the phenomenon is; knowing what knowledge and skills are required for new venture creation; practicing of applying these knowledge and skills; and interacting with significant references or role models. 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.

3.2.2.1. Know-what and other three components

According to Johannisson (1991), know-what refers to the knowledge that is required for new venture creation. As discussed in previous chapter, this factor should encompass elements of start-ups as well as knowledge required for business practice. The knowledge includes development of new organizations, new products, new markets, resources allocation, finance analysis, idea generation, opportunity discovery, business planning, team building, risk management, legal issues, and organizational management (Gartner, 1989). Further, know-what also includes understanding of how to act entrepreneurially (Bailey, 1986), negotiation, leadership, creative thinking and technological innovation (Plaschka & Welsch, 1990), tax framework and recruitment (Garavan & 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 attainting 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).

People who understand what entrepreneurship is, what entrepreneurs do, what the outcomes will be, are more likely to have a better understanding of why there are entrepreneurship, what values and motives to initiate entrepreneurial behaviors, and

what the benefits and importance of entrepreneurship. Hence, understanding of entrepreneurship concepts helps to identify or clarify why entrepreneurial effort is worthwhile. For students, the perception of the entrepreneurial phenomenon and its outcome and advantages, learning of business planning, financial planning, marketing management, strategic management, and process of starting a firm all are useful to have a clearer picture about entrepreneurship and better evaluate whether they should pursue an entrepreneurial career by identifying own motives and values to act.

In addition, entrepreneurial knowledge can also improve communication between students and significant others about entrepreneurial fairs. The significant people may include professors who are the experts in the field and guest speakers (Fiet, 2001a; 2001b; Hegarty, 2006) who are successful entrepreneurs. It is obvious that with the knowledge of a certain topic, people will have a more effective communication on this topic. Thus, with the knowledge of entrepreneurship they have learnt, the students can discuss or communicate with other people regarding creating own business in a more effective way. More specifically, the learning of know-what helps the students obtain useful comments, suggestions, and information about entrepreneurial acts from the significant referents that are important for them to make decision on pursuing entrepreneurship. Thus, know-what exerts positive influence on the learning of know-who.

Furthermore, based on the entrepreneurial knowledge acquired, the students know what kinds of abilities and skills, information, and tools are required for entrepreneurship and also they know how to apply these skills. This is supported by Bloom et al.'s (1956) taxonomy of level of learning that know-what (i.e. knowledge) is the most basic learning element. Theories and concepts should be learnt before application. In entrepreneurship education, theory should be integrated with skills and practice. The knowledge acquired through related education will facilitate the application of skills (Sumerall et al., 2000). Thus, know-what actually facilitates know-how.

Accordingly, in our education-entrepreneurial intention model, we propose the following hypotheses:

H5a: Know-what influences know-why.

H5b: Know-what influences know-who.

H5c: Know-what influences know-how.

3.2.2.2. Know-why and know-who

Know-why refers to the values and motives of entrepreneurial actions (Johannisson, 1991). The purpose of know-why component is to develop the motivation of students to start up with the entrepreneurial values and perceptions they obtain in entrepreneurship courses/programs. Therefore, learning of know-why relates to a series of questions: Why should I learn entrepreneurship? How exciting/challenging is entrepreneurship? How do the entrepreneurial experience, skills, knowledge, and abilities will benefit my whole life? Why should I engage in entrepreneurial activities? How does entrepreneurship fit or help my career development or job performance or increase my competency? Understanding of the importance of entrepreneurship at both the societal level (new businesses, new jobs, and increased wealth) (Drucker, 1985; Gorman et al., 1997; Jack & Anderson, 1998) and individual level (a good way to achieve their desires for independence or authority, money, social status, interest, excitement, or challenges) is important for students to evaluate their own profiles relating to entrepreneurship and develop their motives and values of pursuing an entrepreneurial career. For those who are not going to be entrepreneurs, entrepreneurship is also important to them. Whatever their career choices, students will benefit from learning entrepreneurship by learning to be creative and innovative, and adapted to change. Thus, entrepreneurial skills and abilities are important for all people.

As the learning of know-why is to develop the values and motives of initiating entrepreneurship, students with know-why competence appear more active and aggressive to interact with entrepreneurial professionals. This can be explained by motivation theory (Deci, 1972; Hunt, 1965; Ryan & 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). When studying the entrepreneurship phenomena, participants not only consider the information seeking by teachers or classmates, but also by other professions, or those who have relevant experiences. The participants who have motives and values of performing entrepreneurship appear more desired to seek professional opinions, comments, recommendations, and updated information, as they believe that all these are useful for them to know more about entrepreneurship, to have better decision-making on

entrepreneurship, and to learn skills and techniques from the professional referents. Based on the motivation theory, the useful information, comments and learning are considered as the rewards or benefits that facilitate the participants to interact with professionals.

Further, 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.

Social environment is an important source of updated information, knowledge and skills. This is particularly important for entrepreneurship as social interaction is essential to develop entrepreneurial intelligence. Therefore, for entrepreneurship students, seeking information and comments from entrepreneurial professionals is very important to know more about entrepreneurship, obtain updated information in the field, and learn techniques or skills from these referents through imitation and modeling. To interact with the entrepreneurial referents effectively, the students should develop their own values and motives of entrepreneurship and be interested in increasing their competences required for entrepreneurship (Butler, 2000). That is, students who develop own values and motives of entrepreneurship are more desired to interact with the entrepreneurial professionals and tend to have more effective interaction/communication with these people. Therefore the students will be more eager to participate in entrepreneurial seminars and workshops, interview with entrepreneurs, company visits and other entrepreneurship activities, in order to get updated information and learn to make better decisions on 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". Therefore, we propose the following hypothesis:

H6: Know-why influences know-who.

3.2.2.3. Know-who and know-how

Know-who is about social interaction (Johannisson, 1991). Know-who is an important competence of entrepreneurs as interacting with different parties, entrepreneurs can collect updated information which is useful to obtain supports and resources required for identifying business opportunities and setting up a new company. Thus, know-who is an important component of entrepreneurship education programs/courses (Johannisson, 1991; Raichaudhuri, 2005; Ronstadt, 1987). Access to the networks of entrepreneurial professionals is particularly useful for students, as they have no experiences and lack resources for entrepreneurship. An entrepreneurship program/course should offer opportunities for students to interact with practicing entrepreneurs and other entrepreneurial professionals.

Know-who, in the context of students, emphasizes the interaction or communication with entrepreneurial professionals, including teachers, guest speakers, and local successful/practicing entrepreneurs. The development of know-who competence allows learning through networking. Students can be benefited from talking and discussing entrepreneurial issues with entrepreneurial professionals such as entrepreneurship professors, or practicing entrepreneurs. Meeting with those people and discussing entrepreneurial ideas and related issues with them help students to access and interpret those people's entrepreneurial experiences. 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 et al., 2010).

The learning of know-who has a positive impact on the development of know-how. This can be explained in Bandura's (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 who are skillful or are experts in the behavior (Goldstein & Sorcher, 1974; Luthans & Kreitner, 1985). Therefore, through interacting with the entrepreneurial professionals, the students are expected to imitate the behaviors of those professionals to learn how to make decisions, solve problems, and other knowledge and skills related to entrepreneurship or job performance.

Further, 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 do and how to do in order to carry out the entrepreneurial events successfully (i.e., know-how). That is, the learning from the entrepreneurial referents can help the students develop know-how competence to perform entrepreneurial activities (Fiet, 2001a). Therefore, we formulate the following hypothesis:

H7: Know-who influences know-how.

3.2.3. Hypotheses between entrepreneurship education and TPB

3.2.3.1. 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 Katz's (1960) adjustment or utilitarian function of attitude and Wyer's (1970; 1974) pobabilogical model.

The adjustment or utilitarian function of attitude (Katz, 1960; Katz & Stotland, 1959) states that attitudes allow people to maximize rewards (values and benefits) in a context. People form favorable attitudes toward an object when needs and benefits are expected to be satisfied. 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 changes their beliefs when they have certain logically related beliefs. As noted by Wyer (1970; 1974), peoples' belief in a conclusion is related to their beliefs associated with a premise. Thus to have a target conclusion, related premises must be provided. In this way, students' belief in that entrepreneurship is good for them (i.e., favorable attitude of students toward entrepreneurship) can be the result given a related premise, such as, "entrepreneurship is very important to the society and economy; many real examples show that students

or graduates create own business successfully earning a lot money and realizing their dreams of starting own businesses; many entrepreneurship students/graduates become more innovative, have higher abilities to solve problems, and have better job performance." Beliefs in a premise (i.e., understanding of the values, motives, and benefits of entrepreneurship), based on Wyer's (1970; 1974) model, will change or improve the students' beliefs in the proposition that entrepreneurship is beneficial to them.

The "message-induced persuasion" (Eagly & Chaiken, 1993) is also relevant in this respect. For example, in entrepreneurship education, teachers attempt to convince students of the truth of the values and benefits of entrepreneurship. 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 & Hartwick, 1980). Exposed to the training of know-why in entrepreneurship education, the attitudes of students toward entrepreneurship can be changed. Some literature on psychology has supported the influence of changes in individual beliefs in a premise on his/her conclusion (attitude) (Holt, 1970; Wyer, 1970). In entrepreneurship education, more convincing messages will be obtained if teachers explicitly emphasize the conclusion for the students (e.g., pursuing an entrepreneurial career is worthwhile) instead of allowing the students to infer this conclusion on their own understanding of the related premises (Hovland & Mandell, 1952; McKeachie, 1954).

Therefore, the learning of know-why is important to develop students' attitude toward entrepreneurship. With the learning 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. It is not surprising that know-why is an important part of entrepreneurship education aiming at fostering the entrepreneurial sprits and intention of students. An entrepreneurship program should emphasize not only on developing abilities, knowledge, skills, but also the values of initiating entrepreneurship. Also, the content for the entrepreneurship program should include learning about the benefits of entrepreneurship, the cultures, norms, values and attitudes in which the entrepreneur works. These will help to develop the learning of know-why, which influence the attitude of students toward entrepreneurship.

Based on the discussion above, we postulate the following relationship between know-why and attitude:

H8: Know-why influences attitude toward entrepreneurship.

3.2.3.2. 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, 1977) and social capital theory (Lin et al., 1981; Portes, 1998).

Social learning theory (Bandura, 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. The significant entrepreneurial referents can be considered as the entrepreneurial models for the students. 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 & Honig, 2003; Scherer et al., 1989). The entrepreneurial models can effectively encourage and qualify students for engaging in entrepreneurial activities, significantly increasing their perception about social norm. This reflects the dominant role of teachers, entrepreneurs and guest speakers in the interaction/socialization with the students regarding entrepreneurship. Through assessing or interpreting the experiences and performance of the entrepreneurial professionals, students will have cognitive evaluations of creating own business. Observational learning hence has a significant impact on the career choice of students (Betz & Hackett, 1981; Krumboltz et al., 1976).

Based on social capital theory, social interaction not only influences know-how, but also normative perceptions. The social capital theory, based on social learning

theory (Bandura, 1986), refers to the ability to acquire benefits from social networks (Lin et al., 1981; Portes, 1998). According to this theory, social interaction (e.g., with significant people) is an important source of useful information and support, such as assistance in opportunity identification and exploitation and critical new messages (Birley, 1985; Greene & Brown, 1997; Uzzi, 1999). Thus, exposing students to interaction with the significant entrepreneurial referents will help them to develop new ideas, views on critical issues on entrepreneurship, and widen the students' reference network to support and foster their new potential business (Aldrich et al., 1998; Aldrich & Zimmer, 1986). Friendship and advice often influence the decisions of entrepreneurs (Bruderl & Preisendorfer, 1998; Paxton, 1999), and this is particularly important for entrepreneurship students as entrepreneurial referents around them are often limited. Further, innovations, visions and normative beliefs are also the benefits for the students extracted from interaction with the entrepreneurial referents. All those advantages mentioned not only strengthen the students' know-how, but also influence the normative perception that whether they are encouraged or discouraged to perform entrepreneurial behaviors. Therefore, know-who has an impact the perception of subjective norm.

Through discussion on entrepreneurial topics, share of successful entrepreneurs or experts, the students can acquire useful information about new venture creation as well as comments and suggestions on entrepreneurial tasks or activities. The importance of the social interaction achieved through guest lectures, seminars on entrepreneurship, company visit, and interview with entrepreneurs would suggest that whether one performs entrepreneurial activities is likely to be influenced if he or she is encouraged or discouraged to act entrepreneurially. For example, if the teachers and guest lecturers and sparkers (practicing/successful entrepreneurs) do not advise students to participate in any entrepreneurial activities, the students will lack confidence and motivation to conduct these activities even they have an interest in entrepreneurship. On the other hand, if the teachers, guest lecturers and speakers all strongly recommend that the students should join entrepreneurial activities and create own business, the students will feel motivated and more confident to perform those behaviors. Thus, interaction with the entrepreneurial referents will form social pressure for the students to perform entrepreneurial activities or not perform (i.e., subjective norm) (Ajzen, 1991; 2005). That is, the influence of social interaction

reflects the extent to which entrepreneurial referents affect students' perceptions about pressures to perform or not to perform the entrepreneurial behaviors. Based on the discussion above, we formulate the following hypothesis:

H9: Know-who influences subjective norm

3.2.3.3. Know-how and perceived behavioral control and subjective norm

Know-how refers to the skills and abilities required for new business creation. Know-how is a crucial component of entrepreneurship programs/courses. 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. This component includes the skills of creativity, decision-making, leadership, communication skills, the ability to work in a team, marketing, management, the ability to accept failure, flexibility, risk-taking, confidence, passion, oral presentation skills, management skills, logical thinking, analytical skills, goal-setting skills, business idea generation, opportunity identification and analysis, and abilities and techniques to prepare and present a business plan (Henry et al., 2005a; Lazear, 2004; Michelacci, 2003; Ronstadt, 1985; Vesper & McMullan, 1988).

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. For example, positive feedback can be obtained from successful experience and increase the confidence of students to go further. Unsuccessful experiences that are ultimately overcome by teams with the guidance of teachers and entrepreneurs will impress the learning experiences and increase the perceived capability of the students to solve

similar problems. Confidence in self-capability is always a crucial factor for entrepreneurs to set up and run a new business successfully. This is because they have stronger control beliefs about coping with the difficulties and uncertainties when pursuing the entrepreneurial goal (Ajzen, 2005). Accordingly, students who have the stronger entrepreneurial abilities and skills to recognize opportunities, identify, collect and allocate resources and support, deal with uncertainties, and solve problems, will have higher confidence and capability to perform entrepreneurial behaviors. Therefore, we postulate the following hypotheses:

H10: Know-how influences perceived behavioral control.

3.3. Summary of the Conceptual Model

Summarizing all the hypotheses developed above, an intentional entrepreneurship education model is developed, as shown in **Figure 11**.

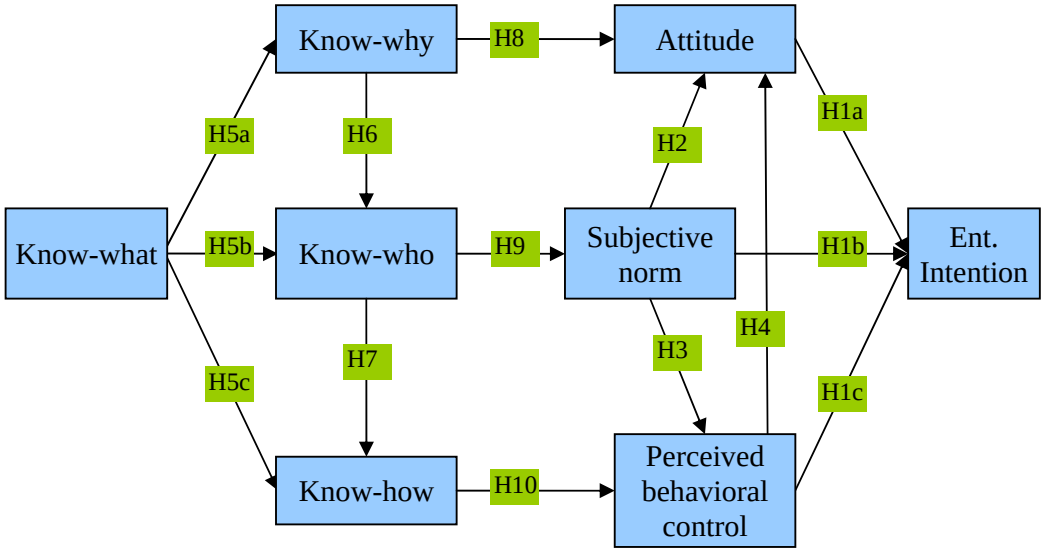

Figure 11. An education-entrepreneurial intention model

Developed based on the preliminary conceptual model, the education-entrepreneurial intention model contains 10 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. Hypothesis 1a, 1b, and 1c are to verify the TPB model in the context of the engineering students. Hypothesis 2, 3 and 4 are formulated to illustrate the relationships among the three antecedent attitudes of intention (attitude toward entrepreneurship, subjective norm and perceived behavioral control). Specifically, H2 and H3 depict that subjective norm respectively influences the attitude toward entrepreneurship and perceived behavioral control. H4 shows the influence of perceived behavioral control on attitude toward entrepreneurship.

The *second* group of hypotheses is related to the relationship among the entrepreneurial education components. This group includes H5a, H5b, H5c, H6, and H7. Hypothesis 5a, 5b and 5c state that know-what, acts as the initiator that exerts a positive influence on the other three education components (know-why, know-who, and know-how). H6 and H7 show the relationship among know-why, know-who and know-how. H6 presents the influence of know-why on know-who and H7 states the influence of know-who on know-how.

The *last* group of hypotheses presents the relationships between entrepreneurship education and the TPB. Three hypotheses are included (H8, H9, and H10). Hypothesis 8 is formulated showing the influence of know-why on attitude toward entrepreneurship. Hypothesis 9 shows the effect of know-who on subjective norm. The last hypothesis (H10) illustrates the relationship between know-how and perceived behavioral control.

The hypotheses are developed based on theoretical support. The theories used to explain the relationships among the variables are summarized in **Figure 12**. Hypothesis 1a, 1b, and 1c are formulated based on the TPB (Ajzen, 1991; 2005), and hypothesis 2 is developed based on persuasion theory (Eagly & Chaiken, 1993) and cognitive dissonance theory (Festinger, 1957). Hypothesis 3 is developed based on Bandura's (1986) social cognitive theory, while hypothesis 4 is formulated based on expectancy theory (Eagly & Chaiken, 1993; Feather, 1982). Hypothesis 5a,5b, 5c are developed based on Fiet's (2001a) argument and Bloom et al.'s (1956) taxonomy of learning level that know-what (knowledge) is the most basic component of entrepreneurship education that facilitates other three components. Hypothesis 6 is supported by motivation theory (Deci, 1972; Hunt, 1965; Ryan & Deci, 2000) and function of information seeking in goal theory (Butler, 2000), while hypothesis 7 is developed based on Bandura's (1977) social learning theory. Hypothesis 8 is

explained by Katz's (1960) adjustment or utilitarian function of attitude and Wyer's (1970; 1974) pobabilogical model. Hypothesis 9 is developed based on social learning theory (Bandura, 1977) and social capital theory (Lin et al., 1981; Portes, 1998). Lastly, hypothesis 10 is supported by Bandura's (1986) social cognitive theory.

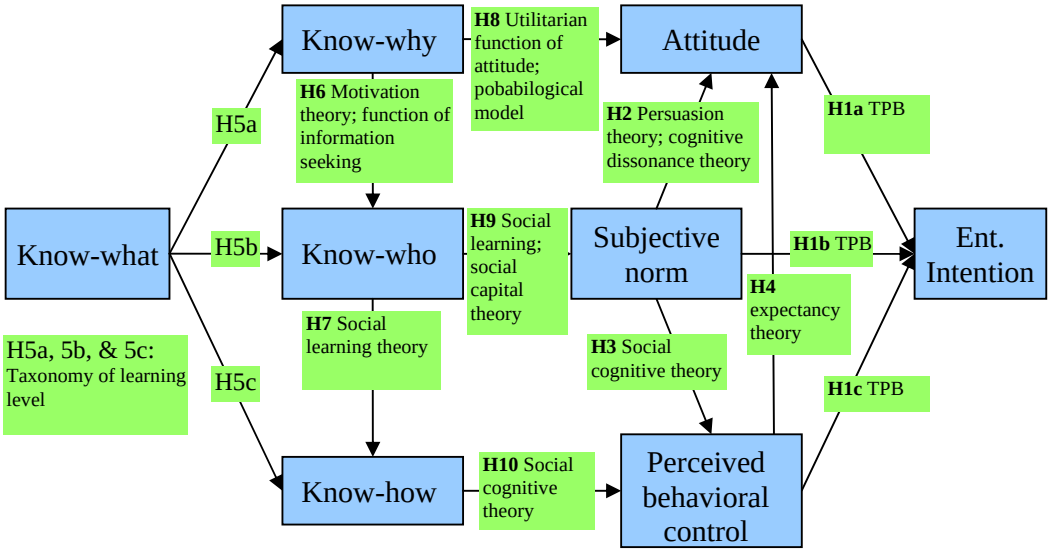

Figure 12. Summary of theories used for hypothesis formulation

In general terms, in the education-entrepreneurial intention model, intention of students toward entrepreneurship can be enhanced by improving three antecedent attitudes (attitude toward entrepreneurship, subjective norm and perceived behavioral control) through entrepreneurship education centering at four key components. In other words, entrepreneurship program/course is assessed based on its impact on the students' attitude towards entrepreneurship, subjective norm, perceived behavioral control and intentions. Compared with previous research on entrepreneurship education, this model has **two** merits.

First, the model elaborates the specific components of entrepreneurship education in terms of what, why, who and how as well as their interrelationships. This provides systematic relationship between entrepreneurship education and entrepreneurial intention. Existing studies (Fayolle et al., 2006; Gelderen et al., 2008; Kolvereid, 1996b; Peterman & Kennedy, 2003) are on a relatively general level that they only concern the changes in entrepreneurial intentions after the entrepreneurship education, without dealing with how those changes are actually caused. Filling this

gap, our model provides in-depth insights into specific education components which influence the entrepreneurial attitudes and intentions of students.

Second, the model considers the inter-relationships among the three antecedents (attitude toward entrepreneurship, subjective norm and perceived behavioral control) of entrepreneurial intention rather than solely on their direct impact. It highlights the effect of subjective norm on attitude toward entrepreneurship and perceived behavioral control, showing the importance of subjective norm in the formation of entrepreneurial intention of students. Also, it shows the effect of perceived behavioral control on attitude toward entrepreneurship, suggesting that attitude can be improved through capability to control the entrepreneurial event. This model, thus, provides more details about the formation process of entrepreneurial intentions and contributes to TPB applying to the field of entrepreneurship education research.

In short, the entrepreneurship education model provides more comprehensive insights than the previous studies on entrepreneurship that it considers the influence of specific education contents on the entrepreneurial attributes of students as well as the inter-relationships among the antecedents of entrepreneurial intention.

In the following chapter, we will discuss how to carry out the research to verify the education-entrepreneurial intention model and to test the hypotheses.

Chapter 4: Methodology

The purpose of this thesis is to investigate the impact of entrepreneurship education components on entrepreneurial intention of students. In order to achieve this purpose, we have identified four research objectives which can be achieved by respectively answering one research question. The first research question has been answered by an exhaustive review of literature on entrepreneurship and education in **Chapter 2**, where the key theories of entrepreneurship (e.g., trait models and different intention models) were reviewed and evaluated. The TPB model was found most appropriate to be implemented in entrepreneurship education research. According to the TPB, exogenous factors of entrepreneurial knowledge and information will change people's attitudes and intentions toward entrepreneurship. In this sense, the TPB model is suitable to study the influence of education components on entrepreneurial attitudes and intentions. Therefore, based on TPB, we developed an education-entrepreneurial intention model specifying the effect of education components on entrepreneurial intention. Other research questions are about addressing the effectiveness of entrepreneurship education (RQ2), the specific impact of education components on entrepreneurial intentions (RQ3), and teaching guidelines for entrepreneurship (RQ4). RQ 2 will be answered through a comparison study between the entrepreneurship group students and control group students regarding their entrepreneurial intentions. RQ 3 can be answered through testing the education-entrepreneurial intention model and RQ 4 will be achieved by exploring the test results from the theoretical and practical perspectives.

In this chapter, we will present the methodological procedures employed for the conduct of this research in order to solve the research questions. It includes **seven** sections, excluding the last one presenting chapter summary. The **first** section describes the quantitative research design adopted in this thesis and a survey is conducted to collect data. The **second** section explains the procedures used to reduce survey errors. The **third** section presents the participants of this study. The participants included two subgroups: the entrepreneurship group which was composed of engineering students who had completed an entrepreneurship course and the control group engineering students who had not been exposed to the

entrepreneurial course. The details of the entrepreneurial course are also introduced in this section. Next, the **fourth** section describes the development of a questionnaire used for the survey to collect data on the entrepreneurial learning, attitudes and intentions of students. The questionnaire was developed based on the education-entrepreneurial intention model. A total of eight variables were involved in the questionnaire: entrepreneurial intention, attitude toward entrepreneurship, subjective norm, perceived behavioral control, know-what, know-why, know-who, and know-how. The **fifth** section details the measures of the eight variables used in the questionnaire. In the **sixth** section, procedures are described about how data was collected, including a pilot study and collecting data from the entrepreneurship group and the control group. In the **seventh** section, a set of statistical methods for data analysis are discussed. An overview of the methodology is provided in **Table 6**.

Table 6. Summary of major elements of research procedures

Procedural element	Description
Research design	Quantitative design: cross-sectional survey: The design approach offers best practice for studying the dependent relationships among the 8 variables of the education-entrepreneurial intention model. Entrepreneurial intention is dependent variable, know-what is exogenous independent variables and know-why, know-who, know-how, attitude toward entrepreneurship, subjective norm, and perceived behavioral control are endogenous independent variables.
Participants	A total of 594 engineering students from three universities in Hong Kong participated in the survey. The participants included two groups: the entrepreneurship group (294) and the control group (300). The former group included engineering students who had completed an entrepreneurship course while the latter group students were not exposed to the entrepreneurial course.
Questionnaire	A questionnaire was developed based on the education-entrepreneurial intention model. It comprised demographic information and measure of the 8 variables. Each of the variables was measured by multiple-items. The measures were developed based on relevant literatures on entrepreneurship and education.
Data collection	Prior to data collection, a pilot study was conducted to improve the content, simplicity, clarity, comprehensiveness and layout of the questionnaire. Data of this study were collected from engineering students from 3 universities in Hong Kong. The questionnaires were administered to the participants in class or through email. There were 594 questionnaires distributed and finally 411 completed questionnaires were collected with a general response rate of 69.19%. Among the respondents, 201 were entrepreneurship group students and 210 were control group students. Specifically, the response rate of the entrepreneurship group was 201/294=68.37% and the response rate of the control group was 210/300=70%.
Data analysis	The **first** step was data screening which was to check if the missing data was significant or if the data was randomly distributed. **Second,** data collected from different sources (e.g., different universities) were verified for statistical homogeneity and the control group students were tested if they had homogeneous demographical backgrounds to entrepreneurship group students. **Third**, reliability and validity of the measurements used in the survey were tested. **Fourth**, some statistical remedies for common method variance were discussed. **Fifth**, the descriptive information (e.g., means and standard deviations) of the variables of the conceptual model was calculated before ANOVA and T-test which were used for the comparison study between the entrepreneurship and control group. **Sixth**, the hypotheses of the conceptual model were tested with SEM path analysis.

4.1. Research Design

4.1.1. Quantitative research design

Research design can be qualitative or quantitative. These two approaches are different in terms of the nature of data. Qualitative research is required for soft data that present impressions, words, sentences, photos, and symbols, while Quantitative research is suitable for hard data in the form of numbers (Neuman, 2003). In this thesis, qualitative research design is not suitable for this thesis, thus the **quantitative research** design is adopted. The explanation is discussed below.

Qualitative research is to explore and learn about a phenomenon. Researchers usually ask participants the broad and general questions, collect the detailed opinions in the form of words or images, and analyze the patterns of the data (Creswell, 2009). This approach is to understand a phenomenon in depth, not to test the statistical association (Bell, 1991). The qualitative research has advantage to use various formats to report a study in a very detailed level. However, researcher bias is inherent in this research approach. Therefore, qualitative research is exploratory and appropriate to understand a concept or phenomenon, or problems that researchers have no idea about the important variables to examine (Creswell, 2009). Further, the qualitative approach is usually used when a quantitative approach is not feasible (Walsham, 1995).

Differently, q*uantitative* research design is systematic and scientific. It aims to reveal relationships among the variables. Researchers are interested in trends or relationships among variables using mathematical models, theories and hypotheses. (Creswell, 2009). Thus, quantitative research is suitable for comparisons between groups, analysis and explanation of dependency between variables (Creswell, 2009). This approach is effective when the research problem is to identify factors that influence an outcome (dependent) or to test a theory or explanation. In fact, it is recognized as the best way of testing hypotheses (Creswell, 2009).

Given the principles of the two approaches, **quantitative** design is appropriate for this thesis. First, the quantitative approach offers excellent analysis for testing a theory in terms of hypothesis (Creswell, 2009; Maxwell & Delaney, 2004). In our study, in order to address the objectives, we need to test the education-entrepreneurial intention model by using a survey instrument. Numerical data must be used to

determine the relationships among specific education components and entrepreneurial attitudes and intentions. In our model, 8 variables (entrepreneurial intention, attitude toward entrepreneurship, subjective norm, perceived behavioral control, know-what, know-why, know-who, and know-how) are included. Further the inter-relationships among these variables are also considered. Entrepreneurial intention is the dependent variable, and know-what is the exogenous independent variable. Others are considered as endogenous independents (Creswell, 2009). The quantitative design can be best to study the relationship among variables. According to Creswell, quantitative research "is an inquiry into a social or human problem, based on testing a theory composed of variables, measured with numbers and analyzed with statistical procedures, in order to determine whether the predictive generalizations of the theory held true" (p. 2). Therefore, quantitative design is adopted for this thesis.

Second, quantitative design is effective to compare two groups (Creswell, 2009). This feature fits the objective of this study. One of the objectives of this thesis is to test the effectiveness of entrepreneurship education in terms of entrepreneurial intentions by conducting a comparison study between the entrepreneurship group students and control students. Third, from a substantial review of literature on entrepreneurship education (in **Chapter 2**), we have identified that there is a lack of empirical data on the specific topic under study (i.e., specific effect of education components on entrepreneurial intentions). Thus, by conducting a quantitative study, this thesis will provide valuable empirical data on this topic and offer important implications for entrepreneurship education. Based on the reasons above, quantitative research design is appropriate for this thesis.

It is noted that the drawback for quantitative research is that this approach requires data that can be measured or assessed using an instrument or observed on a scale (Creswell, 2009). Thus, measurement of variable is the key to quantitative design as it reflects the relationship between data and observation. The measurement issues (including procedures to reduce measurement errors, design of questionnaire, reliability and validity of the measurements) will be detailed in the following sections.

4.1.2. Survey

In quantitative research design, a cross-sectional survey is adopted in this thesis. In a cross-sectional survey, data is collected at one point in time from a sample to depict a population (Babbie, 1990). According to the author, survey study provides a quantitative description of trends, attitudes, or opinions of a population by studying a sample. Further, a survey is also useful to investigate the underlying relationships between variables (Babbie, 1990). This supported by Leedy and Ormrod (2001) who argued that cross-sectional survey is useful to identifying “the characteristics of an observed phenomenon or exploring possible correlations among two or more phenomena" (p. 191). Thus, using the survey design, we can use statistical tools to test the relationship between the specific education components and entrepreneurial attitudes and intention (Creswell, 2009). The cross-sectional survey design is most suitable for achieving the objectives of this thesis.

The survey design allows differentiating responds in a systematic and standardized way. This design approach provides a consistent benchmark for the research. Measurement (in proper scales) can gauge fine differences between responds provided by participants. The consistent gauging scale provides the basis for precise estimates of the association between variables. The measurement issues will be detailed in **section 4.5**.

In a cross-sectional survey design, vagueness about the direction of influence of variables may exist. Nevertheless, this approach is used in most social survey research (Bryman, 2008). According to Bryman, to indicate independent and dependent variables, theoretical supports are necessary for researchers to infer the influence of one variable to the other. This relates to a matter of hypothesis development. The hypotheses of this study are developed based on theoretical supports in psychological and entrepreneurial research, as discussed in **Chapter 3**.

In the field of entrepreneurship research, cross-sectional survey has been widely used (Autio et al., 2001; Luthje & Franke, 2003; Kristiansen & Indarti, 2004; Krueger et al., 2000) and regarded appropriate and reliable to investigate entrepreneurial intentions. For example, in order to test the applicability of two intention models (TPB and EEM) to entrepreneurship research, Krueger et al. (2000) adopted a competing models approach using data obtained from a cross-sectional

survey. The authors compared regression analysis results for the two models and found that both models had strong statistical support.

Further, Autio et al. (2001) applied TPB to analyzing factors influencing entrepreneurial intention among university students. With cross-sectional survey, the authors compared participants from different areas, such as Finland, Sweden, USA, and UK. With the dependent variable of entrepreneurial intention of their study, the independent variables included attitude, subjective norm, perceived behavioral control, work experience in small firms, employment status, change job within one year, and age. The results showed that TPB was robust and perceived behavioral control was found as the most important determinant of entrepreneurial intention.

Similarly, Kristiansen and Indarti's (2004) conducted surveys among Indonesian and Norwegian students to study the impact of different economic and cultural texts. Independent variables in their study included demographic factors, individual background, personality traits, attitudes, and contextual elements, while the dependent variable was entrepreneurial intention. They found that the level of entrepreneurial intention was higher among Indonesian students than Norwegian students; the individual perceptions of self-efficacy and instrumental readiness were the variables that affected entrepreneurial intention most significantly, while age, gender and educational background had no statistically significantly impact.

In addition, Luthje and Franke (2003) explored whether personality traits or contextual founding conditions (independent variables) had an impact on the intention (dependent variable) to create own business. The authors also adopted cross-sectional survey design in their study and reported that personality traits did not directly influence entrepreneurial intention, but through attitudes; perceived barriers and support factors directly affected entrepreneurial intention. Similarly, Kolvereid (1996b), Tkachev and Kolvereid (1999), and Gird and Bagraim (2008) also used cross-sectional survey design to investigate the entrepreneurial intention of students.

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

In order to achieve the aim of this study, the engineering students who had completed entrepreneurship courses (i.e., entrepreneurship group) as well as those

who had not (i.e., control group) were involved in the survey. A questionnaire was developed to measure the response of the students regarding the constructs of the education-entrepreneurial intention model. The responses of the control group were used for comparison purposes to study the effects of entrepreneurship education on the students' attitudes toward entrepreneurship, subjective norm, perceived behavioral control, and entrepreneurial intentions. The 10 sets of hypotheses developed were statistically tested in order to study the specific effect of the education components.

4.2. Procedures to Reduce Survey Errors

In survey design, questionnaire development is very important as improper questionnaire design may introduce potential bias. There are several types of resources of survey errors. ***First,*** bias/errors may be related to samples, including under-coverage bias and non-response bias (Thompson, 2002). The former occurs when a sample extracted from a population does not adequately represent the characteristics of the population. The latter is the bias that results when respondents differ in meaningful ways from non-respondents. ***Second,*** bias may come from the measurement, leading to response bias, such as leading questions, acquiescence bias, and social desirability (Podsakoff et al., 2003). *Leading questions* refer to the wording of the question may be loaded in some way to excessively favor one response over another, for example, giving the respondents one response option to express positive feeling and two response options to express negative feelings. Such question is biased toward getting positive response. *Acquiescence bias* refers to the bias caused by a tendency to agree with all or most questions. For example, answering all questions with the same choice, such as all "yes". *Social desirability* occurs when respondents present themselves in a favorable way, and feel unwilling to admit to unpleasant attitudes in a survey. In this sense, their responses may be biased toward fitting the desirability of others.

Moreover, in this study, the independent and dependent variables were obtained from the same rater. It is probably to produce common method bias, which is attributable to the measurement method rather than of the measures of the constructs (Podsakoff et al., 2003).

All of the potential threats mentioned above may exist in the research methodology of this study. These biases are addressed, as presented in the following paragraphs.

First, in this study, our participants included both entrepreneurship group students as well as the control group students (as detailed in **section 4.3**). For the entrepreneurship group students, all of them were engineering students who had typical academic engineering background such as, information technology, mechanics, mathematics, physics, industry, logistics, quality engineering, mathematics, computer techniques such computer drawing, computer programming. They had well received engineering logical training. These students were exposed to the entrepreneurship course offered in their departments. It was the first course that conveyed entrepreneurial knowledge during their university studies. In this sense, it is appropriate to study the influence of the entrepreneurship course on the students' attitudes and intentions toward entrepreneurship.

The control group students were also engineering students from the engineering departments. They had similar academic engineering background with the entrepreneurship students and they also had received extensive engineering logical training. Furthermore, the characteristics (including age, gender, work experience, year of study and role models) of the control students were statistically homogeneous to those of entrepreneurship students ($p>0.1$). This will be further discussed in **section 4.7.2**. The salient difference between the two groups of students was that the entrepreneurship students were exposed to an entrepreneurship course, while the control group students were not. Therefore, it is feasible to compare the control group students and the entrepreneurship students in order to study the effectiveness of the entrepreneurship course.

Second, in order to reduce the non-response bias, during data collection, we approached the participants in their classes with the permission of their teachers. For those who were absent, we sent an electronic version of the questionnaire. Further, for the senior students (who had completed the entrepreneurship course one or two semesters earlier), we also sent electronic questionnaires. Follow-up letters were sent to remind the students to complete and return the questionnaires. In addition, the design of the measurements was also considered to reduce non-response rate. For example, we designed balanced options to the each of the questions to eliminate the

errors due to leading questions. We used a 7-point Likert-Scale for the questions with 1 =strongly disagree, 4=neither disagree nor agree, and 7=strongly agree.

Consequently, the response rate for the entrepreneurship group was about 68% and that for the control group was 70% (will be discussed more in **section 4.6**). According to Babbie (2008), a response rate of at least 50 % is adequate for analysis and reporting; a response of at least 60% is good and a response rate of at least 70% is very good (p. 289). Therefore, the response rates of the two groups are considered good, which indicates less probability of getting non-response bias (Aday, 1996; Rea & Parker, 1997). Further, we also noted that the characteristics of the participants were similar to that of the total samples in terms of their age, gender and year of study. Therefore, non-response bias of this study is insignificant.

Third, we conducted a pilot study to check the content validity, clarity, readability, and comprehensiveness of the questionnaire. The pilot study is discussed more in **section 4.6.1**. The questions were developed as clear, concise, and specific as possible to measure the variables of this study. Efforts were put to eliminate item complexity or ambiguity, through using simple and familiar words and short phrases, rather than the difficult ones, and to cut out unnecessary words.

Fourth, during the data collection process, to reduce social desirability in reporting the perceptions about the variables, our survey instructions also emphasized the importance of honesty for self-assessment and promised confidential. At the beginning of the survey or in the emails to the respondents, they were informed that the survey was voluntary and anonymous. All data collected were confidential. The answers provided for selection did not mean the higher the better or the lower the better and there was no right or wrong answers; the survey was not a part of their exam or a form of evaluation that had nothing to do with their performance. The respondents were asked to answer the questions according to their true feelings about the questions, and the reliability of the completed questionnaires would be finally checked and individual feedback of the participant's own score in comparison with the aggregate score of the total sample. The improper ones would be screened out. All these procedures could help the respondents try to avoid providing similar answers to all questions, or providing answers in order to get social approval and acceptance, and hence to reduce errors due to consistency motif and social desirability (Podsakoff et al., 2003).

Fifth, the validity and reliability of the measurements used in the survey were tested and the results show that the measurements used were reliable and valid. The details are demonstrated in **section 4.7.3**.

Sixth, some statistical procedures were used to further control the common method variance that may exist in the survey study. Harman's single-factor test and partial correlation procedures designed to control for method biases were used. These will be discussed in **section 4.7.4**.

4.3. Participants and Scenario of the Entrepreneurship Course

Prior to studying the influence of specific education components on entrepreneurial intention of students, we have to firstly investigate if the entrepreneurship program/course is effective to increase students' entrepreneurial intention, attitude toward entrepreneurship, subjective norm, and perceived behavioral control. In order to test the effectiveness of the entrepreneurship course, we employed a comparison study between the entrepreneurship group students who took an entrepreneurship course and the control group students who did not take the course.

Therefore, the units of analysis of this study included engineering students who took an entrepreneurship course and those who did not. That is, the entrepreneurship students and the control group students. These students were from three universities in Hong Kong: City University of Hong Kong (CityU), The Chinese University of Hong Kong (CUHK), and The Hong Kong Polytechnic University (PolyU). In particular, a sample of 294 the entrepreneurship group students (who took an entrepreneurship course in the engineering departments) from the three universities participated in this study. The entrepreneurship group respondents majored in systems engineering and engineering management (CUHK), Industrial engineering and engineering management (CityU), and Industrial and systems engineering (PolyU). The control group students were engineering students from CityU. Three hundred of students from the same engineering department who did not take the entrepreneurship

course served as the control group. The control sample of CityU was expected to give a relatively more reliable comparison results. Compared with the other two universities, CityU offered relatively less entrepreneurship activities to undergraduate engineering students in the campus, such as entrepreneurship seminars, workshops, or other forms of promotion of entrepreneurship. Thus, the control group students were more "pure" that they were less contaminated by the "entrepreneurial events", and thus could provide more accurate comparison with the entrepreneurship group. Therefore, the control group students were appropriate to be involved in the comparison study.

The entrepreneurship courses were offered in the engineering department of the three universities. The courses were about awareness education of entrepreneurship conveying entrepreneurial knowledge and skills to the engineering students (Linan, 2004). The syllabi of the entrepreneurship courses are summarized in **Table 7**. The detailed course information is shown in **Appendix 2**.

In the entrepreneurship course, the instructors (lecturers or professors) did not actually try to transform the students into entrepreneurs, but only to foster their interest in entrepreneurship and provide them with an alternative career choice of entrepreneurship through transmitting entrepreneurship knowledge and skills. The course offered at the three universities lasted one semester, around 5 months and they were comparable in terms of teaching contents and teaching methods. Regarding the teaching contents, the entrepreneurship course offered at each university was in charge of one professor or lecturer. It was entirely dedicated to entrepreneurship topics, covering different areas including understanding of entrepreneurship (definition and challenges of entrepreneurship) and entrepreneurs, industrial context and entrepreneurship environment, innovation and creativity, new product development, market research, business planning, management, finance, team work and other topics related to business management. The reference books used in the three entrepreneurship courses were also similar that they are related to entrepreneurship and innovation. The four dimensions of entrepreneurship education (Johannisson, 1991) were covered in these courses. For example, understating the motivation and values of entrepreneurs to start up (e.g., characteristics and motives) and the importance and benefits of entrepreneurship (i.e., know-why), understanding of the entrepreneurial process, industrial context and environment, the theories and

strategies required for innovation and establishing a new venture (i.e., know-what), learning from group discussion, interacting with teachers, classmates, or guest speakers (know-who), and preparation and presentation of business plan (know-how).

In general, interactive and creative methods were included in the teaching process. These methods comprised lectures, group and class discussions, group projects related to business plan (where students form teams to create a virtual new venture based on an innovative service or product by integrating entrepreneurial theories and skills), written reports, seminars or talks (share of practicing entrepreneurs or academic professionals in entrepreneurship), and creativity exercises. The core teaching method could be considered as “learning by doing”, where the objective was to train entrepreneurship students by guiding them throughout their project’s development, helping them to have a favorable attitudes toward entrepreneurship and intention to start up. Here, interest in entrepreneurship and entrepreneurial intention are the central part of the courses, not the number businesses created by the students.

Project teams were created at the beginning of the course. Each group required to come up with new ideas for developing their new products (or services), which was the basis for their business plan project. There was no limitation on product functions or appearance, but the product must be new, innovative, and different from existing ones. The market demand for the product or service should exist. Different from traditional teaching approach that emphasizes the transmission of knowledge from the teacher to the students, these entrepreneurship courses encouraged students to integrate the entrepreneurial and business knowledge and skills they acquired from the course into a business project in order to practice how to plan a business.

In the courses, teachers acted as advisors who respond to questions from the students. The teachers guided students to obtain an entrepreneurial and innovative sense, giving a direction and assistance to the students. They also tried to create a pleasant learning environment that facilitates new idea generation and team cooperation. The learning process was student centered.

Table 7. Syllabi of the entrepreneurship course offered in the 3 universities

	City	Poly U	CUHK
Course Title	MEEM4040 Entrepreneurship for Engineers	ISE 376 Entrepreneurship and Innovation	SEG 3600 Engineering Entrepreneurship
Duration	One semester	One semester	One semester
Objectives	a. Offer basic principles of entrepreneurship and innovation b. Offer key elements of the complementary skills and knowledge bases: both managerial and engineering which allow various technological and business opportunities to be pursued and planned effectively	a. Offer the concepts of entrepreneurship and strategies b. Develop an awareness of the sources/processes of innovation c. Develop the ability to analyze innovative business	a. Explore the facets of innovation and new venture creation, and the issues relating to the conceptualization, development and management of successful new ventures
Contents/ learning outcomes	a. Creative thinking and techniques in idea generation (i.e., creativity, innovation and opportunity identification) b. Principle of engineering entrepreneurship and understanding of entrepreneurship and industrial environment and entrepreneurs c. Entrepreneurship strategies: marketing theory and method, financial planning, and risk management for a new business development d. Integrating all the relevant entrepreneurship theories and methods into the formulation of business plan	a. Overview of entrepreneurship (fundamental concept of entrepreneurship and relevant issues): b. Industry context and entrepreneurship strategies (approaches to justifying the industry context and various strategies involved in the business development process c. Innovation and business development d. Implementation of innovation	a. Experience the process: develop and/or identify and pursue a business opportunity with a team of motivated peers b. Write a plan: develop a business plan for a new venture c. Analyze the issues: ponder the basic issues related to new ventures, the risks, challenges and rewards in innovation and new ventures
Methods	Lectures, group discussion, creativity games/exercise, group project (e.g. form virtual new venture team), seminars	Lectures, cases, in-class activities(seminars by industrialists), Projects (business plan), Group discussions	Case discussion, Group project (a new venture team), Group discussion, talks by entrepreneurship experts
Assess-ment	Q&A (i.e., in class participation), group discussion, group project presentation & written report, & examination	Test, in class participation, case studies, group project presentation & project report	Attendance, class participation, preliminary venture idea proposal and final proposal, & examination
Reference books used	a. Dorf, R. C., & Byers, T. H. (2005). *Technology Ventures: From Idea to Enterprise* (1st ed.), Singapore: McGraw Hill. b. Drucker, F. P. (1985). *Innovation and Entrepreneurship*, New York: Harper Business. c. Zimmerer, T. W., & Scarborough, N. M. (2005). *Essential of Entrepreneurship and small business management* (4th ed.), Upper Saddle River, New Jersey: Pearson Prentice Hall.	a. Dorf, R.C., & Byers, T.H. (2008). *Technology Ventures: From Idea to Enterprise* (2nd ed.), Singapore: McGraw Hill. b. Hisrich R.D., Peters, M.P., & Shepherd, D.A. (2008). *Entrepreneurship (*7th ed.), McGraw-Hill. c. Drucker, F. P. (1985). *Innovation and Entrepreneurship*, New York: Harper Business.	a. Hisrich R.D., Peters, M.P., & Shepherd, D.A. (2008). *Entrepreneurship (*7th ed.), McGraw-Hill. b. Timmons, J. A., & Spenelli, S. (2007). *New venture creation: Entrepreneurship for the 21st century* (7th ed), Irwin/McGraw-Hill.

In short, the entrepreneurship courses were delivered through learning by doing. Both traditional lecturing and other methods were used (e.g., talks by practicing entrepreneurs or academic in entrepreneurship, creativity and innovation exercises and business plan project). As at the primary level, the entrepreneurship courses aimed to provide students entrepreneurial competencies (new business entry, product and market innovation) and business managerial competencies (organizational & business management) and improve their attitudes and intentions toward entrepreneurship.

4.4. Questionnaire Development

A questionnaire (as shown in **Appendix 3)** was designed to collect the response of students regarding their learning and entrepreneurial attitudes and intentions. The questionnaire was composed of three sections. *Section one* consists of four TPB constructs: attitude toward entrepreneurship, subjective norm, perceived behavioral control and intention to perform entrepreneurial activities. The four constructs of education components: know-what, know-why, know-who and know-how constitute *section two*. The *third section* addresses demographic information. Item or question distribution for section one is that 3 items (or questions) for attitude toward entrepreneurship, 3 for subjective norm, 3 for perceived behavioral control, and 4 for entrepreneurial intention. The second section contains 21 items that measured respondents' learning from the entrepreneurship course, in which 5 items for know-why, 5 for know-what, 6 for know-who, and 5 for know-how. Totally, there were 34 questions for the 8 constructs. The third section consists of demographic variables: gender (coded as 0=female, 1=male), age (1= "<20", 2= "20-22", 3= "23-25", 4= ">25"), year of study (1=year 1, 2=year 2, 3=year 3, 4=other), work experience (1= "<1 yr", 2= "1-<2 yrs", 3= "2-<3 yrs", 3= ">=3 yrs"), and exposure to role model (0=no, 1=yes).

The questionnaire for the control group was exactly the same to the questionnaire for the entrepreneurship group, but the section about entrepreneurship education program was crossed out, as it was not applicable for the control group.

Next section presents the measures of each of the constructs. In this thesis, two categories of participants were considered: the entrepreneurship group students (who had completed an entrepreneurship course) and control group students (who had not been exposed to entrepreneurship course). The participants were coded as 0=control group, 1= entrepreneurship group).

4.5. Measures

According to the education-entrepreneurial intention model (**Figure 11**), there are totally 8 variables (entrepreneurial intention, attitude toward entrepreneurship, subjective norm, perceived behavioral control, know-why, know-what, know-who, and know-how), which are measured by multiple-item scales. The use of multiple-item measure is superior to that of single-item measure for several reasons (Bryman, 2008). *First*, the single item measure may incorrectly classify many individuals for some possible reasons, such as incorrect wording of the question or misunderstanding. Multiple-item measure can solve this by offsetting the effects. *Second*, single-item measure may not cover all the aspects of the underlying concept. A single question may be too general or extract only part of information and thus, may not represent the concept. *Lastly*, multiple-item measure gauges the fine differences of the response provided by participants and allows more accurate computation.

Each of the items (or questions) was measured by a 7-point Likert scale, which is the most frequently used variation of the summated rating scale (Cooper & Schindler, 2003). The Likert scale consists of statements that express either a favorable or unfavorable attitude toward the object of interest. Students were asked to agree or disagree with each statement or indicate the extent of their feeling to each statement. The points 1-7 indicate the value to be assigned to each possible answer with 1 representing the least favorable impression of "entrepreneurship issues" and 7 representing the most favorable. Thus, these measurement scales help us compare a student's score with a distribution of scores from the sample group and is useful to measure attitudes and intentions toward entrepreneurship after joining the entrepreneurship program. The measures of the variables of the education-entrepreneurial intention model are summarized in **Table 8**.

Table 8. Summary of measures of variables

Variables	Items	References	Score
Attitude toward entrepreneurship	att1: I'd rather be my own boss than have a secure job. att2: I can make big money only if I create my own business. att3: I'd rather create a new firm than be the employee of an existing one.	Ajze (1991); Luthje and Frank (2003); Kolvereid and Isaksen (2006)	avg. (att1+att2+att3)
Subjective norm	sn1: I believe that my family thinks that I should pursue a career by creating my own business. sn2: I believe that my closest friends think that I should pursue a career by creating my own business. sn3: I believe that other people who are important to me think that I should pursue a career by creating my own business.	Ajze (1991); Autio et al. (2001); Carr and Sequeira (2007); Linan (2005)	avg. (sn1+sn2+sn3)
Perceived behavioral control	pbc1: If I start my own business, the chances of success would be very high. pbc2: I have enough knowledge and skills to start a business. pbc3: I am capable to develop or handle an entrepreneurial project.	Ajze (1991; 2002; 2005); Autio et al. (2001) Kolvereid (1996b)	avg. (pbc1+pbc2+pbc3)
Entrepreneurial intentions	int1: I will join on-campus entrepreneurial programs/activities which assist students in creating own business if available. int2: I will start my own business after graduation in the future. int3: I will work together with good partners to start a new business in the future. int4: I will start my own business if financial support is secured	Autio et al.(2001); Chen et al. (1998); Krueger (1993); Kolvereid (1996b); Kolvereid & Isaksen (2006); ; Zhao et al.(2005)	avg.(int1+int2+int3+int4)
Know-what	kwa1: The entrepreneurship course increases my understanding of generating innovative ideas. kwa2: The entrepreneurship course increases my understanding of environmental assessment of entrepreneurial ventures. kwa3: The entrepreneurship course increases my understanding of financial preparation for entrepreneurial ventures. kwa4: The entrepreneurship course increases my understanding of planning a business. kwa5: The entrepreneurship course increases my understanding of market research for entrepreneurial ventures.	Johannisson (1991); Souitaris et al. (2007)	avg. (kwa1+…+kwa5)
Know-why	ky1: The entrepreneurship course increases my understanding of the attitudes of entrepreneurs (i.e., how they view entrepreneurship and why they act). ky2: The entrepreneurship course increases my understanding of the importance of entrepreneurship to both the society and individuals. ky3: The entrepreneurship course increases my understanding of the personal characteristics of entrepreneurs (e.g., risk-taking, innovation, etc.). ky4: The entrepreneurship course gives me a sense that entrepreneurship is achievable. ky5: The entrepreneurship course increases my understanding of the motives of engaging in entrepreneurial activities (e.g., money, self-achievement, social status, etc.).	Johannisson (1991); Souitaris et al. (2007)	avg. (ky1+…+ky5)

Table 8. Summary of measures of variables (Cont.)

Variables	Items	References	Score
Know-who	kwo1: The entrepreneurship course enhances my ability to develop networks (e.g., obtaining useful advice/information from professors, guest speakers or classmates). kwo2: The creative atmosphere in the entrepreneurship class inspires my entrepreneurial mind. kwo3: Views of the professor inspire my entrepreneurial mind. kwo4: Views of external speakers inspire my entrepreneurial mind. kwo5: Successful stories of local entrepreneurs inspire my entrepreneurial mind. kwo6: The entrepreneurial experience of the entrepreneurs enhances my understanding of the entrepreneurial process.	Johannisson (1991); Souitaris et al. (2007)	avg. (kwo1+ …+kwo 6)
Know-how	kh1: The entrepreneurship course enhances my skills to develop a business plan. kh2: The course enhances my skills to handle an entrepreneurship project. kh3: The entrepreneurship course enhances my skills to deal with risks and uncertainties. kh4: The entrepreneurship course enhances my skills to allocate resources (e.g., money, personnel, time etc.). kh5: The entrepreneurship course enhances my ability to identify a business opportunity.	Johannisson (1991); Souitaris et al. (2007)	avg. (kh1+… +kh5)

The first four variables are TPB variables. They include attitude toward entrepreneurship, subjective norm, perceived behavioral control, and entrepreneurial intention. Many studies on entrepreneurship have studied the four TPB variables (Chandler & Lyon, 2001). In this thesis, we summarize the key measures of the entrepreneurial attitudes and intentions that are frequently used in the literature and develop our measures based on the previous studies.

Attitude toward entrepreneurship

In the entrepreneurship literature, different kinds of scale have been used to measure attitude toward entrepreneurship. For example, Kolvereid (1996b) measured this construct in terms of the reasons for organizational employment or self-employment. The author assumed five reasons favor organizational employment (security, work load, social environment, avoid responsibility, and career) and six reason to favor self-employment (economic opportunity, challenge, autonomy, authority, self-realization, and participate in the whole process). This kind of attitude

measure can be considered as a belief measure that emphasizes one's beliefs about different aspects of organizational employment. Kolvereid's (1996b) measure was adopted in the studies of Fayolle et al. (2006) and Souitaris et al. (2007).

However, based on Ajzen's (1991; 2005) definition, attitude toward entrepreneurship is the degree to which a person has a favorable or unfavorable evaluation of becoming an entrepreneur. The author posits that behavioral beliefs are the *antecedents* of attitude rather than attitude itself. In this sense, attitude should be measured through aggregate or summative items (Ajzen, 1991; 2005). Some researchers have used aggregate scale to measure attitude toward entrepreneurship in entrepreneurship studies. For example, Krueger et al. (2000) used an aggregate scale to measure the attitude toward entrepreneurship while they studied the relationship between attitudes and entrepreneurial intention by comparing Ajzen's TPB and Shapero's EEM (detailed in **Chapter 2**). In their study, a single question ("Is starting your own business an attractive idea to you? (Scale: 0-100)") was used to measure the attitude construct.

Complementing to weakness of single-item measure, Luthje and Frank (2003) adopted 3 items to measure the aggregate attitude of students toward entrepreneurship. The items included: I'd rather be my own boss than have a secure job; You can only make big money if you are self-employed; I'd rather found a new company than be the manager of an existing one. A 5-point rating scales were used (1=not at all accurate; 5=very accurate).

Kolvereid and Isaksen (2006) used a mixed scale (beliefs and aggregated). Beliefs and attitude were considered as two separated independent variables and entrepreneurial intention was dependent. The beliefs were measured using four belief-measures of self-employment identified by Kolvereid (1996b): autonomy, authority, economic opportunity and self-realization. The aggregate attitude was measured by 4 items: (1) I would rather own my own business than earn a higher salary employed by someone else. (2) I would rather own my own business than pursue another promising career. (3) I am willing to make significant personal sacrifices in order to stay in business. (4) I am willing to work more with the same salary in my own business, than as employed in an organization. The results showed that no significant relationship was between beliefs and entrepreneurial intention. However, the aggregate attitude significantly predicted entrepreneurial intention.

In view of this, an aggregate measure of attitude toward entrepreneurship is more appropriate than the belief measure. Therefore, the aggregate attitude scale is adopted in this thesis. Considering the definition of the attitude toward entrepreneurship (Ajzen, 1991; 2005) and referring to the items used by Luthje and Frank (2003) and Kolvereid and Isaksen (2006), we measure attitude toward entrepreneurship using three items, as shown below. These items capture if a student has a favorable or unfavorable attitude toward creating his or her own business.

att1: I'd rather be my own boss than have a secure job.

att2: I can make big money only if I create my own business.

att3: I'd rather create a new firm than be the employee of an existing one.

Subjective norm

As Ajzen (1991; 2005) defined, subjective norm is about the perceived social pressure to carry out or not to carry out entrepreneurial behaviors; such social pressure comes from the perception that "significant referents" (such as parents and friends) would approve or disapprove of the decision to become an entrepreneur.

Among the three antecedents of intention in the TPB model, the effect of subjective norm is relatively more disputed. Some researchers found significant effect of subjective norm on intention (Kolvereid & Isaksen, 2006; Tkachev & Kolvereid, 1999), whereas others did not find the significant effect (Autio et al., 2001; Krueger et al., 2000). Some studies on entrepreneurial intention even ignored this factor (Peterman & Kennedy, 2003; Veciana et al., 2005).

Different measures of subjective norm have been observed. Kolvereid (1996b) measured this factor using "beliefs x motives to comply", arguing that perceived social impact is the product of normative beliefs and motives to comply. According to the author, subjective norm was measured by three belief items and three motives to comply items. The former group of items included "I believe that my closest family/closest friends/people who are important to me thinks that I should not (point 1)/ should (point 7) pursue a career as self-employed." The latter group of items was: "To which extent do you care about what your closest family/closest friends/people who are important to you think when you are to decide whether or not to pursue a career as self-employed?" The responses were given along a 7-point scale ranging from 1=I don't care at all to 7=care very much. The belief items multiplied with the

respective motivation items and then the scores added together to generate an overall measure of subjective norm. These measures were adopted by Kolvereid & Isaksen (2006) and Souitaris et al. (2007).

However, in a meta-analytic review on theory of planned behavior, Armitage and Conner (2001) argued that measure of multiple-item subjective norm have significantly stronger predictive power to intention than the measure of "subjective norm x motives to comply" or single-item measure of this factor. In this sense, this thesis adopts a multiple-item subjective norm measure. This kind of measure is popular in the field of entrepreneurship research. For example, Autio et al. (2001) measured the concept of subjective norm using four items to reflect the degree to which the individual perceived the university environment to encourage entrepreneurship, and the degree to which entrepreneurship was perceived as an acceptable career alternative after graduation. Similarly, Carr and Sequeira (2007) used multiple items to subjective norm capturing response of participants to the opinions of significant referents (such as parents/siblings/close relatives) on starting own businesses. In addition, Linan (2005) also used the multiple-time measure of subject norm in their study. The author argued that subjective norm is appropriate to be measured by items reflecting the opinions of significant others, such as family, friends and colleagues and mates, about engaging in entrepreneurial behaviors.

Based on the definition of subjective norm (Ajzen, 1991) as well as the findings of the above studies (Autio et al., 2001; Carr & Sequeira, 2007; Linan, 2005), we develop three items to measure subjective norm. The measures depict how a student perceives the normative considerations (e.g. the opinions of family, closest friends, and important others about performing the entrepreneurial behaviors). The three items are:

sn1: I believe that my family thinks that I should pursue a career by creating my own business.

sn2: I believe that my closest friends think that I should pursue a career by creating my own business.

sn3: I believe that other people who are important to me think that I should pursue a career by creating my own business.

Perceived behavioral control

The last antecedent attitude, perceived behavioral control, is defined as the perception of the ease or difficulty of becoming an entrepreneur (Ajzen, 1991). It relates to the beliefs about the presence of factors that may facilitate or hinder performance of the behavior (control beliefs).

This factor has been considered similar to the concept of self-efficacy (Bandura, 1997) and perceived feasibility (Shapero & Sokol, 1982). In this sense, some empirical studies on entrepreneurial intention measured perceived behavioral control through the perception of self-efficacy (Chen et al., 1998; Zhao et al., 2005; Kolvereid & Isaksen, 2006).

In particular, Chen et al. (1998) measured self-efficacy in terms of 26 roles and tasks related to entrepreneurship (e.g., marketing, innovation, management, risk-taking, and financial control) and respondents were asked to indicate their degree of certainty in performing each of the roles/tasks. Based on the measure used by Chen et al. (1998), Zhao et al. (2005) developed items to measure self-efficacy regarding specific entrepreneurial tasks and averaged over those specific tasks to form a more general measure of self-efficacy for the overall entrepreneurial task. Both studies found significant relationship between self-efficacy and intention. On the other hand, Kolvereid and Isaksen (2006) used a pure self-efficacy scale to measure the capability of respondents. The authors used a large number of items (18) to capture the degree of confidence of respondents regarding accomplishing different tasks successfully on an 11-point scale. These items were subsequently labeled as four specific self-efficacies: opportunity recognition, investor relationships, risk-taking and economic management. However, the results of their study did not support the influence of perceived behavioral control on entrepreneurial intention.

In a more general way, the measure of perceived behavioral control was related to the concept of both self-efficacy and perceived controllability of entrepreneurial behavior. For example, Kolvereid (1996b) measure perceived behavioral control in terms of six general items. The author found that perceived behavioral control was significantly influencing entrepreneurial intention. Self-efficacy is part of the perceived behavioral control. The concept of perceived behavioral control is more than the domain of self-efficacy which reflects the capability or ability of individuals (Ajzen, 2002). A person’s control over an

entrepreneurial behavior includes not only the capability to initiate and manage an own business, but also the controllability that reflects the degree of the person can successfully accomplish the entrepreneurial goal. Therefore, in this study, the questions to measure perceived behavioral control of the students include the perception of both self-capability and controllability.

Based on the definition of perceived behavioral control (Ajzen, 1991; 2005) and the measures used by previous studies (Autio et al., 2001; Kolvereid, 1996b), we develop three items to measure perceived behavioral control, describing the easiness or difficulty in creating own businesses that a student may perceive. The engineering students are instructed to indicate their level of agreement with the statements about their feeling of capability and controllability regarding creating own business. The three items are:

pbc1: If I start my own business, the chances of success would be very high.

pbc2: I have enough knowledge and skills to start a business.

pbc3: I am capable to develop or handle an entrepreneurial project.

Entrepreneurial intention

Previous studies have shown that intention is a reliable predictor of entrepreneurial actions as starting a new company is typically a planned behavior (Krueger et al., 2000). Entrepreneurial intention is often used as a dependent variable in entrepreneurship studies (Autio et al., 2001; Chen et al., 1998; Kolvereid, 996b; Kolvereid & Isaksen, 2006; Zhao et al., 2005). Different ways of measuring entrepreneurial intention have been observed in the field, but coincidently, there is a common agreement on measuring this variable in terms of the likelihood that one will engage in entrepreneurship at some time in the future) (Autio et al., 2001; Chen et al., 1998; Hood & Young, 1993; Kolvereid & Isaksen, 2006; Krueguer and Carsrud, 1993; Zhao et al., 2005). Therefore, in our study, we also measure entrepreneurial intention based on the likelihood measurement.

Krueger (1993) measured this construct using a single item with dichotomous scale (yes or no): “Do you think you’ll never start a business?” This kind of measure although is easy to use, it is a loose measurement with least information to be acquired (Cooper & Schindler, 2008). In a different vein, Kolvereid (1996b) measured entrepreneurial intention by examining the choice between organizational

employment and self-employment: “(1) If you were to choose between running your own business and being employed by someone, what would you prefer? (1=would prefer to be employed by someone; 7=would prefer to be self-employed); (2) How likely is it that you will pursue a career as self-employed? (unlikely-likely); and (3) How likely is it that you will pursue a career as employed in an organization? (likely-unlikely).” The average score on the items represented the intentions to be self-employed.

Different from the “choice measure” of Kolvereid (1996b), researchers tended to use general measure for entrepreneurial intention (Autio et al., 2001; Chen et al., 1998; Kolvereid & Isaksen, 2006; Zhao et al., 2005). For example, Kolvereid & Isaksen (2006) used a single item to measure intention to become self-employed: “How likely are you to be working full-time for the new business in one year from now? (seven-point scale from 1=very unlikely to 7=very likely).” In more detail, Autio et al. (2001) assessed entrepreneurial intention through examining the perceived likelihood of the individual to start a new firm (on part-time or full-time) within one or five years: “Start a firm on full-time basis within one year or five years from now; starting a firm on part-time basis within one year or five years.” A 5-point scale was used, ranging from 1 indicating not at all likely to 5 indicating already stated a firm. However, in the context of our study, the participants (engineering students on campus) may lack a clear concept about the difference between intentions toward part-time and full-time entrepreneurship. In this sense, a combined way to measure the general entrepreneurial intention is more appropriate.

Without distinguishing part-time or full-time engagement in entrepreneurship, some researchers measured entrepreneurial intention in a more general way. Chen et al. (1998) measured entrepreneurial intention in terms of 5 items: (1) how interested the respondents were in setting up their own businesses; (2) to what extent they had considered setting up their own business; (3) to what extent they had been preparing to set up their own business; (4) how likely it was that they were going to try hard to set up their own business; and (5) how soon they were likely to set up their own business. Their study aimed to test the effect self-efficacy on entrepreneurial intention. As the sample included MBA students, business owners and executives, the intention measurement emphasized more on the detailed planning of creating own business.

Similarly, Zhao et al. (2005) investigated the effect of self-efficacy on MBA students' intention to become entrepreneur. The authors measured entrepreneurial intention in terms of how interested the respondents were in engaging in prototypical activities (starting a business, acquiring a small business, starting and building a high-growth business, and acquiring and building a company into a high-growth business) in the next 5 to 10 years. A 5-point Likert scale was used, ranging from 1 (very little) to 5 (a great deal). This measure of entrepreneurial intention tended to access the intention toward specific forms of start up, rather than the general intention to create a new venture.

In this thesis, the participants are engineering students on campus and the entrepreneurship education is awareness education which aims to deliver entrepreneurial knowledge and skills to students in order to improve their attitudes and intentions toward entrepreneurship. The items to measure the entrepreneurial intention of the students is more appropriate to be general and related to the university environment (e.g., entrepreneurial activities/programs offered in university). Accordingly, we develop four questions to measure the students' intentions toward entrepreneurship. The measures concern the likelihood that the students would be involved in the on-campus entrepreneurial programs/activities (which aim to assist students in creating own business) and the likelihood that they would start own business in the future. The questions are:

int1: I will join on-campus entrepreneurial programs/activities which assist students in creating own business if available.

int2: I will start my own business after graduation in the future.

int3: I will work together with good partners to start a new business in the future.

int4: I will start my own business if financial support is secured

Entrepreneurship education components

Measure of the four specific education components (know-what, know-why, know-who, and know-how) concern the extent to which entrepreneurial knowledge, values, motivations, and skills are acquired by participants through the entrepreneurship course.

As discussed in **section 3.1**, previous studies on entrepreneurship education only emphasized the general impact of entrepreneurship education on entrepreneurial attitudes and intentions (Autio et al., 1997; Brown, 1990; Charney & Libecap, 2000; Chen et al., 1998; Clark et al., 1984; Dutta et al., 2010; Fayolle et al., 2006a; 2006b; Lee et al., 2005; Perterman & Kennedy, 2003; Souitaris et al., 2007; Tkachev & Kolvereid; Varela & Jimenez, 2001). These studies considered entrepreneurship education as a general control factor or independent variable (i.e., yes/no) in their studies, none of them investigated the specific influence of education components on intention. Three of these studies used Johannisson's (1991) learning dimensions to represent the general effect of entrepreneurship education (Fayolle et al., 2006a; 2006b; Souitaris et al., 2007). For example, Fayolle et al. (2006a; 2006b) considered entrepreneurship education content as a general factor that included the specific education components. In these two studies, the authors did not put the general factor of entrepreneurship education into their regression model. They used these measures to represent the characteristics of an entrepreneurship program under study. They measured the effectiveness of entrepreneurship program by studying the changes in the entrepreneurial attitudes and intentions of the participants after they had completed the entrepreneurship program. The authors measured each of the components with single non-numerical item. Non-numerical scale variable provides the less amount of information relative to numerical scales of measurement, since the scale assumes that particular ordering and intervals between the variables are without meaning, and also single item measure provides less amount of information relative to multiple-item measurement (Cooper & Schindler, 2008). In our thesis, we aim to investigate the systematic effect of specific entrepreneurship education components on entrepreneurial attitudes and intentions. In this sense, each education component should be considered as a separated construct to measure the different aspects of entrepreneurial learning. Thus numerical and multiple measures are more appropriate.

In the study of Souitaris et al. (2007), entrepreneurship education was also considered as a general factor that was composed of the specific components. Although Likert scale was used, the authors measured each of the components through only one item: "To what extent did the entrepreneurship program (1) increase your understanding of the attitudes, values and motivation of entrepreneurs (i.e., why do entrepreneurs act?), (2) increase your understanding of the actions someone has to

take in order to start a business (i.e. what needs to be done?), (3) enhance your practical management skills in order to start a business (i.e. how do I start the venture?), (4) enhance your ability to develop networks (i.e. who do I need to know)?, (5) enhance your ability to identify an opportunity (i.e. when do I need to act?)". The authors categorized the components into one factor to represent the general benefits of an entrepreneurship program. In this thesis, our purpose is to investigate the specific effect of entrepreneurship education components, in order to bring new insights into the design of course content as well as teaching guidelines of an entrepreneurship course. Thus, we go deeper to elaborate different aspects of each of the education components and design multiple-item measures for these components.

The measures of the first component-**Know-what**, concern the knowledge required in order to start a business. This component is considered as the fundamental part of the entrepreneurship courses/programs, as all other skills or techniques should be built based upon theoretical basis. As discussed in detail in **Chapter 2**, know-what should include not only the typical business concepts but knowledge of new business creation (Gartner &Vesper, 1994; Henry et al., 2005a) including marketing research, financial planning, business management and planning, and innovation (Binks et al., 2006; Gibb, 1993; Hindle, 2007; Kuratko, 2005; Plaschka & Welsch, 1990). In this thesis, we develop five items to measure this component.

kwa1: The entrepreneurship course increases my understanding of generating innovative ideas.

kwa2: The entrepreneurship course increases my understanding of environmental assessment of entrepreneurial ventures.

kwa3: The entrepreneurship course increases my understanding of financial preparation for entrepreneurial ventures.

kwa4: The entrepreneurship course increases my understanding of planning a business.

kwa5: The entrepreneurship course increases my understanding of market research for entrepreneurial ventures.

Measures of **know-why** concern the understanding of the values and motives of initiating entrepreneurial events. This component links to a series of questions: Why is entrepreneurship important? Why entrepreneurs start their businesses (links to

the attitude of entrepreneurs toward entrepreneurship) and what are their characteristics? What are the benefits of entrepreneurship (such as, money, social status, interest, excitement, challenges or contribution to the society)? This component is about the personal beliefs of learning and initiating entrepreneurship (Fayolle et al., 2006a; 2006b; Johannisson, 1991; Souitaris et al., 2007). It is spiritual and allows students to position themselves regarding creating a new business (Fayolle & Gailly, 2008). Therefore, developing the right attitudes and motives for entrepreneurship is very important in awareness education of entrepreneurship (Baruch, 2004; Gibb, 2002a; 2002b; Hall, 2002). The students are expected to build up their own values and motives for entrepreneurship that helps to develop right attitudes toward start-up through the entrepreneurship course. In this study, we develop five items to measure the concept of know-why.

ky1: The entrepreneurship course increases my understanding of the attitudes of entrepreneurs (i.e., how they view entrepreneurship and why they act).

ky2: The entrepreneurship course increases my understanding of the importance of entrepreneurship to both the society and individuals.

ky3: The entrepreneurship course increases my understanding of the personal characteristics of entrepreneurs (e.g., risk-taking, innovation, etc.).

ky4: The entrepreneurship course gives me a sense that entrepreneurship is achievable.

ky5: The entrepreneurship course increases my understanding of the motives of engaging in entrepreneurial activities (e.g., money, self-achievement, social status, etc.).

Know-who refers to the understanding of interacting with significant entrepreneurial experts (entrepreneurship teachers who are teaching or doing research on entrepreneurship), guest speakers (successful/local/young entrepreneurs who are doing entrepreneurial businesses), and classmates who are learning entrepreneurship) and obtaining useful information and advices (comments/suggestions) from these people. Different from the other three components, know-who reflects the learning at the social level (i.e. from the social environment). Researchers have found that a

supportive context that encourages social interaction and share of information will supply the concrete and intellectual resources (Johannisson, 1991; Lundvall, 1998; Raichaudhuri, 2005).

In reality, entrepreneurs need to interact with different parties to get information, resources and support required for setting up and managing their companies. Knowing the important people and acquiring useful information, skills and support from these people are critical for entrepreneurial success. Thus, in entrepreneurship education, it is important to offer opportunities for the students to meet and interact with the entrepreneurial people, such as teachers, guest lecturers and speakers (successful entrepreneurs, graduate entrepreneurs, and other experts in this field) (Fiet, 2001a; 2001b; Gibb, 1987a; Hegarty, 2006). Through the social interaction with the entrepreneurial people, the students are expected to enhance their ability to develop networks with the entrepreneurship related persons and obtain updated and useful information, advices, and suggestions. Also, interacting or working with the entrepreneurial people, the students can get concrete and intellectual supports. Therefore, the measures of know-who reflect the learning at social level. That is, how others (teachers, guest speakers and classmates) influence the entrepreneurial mindset of the students through interacting with these people or from their entrepreneurial experiences. Six items are developed to measure the concept of know-who.

kwo1: The entrepreneurship course enhances my ability to develop networks (e.g., obtaining useful advice/information from professors, guest speakers or classmates).

kwo2: The creative atmosphere in the entrepreneurship class inspires my entrepreneurial mind.

kwo3: Views of the professor inspire my entrepreneurial mind.

kwo4: Views of external speakers inspire my entrepreneurial mind.

kwo5: Successful stories of local entrepreneurs inspire my entrepreneurial mind.

kwo6: The entrepreneurial experience of the entrepreneurs enhances my understanding of the entrepreneurial process.

Know-how refers to the skills and abilities required to start a business. This component is about the practice or application of the knowledge and skills acquired from the entrepreneurship course (Johannisson, 1991). As "learning by doing" is the key characteristic of entrepreneurship education, it is important to provide opportunities for students to practice or apply their learning throughout the course. For example, through the preparation and presentation of a business plan, the students can integrate theories and knowledge with skills in practice (Henry et al., 2005a; Lazear, 2004; Michelacci, 2003; Ronstadt, 1985; Solomon et al., 2002; Sumerall et al., 2000; Vesper & McMullan, 1988). Other simulation games or activities are also useful to strengthen know-how (Brewer et al., 1993). Through the learning of know-how, the students are expected to develop and enhance their managerial skills as well as entrepreneurial skills. For example, how to allocate resources, how to identify the risks involved in decision makings, how to deal with those risks, how to recognize opportunities and other skills related to entrepreneurial techniques and skills. Based on these, we develop five items to measure the learning of know-how:

kh1: The entrepreneurship course enhances my skills to develop a business plan.

kh2: The course enhances my skills to handle an entrepreneurship project.

kh3: The entrepreneurship course enhances my skills to deal with the risks and uncertainties.

kh4: The entrepreneurship course enhances my skills to allocate resources (e.g., money, personnel, time etc.).

kh5: The entrepreneurship course enhances my ability to identify a business opportunity.

4.6. Data Collection

4.6.1. Pilot study

Before the survey, a pilot study was conducted to increase the quality and efficiency of our survey. Particularly the measures of the four entrepreneurship education components were checked, as they are relatively new in this field.

We firstly developed a draft of questionnaire. The measures of the TPB variables (entrepreneurial intention, attitude toward entrepreneurship, subjective norm and perceived behavioral control) were developed based on the items used by previous studies. The measures of the four entrepreneurship education components, as a few studies have empirically measured these components (as discussed in **Section 4.5.**), were developed based on their definitions, the several previous studies, and the contents of the entrepreneurship courses. For example, based on the general measures used by Fayolle et al. (2006a; 2006b) and Souitaris et al. (2007), we elaborated the general measure of each component into specific ones. For example, the measures of know-what included concepts and issues related to the entrepreneurial process (e.g., environmental assessment of the entrepreneurial venture, innovation, business management and planning, market and financial analysis). The measures of know-why reflected the importance and motives of learning and initiating entrepreneurship. They included understanding of why to perform entrepreneurial behavior, the importance and benefits of entrepreneurship. Know-who measured the learning from interacting with teachers (who are teaching entrepreneurship, guest speakers (who are doing it), classmates (who are learning it and doing related projects). Know-how reflected the learning from the application of the knowledge and skills acquired from the entrepreneurship course.

After that, we conducted a pilot interview with 10 entrepreneurship students. The students were asked the following questions: How do they think about the entrepreneurship course (positive or negative; achievable or not achievable)? Is the course useful (to stimulate their entrepreneurial or innovative mindset)? Interesting? What have they learnt from the course? Do they think that the knowledge and skills learning from the course are good for their future development? The opinions of the students were used to modify the questionnaire, especially the measures of the four education components. This came to the preliminary version of the questionnaire.

The preliminary questionnaire was sent to the review of two scholars (an entrepreneurship professional and one academic in management research). The contents, precision and appropriateness of the questions were checked.

The content validity generally passed the scrutiny with minor modifications in some items (i.e., wording problems). Subsequently, the modified questionnaire was pre-tested by administering it to 10 selected undergraduate engineering students who

were exposed to the entrepreneurship course and 10 who were not, in order to test the comprehensiveness of the questionnaire and its layout. No major problems were revealed. Only a few respondents provided comments on the length of the questionnaire, the format and wording of the scales. We therefore made minor modifications to refine, simplify and shorten the questionnaire based on those comments. For example, the preliminary version of the questionnaire was three pages long. Both the scholars and the students suggested that it could be shorter. Accordingly, we shortened the questionnaire to two pages and printed on both sides. Some questions were shortened through replacing some long phrases, long words, and delete unnecessary words. For example, "I will *participate in* on-campus entrepreneurial programs…" was changed to "I will join on-campus entrepreneurship programs…"; "The entrepreneurship course *is useful to* increase my understanding of …" was changed to "The entrepreneurship course increases my understanding of..."; "The *creative* atmosphere in the entrepreneurship class…" was changed to "The atmosphere in the entrepreneurship class… "; "Views of guest speakers invited to the entrepreneurship course …" was changed to "Views of *guest speakers* …."

Besides, the layout of the preliminary questionnaire was modified according to the comments collected. The section of the demographic information was placed at the end of the questionnaire rather than at the beginning, as this section contains some personal information which is quite sensitive such as age.

In short, the pilot study was important to check the content, simplicity, clarity, comprehensiveness of the questionnaire prior to a formal survey. After the improvement, the questionnaire was much simpler, more specific and concise. These procedures help to increase the validity of the measurement and reduce method bias caused by the improper designed measurements (Podsakoff et al., 2003). The improved questionnaire was then used for a formal survey to collect data.

4.6.2. Collecting data from the two groups

Data were collected from both the entrepreneurship group and control group. The questionnaires was either administered to respondents in class with prior permission from the teachers or sent to the respondents who were absent from the

class or who had completed the entrepreneurship course one or two semesters earlier. Both formats of the questionnaire were the same in terms of contents and layout.

At the beginning of the survey conducted in class or in the cover letters of the questionnaires emailed to the participants, we stressed that honesty for self-assessment was very important for us to get accurate data as well as for their personal ethic. Also, we promised that all the questionnaires were anonymous and we would keep them confidential. Further, the participants were told that they were voluntary to join the survey and there were no penalty for refusing to fill the questionnaire.

Further, there were no right or wrong answers for each of the questions and the survey was not evaluating their performance and had nothing to do with their examination results. There was no hurry to finish the questionnaire as we did not accept early submission and collection commenced at the end of a sufficient time. The participants were strongly encouraged to answer the questions carefully based on their true feelings. Further the participants were told that the reliability of the completed questionnaires would be finally checked and individual score would be compared with the general score of the total sample, and the improper ones would be screened out. These procedures should reduce the participants' evaluation anxiety and make them less likely to edit their answers to the questions to be more socially desirable or acquiescent, and thus reduce response error and common method variance (Podsakoff, et al., 2003).

4.6.2.1. Entrepreneurship group

A sampling approach was employed to select respondents from CityU, CUHK and PolyU. This approach has been recognized appropriate for theory testing purposes (MacMillan & Katz, 1992). The sample of entrepreneurship group included students who enrolled in an entrepreneurship course offered in the three universities, which had been operated for 3 years in CityU and CUHK respectively and was the first year implemented in PolyU when the survey was carried out. The students were in the first, second or third year of study when they joined the survey. The data was collected at different times according to the time that the entrepreneurship courses were offered (i.e., semester A or B).

City U:

Data collection at CityU was from May to December 2008 (semester B). The collection included two batches. Batch one was carried out in May 2008, at the end of semester B, students who were studying the entrepreneurship course (referred as "current students") were surveyed. Questionnaires were self-administered to the students in the class. Sixty questionnaires were distributed and 53 of them were completed and returned.

At the same time, batch two was prepared. An electronic version of the questionnaire was sent to all students who had completed the same entrepreneurship course in previous semesters. These students are referred as senior students. The entrepreneurship course was a relatively new in the engineering department and there were two more cohorts of students (totally 98 students) had studied the course. These students were in the second or third year or graduates. Thus, 98 questionnaires were sent out in May 2008, and 49 completed questionnaires have been returned by the end of December in 2008. During the period, a reminding letter was sent out every two months to remind the students to complete the questionnaires. Therefore, in total, we collected 102 completed questionnaires, which 53 were from "current" students and 49 were from senior students. The total number of questionnaire distributed was 158, thus the response rate was 64.56% (102/158).

CUHK and Poly U:

Data collection at CUHK and Poly U was respectively conducted in late April 2009 (nearly the end of semester A). Questionnaires were administered to the students in the class. At CUHK, we administered 100 questionnaires to the students, and 75 questionnaires were returned. However, 3 were not valid and deleted since they were completed by foreign students or contained too much missing data. Thus, the usable rate was 72%. At Poly U, 36 questionnaires were distributed to the students, and 27 completed questionnaires were collected with a response rate of 75%.

In summary, the total number of questionnaire distributed was 294 (CityU: 158; CUHK: 100; PolyU: 36) and 201 (CityU: 102; CUHK: 72; PolyU: 27) were collected. The response rate of the entrepreneurship group was 68.37%. There were 93 nonparticipants, who chose not to participate in our survey. However, they showed insignificant difference from the 201 participants in terms of gender, race, age, and year of study.

4.6.2.2. Control group

The control group students were the engineering students who were not exposed to the entrepreneurship course. The data of control group students were also collected during December 2008 to April 2009. Totally 300 control group students were selected randomly in the manufacturing engineering and engineering management department at CityU. There were 210 completed questionnaires returned with a response rate of 70%. These students were in the same department to the entrepreneurship engineering students, but did not enroll in the entrepreneurship course.

They had similar academic background with the entrepreneurship group students. For example, both of the two groups of students received typical engineering training including (information technology, mechanics, mathematics, physics, industry, logistics, quality engineering, mathematics, and computer techniques such computer drawing and computer programming). An analysis of the control group students yielded no significant differences from the entrepreneurship group in terms of age, gender, year of study, work experience and role models (as further discussed in **section 4.7.2.**). The most obvious difference between the entrepreneurship group and the control group was that the control group students had no academic background related to entrepreneurship. Thus, the 210 students were considered as the control group students in this study.

The control group students from CityU gave a relatively more reliable comparison results. Compared with other two universities, CityU offers relatively less entrepreneurship activities to undergraduate engineering students in campus, such as entrepreneurship seminars, workshops, or other forms of promotion of entrepreneurship. Thus, the control group students were more “pure” that they were less contaminated by the “entrepreneurial events”, and thus could provide more accurate comparison results with the entrepreneurship group. So these control group students were appropriate to be involved in the comparison study.

In summary, a total of 411 completed questionnaires were collected, including 201 from the entrepreneurship group and 210 from the control group. The data was then passed to data analysis, as shown in next section.

4.7. Data Analysis Methods

The first step in data analysis was data screening which is to check if the missing data was significant or not or if the data was randomly distributed. After that, data collected from different sources (e.g., different universities) was verified if the data was statistically homogeneous before combining them together for subsequent analyses. Further, the control group students were tested to see if they had homogeneous demographical backgrounds (age, gender, year of study, work experience and role model) to entrepreneurship group students. Next, reliability and validity of the measurements used in the survey were tested and some statistical remedies for common method variance were discussed. Consequently, the descriptive information (e.g., means and standard deviations) of the variables of the conceptual model was calculated before ANOVA and T-test which were used for studying the impact of demographic factors and the effectiveness of the entrepreneurship course on entrepreneurial perceptions of the students. Finally, the education-entrepreneurial intention model was analyzed with SEM path analysis. The following paragraphs discuss these issues one by one.

4.7.1. Data screening

The data collected from the two groups (entrepreneurship group and control group) were checked through data screening. For the entrepreneurship group, 201 questionnaires were used for further data analysis. Missing values were checked. The percentage of missing data was 4.5%. The little's MCAR test shows that the missing data was randomly distributed (Chi-square=265.683, df=296, sig.=0.897). The missing values were estimated by Expectation Maximization (EM) algorithm (Dempster, 1977; Schipper, et al., 1997). The Q-Q plots (i.e., the values of the data generally fell in a straight line) showed that the data was normally distributed as shown in **Appendix 4**.

For the control group, a total of 210 questionnaires were received. Missing values were checked. The percentage of missing data was 1.9%. The little's MCAR test shows that the missing data was randomly distributed (Chi-square=38.937, df=48, sig.=0.822). The missing values were estimated by EM algorithm. The Q-Q plots (i.e.,

the values of the data generally fell in a straight line) showed that the data was normally distributed. The details are also illustrated in **Appendix 4**.

4.7.2. Sample verification

In this section, data from different sources are verified in terms of homogeneity. It includes three parts: (1) testing the differences between the entrepreneurship senior students and the "current" students, (2) testing the differences among the students from the three universities, and (3) testing the demographic differences between the entrepreneurship group and control group.

As mentioned in **section 4.6.**, the entrepreneurship group participants of CityU included 49 senior students and 53 "current" students. The differences between these two groups were tested by t-test. The purpose was to check if the two groups of students could be combined into one group to represent CityU entrepreneurship participants. The results, as shown in **Table 9**, indicate that responses of the two groups were not statistically different at a level of 0.05. That is, the responses of the senior entrepreneurship students and "current" entrepreneurship students from CityU were considered homogeneous and could be used altogether to represent CityU entrepreneurship students for further analyses.

Table 9. Differences between the senior entrepreneurship students and the "current" students (49 senior students and 53 current students)

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**
Eint	0.028	0.868	-0.149	100	0.882
Att	3.279	0.073	0.436	100	0.664
SN	0.799	0.373	-0.167	100	0.868
PBC	0.373	0.543	-1.326	100	0.188
k_what	0.365	0.547	0.907	100	0.366
k_why	0.365	0.547	0.465	100	0.643
k_who	0.001	0.976	-0.371	100	0.711
k_how	0.195	0.660	-0.133	100	0.895

Eint: entrepreneurial intention; Att: attitude toward entrepreneurship, SN : subjective norm ; PBC : perceived behavioral control ; k_what: know-what; k_why: know-why; k_who: know-who; k_how: know-how.

Table 10. Differences among the students from the three universities

		Sum of Squares	df	Mean Square	F	Sig.
Eint	Between Groups	1.042	2	0.521	0.518	0.596
	Within Groups	198.958	198	1.005		
	Total	200	200			
Att	Between Groups	3.774	2	1.887	1.904	0.152
	Within Groups	196.226	198	0.991		
	Total	200	200			
SN	Between Groups	0.686	2	0.343	0.341	0.712
	Within Groups	199.314	198	1.007		
	Total	200	200			
PBC	Between Groups	0.672	2	0.336	0.334	0.717
	Within Groups	199.328	198	1.007		
	Total	200	200			
K-what	Between Groups	0.608	2	0.304	0.302	0.740
	Within Groups	199.392	198	1.007		
	Total	200	200			
K-why	Between Groups	1.752	2	0.876	0.875	0.419
	Within Groups	198.248	198	1.001		
	Total	200	200			
K-who	Between Groups	1.985	2	0.993	0.993	0.372
	Within Groups	198.015	198	1.000		
	Total	200	200			
K-how	Between Groups	0.107	2	0.054	0.053	0.948
	Within Groups	199.893	198	1.010		
	Total	200	200			

Next, prior to analyzing the entrepreneurship data from three universities as a whole, ANOVA (Analysis of Variance) tests were conducted to examine the differences among the students from the three universities regarding their entrepreneurship leanings as well as their entrepreneurial attitudes and intentions. **Table 10** summarizes the test results. As can be seen, the 201 entrepreneurship students from the three universities can be considered homogeneous with respect to their scores on each of the variables ($p>0.05$) and thus the overall data can be used for subsequent analyses.

Having verified the entrepreneurship group, we turned to test the control group students if they had homogeneous demographical backgrounds (age, gender, year of study, work experience and role model) to the entrepreneurship group students. The results are shown in **Table 11**. From the table, the two groups of

students did not have significant difference regarding their age, gender, year of study, work experience and role model. That is, the control group students had homogeneous background to the entrepreneurship group students. These provide further support that the entrepreneurship group and control group students had similar academic background and demographic background. The most salient difference between these two groups was that the former group took the entrepreneurship course while the latter group did not take the course. Therefore, the control group students are considered appropriate for the comparison study with the entrepreneurship students in order to test the effectiveness of the entrepreneurship course.

Table 11. Demographic differences between the entrepreneurship and control group

Demographic factors	Value	df	Sig. (2-tailed)
Age	6.245	3	0.102
Gender	2.593	1	0.107
Year of study	0.305	2	0.859
Work experience	3.762	3	0.288
Role model	0.041	1	0.840

4.7.3. Reliability and validity

Valid and reliable survey measurement is critical to the accuracy of research findings. In this study, both reliability and validity of the measurements were tested (for both entrepreneurship group and control group). The measurement scales were analyzed for reliability to ensure their appropriateness before proceeding to an assessment of its validity (Hair et al., 2006, p. 137).

4.7.3.1. Reliability

The reliability analysis of an instrument determines its ability to yield consistent measurements. Reliability refers the degree of internal consistency (Nunnally, 1978). Crobach's alpha statistic, the most commonly used test method for the internal consistency (Flynn et al., 1994; Nunnally, 1978), was used to check the measurement reliability. An inter-item correlation matrix was constructed for each scale as illustrated in **Appendix 5**. As all items had correlation with other items in their scale greater than 0.3 (Hair et al., 2006, p.137), calculation of Cronbach's alpha

then proceeded. As can be seen in **Table 12**, 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 alpha (i.e., >0.7). Similarly, as shown in

Table 13, the measurements for the control group also had reliability with all alpha values greater than 0.7. When both groups were analyzed together, in **Table 14**, the measurement scales again showed consistent reliability. Therefore, the measurements used (for both groups) in this study were reliable (Hair et al., 2006). Once the reliability of the scales had been established, validity tests were conducted.

Table 12. Reliability and validity tests of the measurements (Entrepreneurship group, N=201)

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 (Eigen values)	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
Con. alpha	0.883	0.831	0.876	0.770	0.852	0.878	0.890	0.889

Table 13. Reliability and validity tests of the measurements (Control group, N=210)

Items	Eint	Att	SN	PBC
1	0.791	0.838	0.838	0.807
2	0.788	0.850	0.851	0.868
3	0.851	0.877	0.876	0.856
4	0.829	-	-	-
Total (Eigen values)	2.659	2.195	2.196	2.137
% of variance	66.472	73.167	73.187	71.248
Con. alpha	0.832	0.817	0.816	0.796

Table 14. Reliability and validity test of the measurements (All groups, N =411)

Items	Eint	Att	SN	PBC
1	0.831	0.867	0.882	0.823
2	0.838	0.857	0.894	0.866
3	0.874	0.882	0.904	0.873
4	0.847	-	-	-
Total (Eigen values)	2.875	2.264	2.394	2.191
% of variance	71.868	75.463	79.811	73.018
Con. alpha	0.869	0.837	0.873	0.813

4.7.3.2. 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, as discussed in **section 4.5.** All the items were designed according to the definition of the constructs as well as the related findings of the existing literatures. Moreover, the measurements were reviewed by two scholars (an entrepreneurship professional and one academic in management research) and tested though 10 selected undergraduate engineering students who were exposed to the entrepreneurship course and 10 who were not. Their comments were collected, reviewed and used to verify the appropriateness and comprehensiveness of the questionnaire (this is detailed in **section 4.6.1**). Thus the measurements used in this study were considered to have content validity.

4.7.3.3. 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 & Cramer, 2005; Entrialgo et al., 2000) following the procedures of Flynn et al. (1994). Assumptions of the factor analysis of our data was fulfilled: (1) an examination of the correlation matrix indicated that a considerable number of correlations exceeded 0.3 and thus the matrix was suitable for factoring, (2) the Bartlett test of sphericity was significant and that the Kaiser-Meyerr-Olkin measure of sampling adequacy was far greater than 0.6, (3) measures

of sampling adequacy (MSA) values (inspection of the Anti-Image correlation matrix) were well above the acceptable level of 0.5. Thus data was suitable to precede factor analysis.

In **Table 12** (entrepreneurship group) the items for each of the 8 factors were converged into a unique factor with a high factorial weight (>0.5) explaining over 50% of variance (Tabachnick & Fidell, 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 et al., 2006). This was also true for the scales used for the control group in

Table 13 and when the two groups combined (in **Table 14**). Thus, the findings showed that the construct validity of the measurements used in this thesis was achieved.

In addition, the convergent validity and discriminant validity (subsets of construct validity) were further examined. Convergent validity assesses the degree to which to measures of the same concept are correlated, while discriminant validity is the degree to which two conceptually similar concepts are distinct (Hair et al., 2006). According to Hair et al. (2006) convergent validity exists when the items of a concept (or construct) are highly correlated with it. In the entrepreneurship group, as shown in **Table 15**, all the items were highly related to their corresponding scales, indicating that the scales were measuring their intended concepts. This was also true for the control group data, as shown in **Table 16**.

In order to test the discriminant validity, we first used the correlation method. Researchers generally use correlation among different constructs of 0.850 as a rule-of-thumb cutoff. In **Table 15 (upper part)**, the correlation coefficients among the 8 factors were although significant at a level of 0.001, all were well below 0.85 (the correlation among the variables will further presented in **section 5.1.2**).

Table 15. Correlations among the variables and measurement items (Entrepreneurship group, N=201)**

	Eint	**Att**	**SN**	**PBC**	**k_what**	**knwhy**	**k_who**	**k_how**
Eint	1	0.558	0.591	0.58	0.331	0.420	0.448	0.387
Att	0.558	1	0.582	0.425	0.226	0.339	0.305	0.356
SN	0.591	0.582	1	0.477	0.283	0.269	0.421	0.430
PBC	0.580	0.425	0.477	1	0.299	0.340	0.419	0.437
k_what	0.331	0.226	0.283	0.299	1	0.685	0.712	0.701
k_why	0.420	0.339	0.269	0.34	0.685	1	0.687	0.583
k_who	0.448	0.305	0.421	0.419	0.712	0.687	1	0.750
k_how	0.387	0.356	0.430	0.437	0.701	0.583	0.750	1
int1	**0.845**	0.389	0.471	0.496	0.349	0.415	0.402	0.351
int2	**0.861**	0.513	0.472	0.479	0.276	0.398	0.428	0.321
int3	**0.883**	0.510	0.605	0.524	0.228	0.347	0.374	0.333
int4	**0.854**	0.507	0.484	0.497	0.289	0.286	0.338	0.328
att1	0.520	**0.873**	0.513	0.387	0.159	0.258	0.224	0.244
att2	0.479	**0.846**	0.517	0.336	0.27	0.354	0.334	0.358
att3	0.449	**0.877**	0.483	0.38	0.161	0.271	0.237	0.324
sn1	0.501	0.446	**0.886**	0.388	0.198	0.155	0.325	0.372
sn2	0.482	0.530	**0.898**	0.393	0.326	0.244	0.421	0.404
sn3	0.603	0.586	**0.901**	0.498	0.234	0.321	0.384	0.379
pbc1	0.532	0.456	0.442	**0.792**	0.324	0.363	0.361	0.423
pbc2	0.450	0.307	0.391	**0.837**	0.153	0.2	0.332	0.279
pbc3	0.467	0.304	0.359	**0.861**	0.271	0.289	0.353	0.39
k_what1	0.321	0.131	0.208	0.237	**0.713**	0.616	0.604	0.534
k_what2	0.243	0.172	0.213	0.205	**0.828**	0.598	0.631	0.553
k_what3	0.217	0.212	0.228	0.214	**0.771**	0.384	0.443	0.501
k_what4	0.254	0.178	0.217	0.25	**0.833**	0.565	0.528	0.606
k_what5	0.289	0.205	0.258	0.284	**0.831**	0.567	0.631	0.596
k_why1	0.325	0.279	0.222	0.248	0.543	**0.846**	0.592	0.452
k_why2	0.35	0.272	0.213	0.253	0.558	**0.883**	0.595	0.481
k_why3	0.373	0.409	0.237	0.262	0.565	**0.833**	0.541	0.507
k_why4	0.36	0.272	0.253	0.328	0.561	**0.795**	0.551	0.495
k_why5	0.318	0.150	0.178	0.316	0.596	**0.747**	0.545	0.464
k_who1	0.344	0.213	0.325	0.33	0.627	0.587	**0.777**	0.65
k_who2	0.376	0.196	0.321	0.335	0.488	0.411	**0.761**	0.494
k_who3	0.362	0.201	0.238	0.319	0.61	0.623	**0.844**	0.619
k_who4	0.271	0.316	0.345	0.315	0.606	0.56	**0.842**	0.622
k_who5	0.393	0.302	0.368	0.323	0.581	0.595	**0.812**	0.628
k_who6	0.422	0.240	0.441	0.406	0.522	0.533	**0.787**	0.605
k_how1	0.351	0.288	0.404	0.319	0.659	0.482	0.654	**0.834**
k_how2	0.377	0.397	0.396	0.484	0.613	0.434	0.605	**0.845**
k_how3	0.266	0.287	0.341	0.358	0.464	0.458	0.609	**0.824**
k_how4	0.323	0.281	0.323	0.374	0.521	0.496	0.573	**0.840**
k_how5	0.293	0.227	0.326	0.284	0.664	0.558	0.684	**0.820**

**Correlations are significant at the 0.01 level (2-tailed).

Second, discriminant validity was also examined inspecting the correlation of the items with its corresponding construct and others. Discriminant validity exists when the items correlate more strongly with their belonging construct than other theoretically different constructs (Hair et al., 2006, p.137; Linan & Chen, 2009;

Messick, 1988). Again in **Table 15,** from the entrepreneurship group data, items of a construct had much lower correlations with other constructs, demonstrating that the 8 constructs were sufficiently different from one another. Therefore, the measurement scales used for the entrepreneurship group were reliable and valid and the data could be used for further analysis. Similarly, in **Table 16**, the scales used for the control group also achieved discriminant validity (the correlation among the variables will be further presented in **section 5.1.2**).

Third, we used a more restricted method to calculate the extent to which any two scales overlap by using Hunter and Schmidt's (1990) construct validity correction formula: r_{xy} /SQRT(a_{xx} * a_{yy}), where r_{xy} is correlation between x and y, a_{xx} is the reliability of x, and a_{yy} is the reliability of y (Campell & Fiske, 1959; John & Benet-Martinez, 2000). Again, in entrepreneurship group, the adjusted scores were all less than 0.85, as shown in **Table 17.** The results showed that discriminant validity exited between any pair of the factors. This was also true for control group data, as shown in **Table 18**. These provided further support for the discriminant validity of the measurements used for both the entrepreneurship group and control group.

Table 16. Correlations among the variables and measurement items (Control group, N=210)**

	Eint	**Att**	**SN**	**PBC**
Eint	1	0.524	0.592	0.581
Att	0.524	1	0.525	0.37
SN	0.592	0.525	1	0.391
PBC	0.581	0.37	0.391	1
int1	**0.791**	0.359	0.472	0.428
int2	**0.788**	0.442	0.496	0.438
int3	**0.851**	0.526	0.518	0.572
int4	**0.829**	0.379	0.445	0.45
att1	0.474	**0.838**	0.408	0.269
att2	0.371	**0.850**	0.424	0.341
att3	0.499	**0.877**	0.512	0.338
sn1	0.511	0.511	**0.838**	0.368
sn2	0.542	0.457	**0.851**	0.357
sn3	0.468	0.381	**0.876**	0.281
pbc1	0.569	0.346	0.457	**0.807**
pbc2	0.484	0.318	0.294	**0.868**
pbc3	0.423	0.276	0.248	**0.856**

**Correlations are significant at the 0.01 level (2-tailed).

Table 17. Corrected relationships among the factors (Entrepreneurship group)

	Eint	Att	SN	PBC	k_what	k_why	k_who
Att	0.651						
SN	0.672	0.682					
PBC	0.703	0.531	0.581				
k_what	0.382	0.269	0.328	0.369			
k_why	0.477	0.397	0.307	0.414	0.792		
k_who	0.505	0.355	0.477	0.506	0.818	0.777	
k_how	0.437	0.414	0.487	0.528	0.805	0.660	0.843

Table 18. Corrected relationships among the factors (Control group)

	Eint	Att	SN
Att	0.636		
SN	0.718	0.643	
PBC	0.714	0.459	0.485

4.7.4. Statistical remedies for common method variance

Apart from the procedural remedies mentioned in **section 4.2**, some statistical remedies were also used to control the common method variance or bias that might exist in the data of this study. These statistical remedies included Harman's single-factor test and partial correlation procedures designed to control the method variance.

Harman's single-factor test is one of the most widely used techniques for addressing the issue of common method variance (Andersson & Bateman, 1997; Aulakh & Gencturk, 2000; Carr & Sequeira, 2007). In this approach, all variables are put into an exploratory factor analysis and the unrotated factor solution is used to decide the number of factors needed to explain the variance of the variables. This approach presumes that "if a substantial amount of common method variance is present, either a single factor will emerge from the factor analysis or one general factor will account for the majority of the covariance among the measures" (Podsakoff et al., 2003).

Harman's single-factor test is appropriate to identify the degree to which common method variance may be a problem (Podsakoff et al., 2003). According to the authors, if only one factor emerges from the factor analysis and this factor explains all the variance, then common method variance is a significant problem. If multiple factors extracted, common method variance is not a major problem.

Following the procedures mentioned above, we tested common method variance of the survey study with Harman's single-factor test. All the items for the variables were entered into a factor analysis. The assumptions of the factor analysis were checked and fulfilled, for example, the correlations among the items were greater than 0.3 suggesting that the correlation matrix was suitable for factoring; the Bartlett test of sphericity was also achieved; measures of sampling adequacy (MSA) values (inspection of the Anti-Image correlation matrix) were greater than the cut-off value of 0.5. More information about the assumption of factor analysis was discussed in **section 4.7.3**. The unrotated factor solution showed that multiple factors emerged from the factor analysis. This indicated that no major method bias existed in the survey study.

Furthermore, based on the test results of Harman's single-factor test, we adopted partial correlation procedures to control common method biases. This technique has been commonly used to control the effects of method variance through partialling out a general factor score (Podsakoff et al., 2003). According to the author, an exploratory factor analysis is firstly conducted. The partial relationship between the independent and dependent variables is then calculated by partialling out the first unrotated factor, which is assumed to include the largest portion of common method variance (Podsakoff et al., 2003).

Although in this approach, the first unrotated factor may include the common method variance of the variables and some variance may be caused by the true causal relationships between the constructs, this approach is very useful when the specific source of the common method variance cannot be determined (Podsakoff et al., 2003). Also, it is relatively easy to use. Accordingly, this approach has been widely used (Bemmels, 1994; Dooley & Fryxell, 1999; Parkhe, 1993; Podsakoff & Todor, 1985). In this approach, the relationship between the independent variables and dependent variables will be changed when partialling out the general factor (e.g., smaller or larger because common method variance may inflate or deflate the relationships). The common method variance is not significant if the resulted relationships remain significant and the patterns of the coefficient values also remain. That is, the common method variance does not introduce significant effect on the data analysis results. If the resulted relationships are not significant from being significant originally, the common method variance is a problem.

The results of the partial correlation procedure are shown in **Table 19.** The results showed that the partial correlations among the variables were all significant at a level of 0.01. These were similar to the relationships without partialling out the general factor (as shown in **Table 15**), where all the relationships among the variables were significant at the level of 0.01. Moreover, the general pattern of the relationships was also similar. For example, the maximum value of the original correlation was between know-who and know-how (0.750), while the minimum correlation was between know-what and attitude toward entrepreneurship (0.226). The partial correlations also showed similar pattern: maximum value was 0.709 (know-who—know-how) and minimum value was 0.189 (know-what—attitude toward entrepreneurship). The control group data also showed similar results in the lower part of **Table 19**. Therefore, in our study, common method variance of the data was not significant. The consequent data analyses will provide accurate results.

Table 19. Partial correlations among the variables*

	Eint	Att	SN	PBC	k_what	k_why	k_who
Entrepreneurship group (n=201)							
Att	0.548**						
SN	0.604**	0.584**					
PBC	0.577**	0.418**	0.477**				
k_what	0.24**	0.189**	0.316**	0.293**			
k_why	0.448**	0.511**	0.549**	0.571**	0.559**		
k_who	0.388**	0.3**	0.548**	0.483**	0.567**	0.245**	
k_how	0.322**	0.336**	0.458**	0.437**	0.629**	0.545**	0.709**
Control group (n=210)							
Att	0.510**						
SN	0.560**	0.493**					
PBC	0.535**	0.328**	0.339**				

*Control variable: FAC1_1; ** $p<0.01$

4.7.5. Descriptive analysis, ANOVA and T-test

In this thesis, the demographic data of the students (the entrepreneurship group and the control group) were presented to describe profiles of the participants. Further, the descriptive data such as mean, standard deviation of the variables for both groups of student were also presented. Pearson correlations analysis was used to

examine the inter-relationship among the 8 factors (attitude, subjective norm, perceived behavioral control, intention, and know-what/-why/-who/-how).

ANOVA and t-test were used for the comparison study between the entrepreneurship group and control group student. T-test was used to analyze the differences between the two groups regarding their attitude toward entrepreneurship, subjective norm, perceived behavioral control and entrepreneurial intention. Further, t-test together with ANOVA was also used to test the effect of demographic factors on entrepreneurial attitudes and intentions across the two groups. T-test was used when those factors consist of only two subcategories, such as gender and role model (either have entrepreneur parents/close friends or not). ANOVA was used to test the effect of factors consisting of more than 2 subcategories, such as age, year of study and work experience.

There are three ways to calculate t-values depending on whether the sample sizes of two subcategories are equal.

(1) Equal sample sizes, equal variance: In this case, it can be assumed that the two distributions have the same variance. The following formula is used for calculation:

$t = \frac{\bar{X}_1 - \bar{X}_2}{S_{X_1X_2} \cdot \sqrt{\frac{2}{n}}}$, where $S_{X_1X_2} = \sqrt{\frac{S_{X_1}^2 + S_{X_2}^2}{2}}$, degree of freedom(d.f.)=2n-2, n is sample size.

(2) Unequal sample sizes, equal variance:

$t = \frac{\bar{X}_1 - \bar{X}_2}{S_{X_1X_2} \cdot \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$, where $S_{X_1X_2} = \sqrt{\frac{(n_1-1)S_{X_1}^2 + (n_2-1)S_{X_2}^2}{n_1+n_2-2}}$,

d.f.= $n_1 + n_2 - 2$.

(3) Unequal sample sizes, unequal variance:

$t = \frac{\overline{X}_1 - \overline{X}_2}{s_{\overline{X}_1 - \overline{X}_2}}$, where $s_{\overline{X}_1 - \overline{X}_2} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$,

$\text{d.f.} = \frac{(s_1^2/n_1 + s_2^2/n_2)^2}{(s_1^2/n_1)^2/(n_1-1) + (s_2^2/n_2)^2/(n_2-1)}$.

Levene's Test is conducted for testing the equality of variances. In our thesis, the unequal sizes of any two subcategories, for example, in the entrepreneurship group (n=201), female students (60) and male students (141), and those had entrepreneur parents/friends (90) and those had not (109); in the control group

(n=210), females were 48 and males were 162. Therefore, the case 2 and 3 were adopted when using t-test. The characteristics of the participants will be detailed in **section 5.1.1**.

In ANOVA, as with t-test, the homogeneity of variance was also tested using Levene's test. All the above analyses were conducted using SPSS15.0. The test results will be presented in **Chapter 5**.

4.7.6. Structural equation modeling (SEM)

To be able to test the inter-relationships among independent and dependent variables, this study employs SEM path analysis, using AMOS 18.0 (Analysis of Moment Structures), which is a popular package of structural equation modeling because of its user-friendly graphical interface (Kline, 1998).

Path analysis is subset of SEM, which is a multivariate procedure that examines multi-relationships between one or more independent variables, and one or more dependent variables (Ullman, 1996). This technique was developed based on a linear equation system and started to be used in social science research in the 1960s. Nowadays, SEM path analysis is widely used in various research areas, such as marketing, economics, finance, business management, quality management, and entrepreneurship.

The use of the SEM path analysis is pertinent in this study because it can estimate simultaneously a series of multiple regressions equations derived from our research model for modeling the students' entrepreneurial intentions. In multiple regression analysis all independent variables are assumed to affect the dependent variable directly. On the other hand, path analysis can test models with multiple dependents, and to model mediating variables (Anderson & Gerbing, 1988). Thus, indirect relationships can be easily calculated in the modeling process. In the path model, relationship between any two variables is indicated by a coefficient which is computed by controlling for all other relationships. Another advantage of SEM path analysis is that this technique examines the goodness of fit for different nested models, indicating if the proposed model is good or not (Kline, 1998).

In SEM path analysis, the overall model is considered by estimating all hypothesized relationships among the variables (Kline, 1998). Endogenous variables

of the model can be considered as both independent and dependent variables and thus, both direct and indirect effects can be determined at the same time. An indirect effect is the influence of an independent variable on a dependent variable through one or more mediating variables (Hoyle, 1995). By applying the path analysis technique, this study sought to develop a model to explain the extent to which entrepreneurship education has an impact on the students' attitudes and intention toward entrepreneurship. The formulation of the model was intended to predict the students' intentions from four education contents: know-why, know-what, know-who, and know-how.

There are several steps involved in path analysis (Kline, 1998): (1) model specification, (2) model identification, (3) model estimation, (4) model modification, (5) reporting the results. In the first step, model specification, we began the process by drawing a path model based on our education-entrepreneurial intention model. The model included exogenous variable (know-what) and 7 endogenous variables (know-why/who/how, attitude, subjective norm, perceived behavioral control and entrepreneurial intention). The model can also be represented by a set of equations defining the hypothesized relationship among the 8 variables. This step is crucial as it is the basis for latter steps.

The second step is identification. A model is identified (i.e., just-identified and over-identified) when it is possible to estimate every model parameter. That is, the model degree of freedom is equal or greater than zero. Otherwise, the model is not identified (under-identified). If the model is not identified, it should go back to step 1 to re-specify the model until it becomes identified. In our path model, the degree of freedom was greater than 0 (df =15), and thus, it fitted the identification requirement and could move forward to next step.

The third step is estimation, where modeling computation occurs. In our study, raw data was used for the analysis. Maximum likelihood estimation (MLE) was used to perform the modeling process. The purpose of the estimation process is to determine a fitting function that fits the data. In this case, the value of the fitting function should be close to 0. Multiple indices (Hair et al., 1998; Kline, 2005), as shown in **Table 20**, were used to examine the model fit. Indices under different categories of model fit measure (absolute fit measures, incremental fit measures, and parsimonious fit measures) were used in order to have more accurate results.

Table 20. Goodness-of-fit measures

Goodness-of-fit measures	Description	Criteria
Absolute fit measures	A direct measure of how well the model fits the sample data; tests if the model fit is perfect in the population by comparing observed versus expected variances and co-variances; does not depend on a comparison with other models (e.g., saturated or independent models) (Jaccard & Wan, 1996)	--
Chi-square statistic (x^2)	Detects the degree of fit between the causal model and the data set (Joreskog, 1993); it is sensitive to sample size and this assumption holds may not mean that the model fits the data, thus need to consider other indices (Bollen & Long, 1993, p. 6)	p>0.05, i.e. not significant;
Goodness-of-fit index (GFI)	Reduces the problem of dependence on sample size; measures how much better the model fits compared with no model at all (Olobatuyi, 2006); GFI is analogous to a squared multiple correlation (R^2), estimating the proportion of variability in the sample covariance matrix explained by the model	1.0 : perfect model fit; >0.90: optimal model fit
Root mean square error of approximation (RMSEA)	Detects discrepancy between the observed and the expected correlation across all parameter estimates (Steiger & Lind, 1980)	<0.05: good fit; 0.05~0.08: reasonable fit; 0.08~0.1: mediocre fit
Incremental fit measures	Comparing the hypothesized model to a null/independent model (which assumes the variables in the model are uncorrelated)	--
Adjusted goodness-of-fit index (AGFI)	Takes into account differing degrees of model complexity by adjusting GFI by a ratio of the degree of freedom. It penalizes more complex models (Hair et al., 2006); it is affected by sample size and model complexity	>0.90: good fit >0.80: adequate fit
Tucker-Lewis index (TLI)	Compares a default model and a null model. It is not normed and thus its values can fall below 0 or above 1 (Hair et al., 2006)	>0.90: good fit
Normed fit index (NFI)	Sensitive to sample size; it evaluates the estimated model by comparing the chi-square value of the model to that of the null model (Hair et al., 2006)	>0.90: good fit
Parsimonious fit measures	Adjusting the measures of fit to compare models with differing number of parameters to determine the impact of adding additional parameters to the model. It provides useful information in evaluating competing models, but it should not be relied upon alone	--
Comparative fit index (CFI)	Assesses fit of default model relative to the null model; it is sensitive to model complexity	>0.90: good fit
Normed chi-square (x^2/df)	Normalization of chi-square value by dividing the chi-square value by degree of freedom (Schumacker & Lomax, 2004)	<2: good fit; <3: adequate fit; >5: need to improve

The fourth step is re-specification. When poor model fit is obtained, researchers need to modify the model based on possible changes according to relevant theoretical support (returning to the first step). The re-specification or changes of the model should be primarily guided by theories rather than pure statistical considerations. The model being re-specified must be identified. In this thesis, the

path model (i.e., the education-entrepreneurial intention model) had attained acceptable goodness of fit. Hence, we directly moved to the last step to report estimation results.

In the last step, the accepted model and results are presented. The path coefficients, direct and indirect effects and goodness-of-fit measures (mentioned in **Table 20**) were all reported. The whole set of SEM path analysis results will be illustrated in **section 5.3**.

4.8. Chapter Summary

This chapter discusses the methodological procedures used for conducting this study in order to solve the RQ2, RQ3 & RQ4. RQ1 was solved by literature review in **Chapter 2**. This chapter firstly describes the research design of this study. A quantitative research design was adopted and a survey was conducted to collect data.

Next, it discusses the possible errors of the survey approach such as bias/errors related to samples and measurement and offers procedures to reduce survey errors, including both procedural remedies and statistical remedies (e.g., reliability and validity tests and Harman's single-factor test and partial correlation procedures.

Further the characteristics of the participants are presented. There were 594 engineering students from three universities in Hong Kong involved in the study (entrepreneurship group: 294; control group: 300). The entrepreneurship course was respectively offered in the engineering departments of the three universities. The course was about awareness education of entrepreneurship conveying entrepreneurial knowledge to the engineering students and introducing entrepreneurship as a possible and alternative choice of career for them. The aim of the course was to improve the entrepreneurial attitudes and intention of students, rather than pursuing the number of business created by the students.

On top of these, this chapter also describes the development of questionnaire used for the survey. The questionnaire was developed based on the conceptual model and it included 8 variables: entrepreneurial intention, attitude toward entrepreneurship, subjective norm, perceived behavioral control, know-what, know-why, know-who

and know-how. The measures of the eight variables were developed based on relevant literatures on entrepreneurship and education. All of the variables were measured by multiple items.

Having developed the questionnaires, procedures used to collect data was discussed. Before data collection, a pilot study was conducted in order to improve the questionnaire in terms of content, simplicity, clarity, comprehensiveness and layout. The questionnaires were self-administered to the participants in class or through email. A total of 411 completed questionnaires were collected with a general response rate of 69.19%. Among the data, 201 were from entrepreneurship group and 210 from control group.

Finally, a set of statistical methods are used for data analysis. First of all, the data collected were screened to check if the missing data significant or not or if the data was randomly distributed. Then, data from different sources (e.g., senior students and “current students”; different universities) were verified for statistical homogeneity and the control group students were tested if they had homogeneous demographical backgrounds as the entrepreneurship students. Next, the reliability and validity of the measurements used in the survey were checked before using the statistical remedies for common method variance (Harman’s single-factor test and partial correlation procedures). In addition, the descriptive information (e.g., means and standard deviation) of the variables of the conceptual model was calculated before ANOVA and T-test which were used for the comparison between the entrepreneurship group and control students. Lastly, the hypotheses of the conceptual model were tested by SEM path analysis.

Chapter 5: Results

This chapter presents the results of this research. Three major sections are included in this chapter. Section one reports the description of data, including the profiles of participants (both entrepreneurship group and control group) and descriptive information of the variables of the education-entrepreneurial model. The descriptive information of the two groups included means and standard deviation of the variables. For the entrepreneurship group, all eight variables (four entrepreneurial or TPB variables: entrepreneurial intention, attitude toward entrepreneurship, subjective norm, and perceived behavioral control; and four education components: know-what, know-why, know-who, and know-how) of the conceptual model are reported, while for the control group, only the first four variables are reported since the four education components reflecting the leaning of an entrepreneurship course are not applicable in the control case.

Section two provides the comparison results between the entrepreneurship group and control group regarding their entrepreneurial attitudes and intentions and the effect of demographic factors on these entrepreneurial variables. Accordingly the comparison results include two parts. The *first* part was performed by t-test, with a purpose to seek differences between those who took the entrepreneurship course and those who did not, in order to affirm the effectiveness of the entrepreneurship course on improving the entrepreneurial attitudes and intentions of students (i.e., the second objective of this thesis). The *second* part was performed both by t-test and ANOVA. In this part, we go deeper to study the specific effect of demographic factors on the entrepreneurial attitudes and intentions of the two groups. Five demographic factors are reported in this part including age, gender, year of study, work experience, and role model. This part will provide additional information on the effectiveness of the entrepreneurship course and offer insights into developing teaching guidelines for the subject.

Section three reports the results of the hypothesis tests. The purpose of this section is to study the influence of the entrepreneurship education components on students' entrepreneurial intention, attitude toward entrepreneurship, subjective norm and perceived behavioral control (i.e., the third objective of this thesis). Thus, the

SEM path analysis results of the conceptual model are reported in this section. The results are important for designing an effective entrepreneurship course/program to nurture entrepreneurial attitudes and intention of students (i.e., the fourth objective of this thesis). The following paragraphs present the results in detail.

5.1. Description of Data

5.1.1. Participant profiles

The characteristics of the participants are summarized in **Table 21**. Among the 411 respondents, over 70% of them were male students, while less than 30% were females. The average age of all the respondents was 22 years old, and most of them (> 60%) had less than 1 year of work experience. These figures roughly correspond to the general characteristics of engineering students in universities (University Grant Committee Report, 2003/04-2009/10). Thus, the samples can be considered representative.

When looking at the two groups of participants separately, it can be seen that the two groups had comparable characteristics. For example, most (more than 70%) of both the two groups were males. The average ages of the two groups were also similar with a value of 22.23 (entrepreneurship group) and 22.01 (control group) respectively. Both groups had nearly 97% of students in second and third year of study. Further, more than 60% of the two groups had less than 1 year of work experience. In addition, around 45% of all respondents had friends or parents who had entrepreneurial experience, while about 55% of the respondents did not.

Table 21. The characteristics of the participants

Characteristic		Entrepreneurship Group		Control group		All Participants	
		(n)	(%)	(n)	(%)	(n)	(%)
Gender	Female	60	29.85	48	22.86	108	26.28
	Male	141	70.15	162	77.14	303	73.72
Age	<20	2	1.00	9	4.33	11	2.70
	20-22	122	61.00	129	62.00	251	61.52
	23-25	57	28.50	60	28.80	117	28.68
	>25	19	9.50	10	4.81	29	7.11
	Mean	**22.23**		**22.01**		**22.12**	
Year of study	year2	113	56.22	114	54.29	227	55.23
	year3	82	40.80	88	41.90	170	41.36
	other	6	2.99	8	3.81	14	3.41
Work experience	<1 year	127	63.82	129	61.43	256	62.59
	1-<2 years	41	20.60	57	27.14	98	23.96
	2-<3 years	19	9.55	17	8.10	36	8.80
	>=3 years	12	6.03	7	3.33	19	4.65
Role model	No	109	54.77	116	55.77	225	55.28
	Yes	90	45.23	92	44.23	182	44.72

5.1.2. Descriptive of the variables and simple correlations

The mean and standard deviation of the variables for both the entrepreneurship group and control group are reported in **Table 22**. In the entrepreneurship group, the average values of the 8 variables of the conceptual model were reported: entrepreneurial intention, attitude toward entrepreneurship, subjective norm, perceived behavioral control, know-what, know-why, know-who, and know-how. The average values of the variables were all over 4, the neutral point, indicating that entrepreneurship group students had favorable perceptions about the entrepreneurial attitudes, intention and learning.

On the other hand, in the control group, only the four entrepreneurial variables (entrepreneurial intention, attitude toward entrepreneurship, subjective norm, and perceived behavioral control) were reported, because the four education components were not applicable to the control group students. As shown in the table, the average scores of the entrepreneurial attitudes and intentions of the control group were less than 4. These scores were much lower than those of entrepreneurship group. This

might indicate that the engineering students who were not exposed to the entrepreneurship course had less favorable perceptions about entrepreneurship.

Table 22. Descriptive statistics of the variables

Variables	Entrep. group (N=201)		Control group (N=210)	
	Mean	**SD**	**Mean**	**SD**
Eint	4.378	1.21	3.798	1.184
Att	4.368	1.262	3.791	1.111
SN	4.214	1.278	3.272	1.167
PBC	4.689	1.164	3.941	1.045
k_what	4.845	1.157		
k_why	4.886	1.155		
k_who	4.688	1.119		
k_how	4.593	1.185		

Eint: entrepreneurial intention; Att: attitude toward entrepreneurship, SN: subjective norm ; PBC : perceived behavioral control ; k_what: know-what; k_why: know-why; k_who: know-who; k_how: know-how.

The simple correlations among the variables of the two groups are provided in **Table 23** and **Table 24**. The correlations among the 8 variables of the *entrepreneurship group* are shown in **Table 23** and the correlation among the 4 TPB variables of *control group* are presented in **Table 24**. As predicted by TPB, entrepreneurial intention was found to have a statistically significant correlation with attitude, subjective norm, and perceived behavioral control (in both groups). Further, these three antecedent attitudes were significantly correlated to entrepreneurial learning components (know-what, know-why, know-who and know-how). That is, all the variables were significantly correlated, suggesting that subsequent analyses could be used to examine the hypothesized relationships among these variables.

Table 23. Correlation among the variables (Entrepreneurship group, N=201)**

	Eint	**Att**	**SN**	**PBC**	**k_what**	**k_why**	**k_who**	**k_how**
Eint	1	0.558	0.591	0.58	0.331	0.420	0.448	0.387
Att	0.558	1	0.582	0.425	0.226	0.339	0.305	0.356
SN	0.591	0.582	1	0.477	0.283	0.269	0.421	0.430
PBC	0.580	0.425	0.477	1	0.299	0.340	0.419	0.437
k_what	0.331	0.226	0.283	0.299	1	0.685	0.712	0.701
k_why	0.420	0.339	0.269	0.34	0.685	1	0.687	0.583
k_who	0.448	0.305	0.421	0.419	0.712	0.687	1	0.750
k_how	0.387	0.356	0.430	0.437	0.701	0.583	0.750	1

**Correlations are significant at the 0.01 level (2-tailed).

Table 24. Correlation among the variables (Control group, N=210)**

	Eint	Att	SN	PBC
Eint	1	0.524	0.592	0.581
Att	0.524	1	0.525	0.37
SN	0.592	0.525	1	0.391
PBC	0.581	0.37	0.391	1

**Correlations are significant at the 0.01 level (2-tailed).

5.2. Comparison of the Two Groups

Comparison of the entrepreneurship group and control group includes two parts. The first part is about the differences between the two groups of students regarding their attitude toward entrepreneurship, subjective norm, perceived behavioral control and entrepreneurial intention. In the second part, we go deeper to compare the effect of demographic factors (age, year of study, work experience, gender and role model) on the aforementioned four TPB variables. The details are provided in the following sections.

5.2.1. Comparison on entrepreneurial attitudes and intention

The t-test results, as shown in **Table 25**, provided further support for the differences between the entrepreneurship and control group in terms of the four TPB variables. The results indicated significant differences between the two groups at a level of 0.001. Therefore, the engineering students who had completed the entrepreneurship course were more entrepreneurship oriented in terms of their attitude toward entrepreneurship, subjective norm, perceived behavioral control and entrepreneurial intention than those who were not exposed to the entrepreneurship course.

This is the first step to demonstrate that entrepreneurship education enhances the entrepreneurial attitudes and intentions of students. Next, we will test the effect of demographic factors and further analyze how the education components work to influence those entrepreneurial variables.

Table 25. Comparison between entrepreneurship group and control group

Variables	Entrep. group	Control group	Equality of Variances		T-test for Equality of Means		
	Mean	Mean	F	Sig.	t	df	Sig.(2-tailed)
Eint	4.378	3.798	2.837	0.093	5.857	409	**0.000**
Att	4.368	3.791	4.499	0.035	5.692	396.47	**0.000**
SN	4.214	3.272	5.459	0.02	8.863	396.22	**0.000**
PBC	4.689	3.941	1.314	0.252	8.22	409	**0.000**

5.2.2. Effect of demographic factors

The influences of demographic factors on the entrepreneurial attitudes and intentions of the two groups were compared. Five demographic factors were involved: age, year of study, work experience, gender and role model. As mentioned, t-test and ANOVA were used to test the effect of the demographic factors. ANOVA was used to test the factors consist of more than two categories, such as age, year of study, and work experience. T-test was used to test the effect of factors that consist only two different categories, such as gender and role model (yes/no). In ANOVA, the test of homogeneity of variances (Levene's test) of different groups was performed and the results showed that the assumption of homogeneity of variances of different groups was achieved (this assumption was not rejected at a level of 0.05). Thus, the data could be used for ANOVA. The details of this assumption test for each demographic factor are shown in **Table 26** and **Table 27**. In t-test, t-value was also calculated based on the Levene's test results.

Table 26. Test of homogeneity of variance in ANOVA (Entrepreneurship group, N=201)

Age:				
	Levene Statistic	df1	df2	Sig.
Eint	0.967	3	196	0.409
Att	1.502	3	196	0.215
SN	1.34	3	196	0.263
PBC	0.662	3	196	0.577
k_what	0.795	3	196	0.498
k_why	1.357	3	196	0.257
k_who	0.594	3	196	0.620
k_how	1.769	3	196	0.154
Year of study:				
	Levene Statistic	df1	df2	Sig.
Eint	1.436	2	198	0.240
Att	2.108	2	198	0.124
SN	0.495	2	198	0.610
PBC	0.814	2	198	0.444
k_what	0.796	2	198	0.453
k_why	0.444	2	198	0.642
k_who	0.971	2	198	0.380
k_how	1.122	2	198	0.328
Work experience:				
	Levene Statistic	df1	df2	Sig.
Eint	0.747	3	195	0.525
Att	0.825	3	195	0.481
SN	1.795	3	195	0.149
PBC	0.646	3	195	0.586
k_what	1.016	3	195	0.387
k_why	0.377	3	195	0.770
k_who	0.187	3	195	0.905
k_how	0.709	3	195	0.547

Table 27. Test of homogeneity of variances in ANOVA (Control group, N=210)

Age:				
	Levene Statistic	df1	df2	Sig.
Eint	0.468	3	204	0.705
Att	0.86	3	204	0.463
SN	1.055	3	204	0.369
PBC	0.726	3	204	0.537
Year of study:				
	Levene Statistic	df1	df2	Sig.
Eint	1.923	2	207	0.149
Att	1.599	2	207	0.204
SN	0.621	2	207	0.538
PBC	1.060	2	207	0.348
Work experience:				
	Levene Statistic	df1	df2	Sig.
Eint	0.839	3	206	0.474
Att	1.222	3	206	0.303
SN	1.457	3	206	0.227
PBC	0.576	3	206	0.631

The test results of the demographic factors are shown in **Table 28** to **Table 32**. **Table 28** shows the effect of age, year of study and work experience, which were performed by ANOVA test. From the results of entrepreneurship group, no significant impact of age, year of study and work experience on the entrepreneurial attitudes and intentions was found. Similar results were obtained from the control group students that these three demographic factors did not significantly affect the students' attitudes or intention toward entrepreneurship. The findings on the three demographic factors indicated that whether the students were exposed to the entrepreneurship course, their age, year of study or work experience did not significantly affect their perception about entrepreneurship.

Table 29 and **Table 30** show the effect of gender on the entrepreneurial variables. It can be seen from **Table 29**, the mean scores on the four entrepreneurial variables of entrepreneurship group (ranging from 3.933 to 4.718) are significantly greater than those of control group (ranging from 3.000 to 4.018). The results indicated that, regardless of their gender, the students who were exposed to the entrepreneurship course had significantly more positive perceptions about entrepreneurship than those who were not. That is, male students who were exposed to the entrepreneurship course had higher level of attitude, subjective, perceived behavioral control and intention to start up than those males who were not exposed to the course. Same results were also obtained for the female students. The findings may imply that through the entrepreneurship course, both boys and girls can significantly improve their attitudes and intentions toward entrepreneurship.

Table 28. Effect of age, year of study, and work experience (ANOVA)

	Entrep. (N=201)						**Control (N=210)**					
	Age		**Work exp.**		**Year of study**		**Age**		**Work exp.**		**Year of study**	
	F	**Sig.**	**F**	**Sig.**	**F**	**Sig.**	**F**	**Sig.**	**F**	**Sig.**	**F**	**Sig.**
Att	1.15	0.33	0.79	0.5	0.97	0.38	0.25	0.86	0.54	0.66	0.51	0.6
SN	0.68	0.57	0.45	0.72	1.67	0.19	1.3	0.28	0.98	0.41	0.82	0.44
PBC	0.16	0.92	1.2	0.31	2.3	0.1	1.2	0.31	1.41	0.24	1.41	0.25
Eint	0.78	0.51	1.73	0.16	2.09	0.13	1.43	0.23	1.58	0.2	0.28	0.76
k_what	1.82	0.15	2.08	0.11	0.01	0.99						
k_why	0.9	0.45	1.24	0.3	1.06	0.35						
k_who	0.66	0.58	1.05	0.37	0.1	0.91						
k_how	0.88	0.45	0.24	0.87	0.4	0.67						

Table 29. Effect of gender (Comparing females/males *between* Entrep. and Control group)

	Gender	Entrep. (N=201) mean	Control (N=210) mean	(between-group) Sig.
Att	Female	4.194	3.632	**0.007**
	Male	4.442	3.838	**0.000**
SN	Female	3.933	3.000	**0.000**
	Male	4.333	3.353	**0.000**
PBC	Female	4.622	3.681	**0.000**
	Male	4.718	4.018	**0.000**
Eint	Female	4.121	3.578	**0.018**
	Male	4.488	3.863	**0.000**

Table 30. Effect of gender (Comparing females/males *within* Entrep. or Control group)

		Entrep. (N=201)		Control (n=210)	
	Gender	**Mean**	**Sig.**	**Mean**	**Sig.**
Att	Female	4.194	0.146	3.632	0.189
	Male	4.442		3.838	
SN	Female	3.933	**0.036**	3.000	**0.031**
	Male	4.333		3.353	
PBC	Female	4.622	0.527	3.681	**0.021**
	Male	4.718		4.018	
Eint	Female	4.121	**0.034**	3.578	0.127
	Male	4.488		3.863	

We looked deeper into the differences between female and males students, as shown in **Table 30**. Gender had no significant effect on **attitude toward entrepreneurship** regardless of the intervention of the entrepreneurship course (i.e., insignificant in both the entrepreneurship group and control group). However, this factor had significant effect on subjective norm in both groups. This may show that **subjective norm** of male and female students are significantly different, that male students have higher subjective norm than the female students regardless of their entrepreneurship education background. In addition, gender appeared as a significant factor influencing **perceived behavior control** in control group while insignificant in entrepreneurship group. This indicates that the entrepreneurship course successfully reduced the difference between male and females students in their perceived control over an entrepreneurial behavior. The female entrepreneurship students felt as

capable as the males. However, the final entrepreneurial intention of female entrepreneurship students was significantly lower than that of males.

Similar results were also obtained when examining the factor of **role model** (i.e., entrepreneur parents and friends), as shown in **Table 31** and **Table 32**. While comparing the effect of role model between the entrepreneurship group and control group, significant results were obtained. As can be seen in **Table 31**, the average values of entrepreneurship group were between 4.037 and 4.781, which were significantly higher than the values for the control group between 3.130 and 4.086. The results indicated that, regardless of if they had entrepreneurship role models, the students who were exposed to the entrepreneurship course had significantly more positive perceptions about entrepreneurship than those who were not. This may imply that through the entrepreneurship course, both those who had role models and those who did not significantly improved their antecedent attitudes and intentions toward entrepreneurship.

The differences between those who had role model and those did not have *within* the entrepreneurship group and control group are shown in **Table 32**. Role model had a significant impact on **attitude toward entrepreneurship** in entrepreneurship group, but was not significant in the control group. This suggests that through the entrepreneurial learning, the students who had entrepreneurship role models became more desired to create own businesses, indicating the importance of "entrepreneurial role models" in entrepreneurship education. On the other hand, regardless of whether the students were exposed to entrepreneurship education, those who had entrepreneurship role models perceived greater pressure to perform entrepreneurial behaviors (i.e., **subjective norm**). Moreover, the effect of role model on **perceived behavioral control** was significant in control group but not significant in the entrepreneurship group. This indicates that the entrepreneurship course reduced the differences between those who had role models and those who had not in terms of their perceived control over entrepreneurial behaviors.

Lastly, the role model significantly influenced **entrepreneurial intention** of both entrepreneurship students ($p<0.05$) and control group students ($p<0.1$). This factor was more significant for entrepreneurship students, probably because that through the entrepreneurial learning, the role model group students explored more positive attitude toward entrepreneurship.

Table 31. Effect of role model (Comparison *between* Entrep. and Control group)

	Role model	Entrep. (N=201) mean	Control (N=210) mean	(between-group) Sig.
Att	No	4.232	3.762	**0.002**
	Yes	4.533	3.826	**0.000**
SN	No	4.037	3.130	**0.000**
	Yes	4.422	3.442	**0.000**
PBC	No	4.599	3.822	**0.000**
	Yes	4.781	4.086	**0.000**
Eint	No	4.213	3.684	**0.000**
	Yes	4.581	3.932	**0.000**

Table 32. Effect of role model (Comparing females/males *within* each group)

	Role model	Entrep. (N=201)		Control (n=210)	
		Mean	Sig.	Mean	Sig.
Att	No	4.232	**0.046**	3.762	0.632
	Yes	4.533		3.826	
SN	No	4.037	**0.016**	3.130	**0.025**
	Yes	4.422		3.442	
PBC	No	4.599	0.160	3.822	**0.038**
	Yes	4.781		4.086	
Eint	No	4.213	**0.012**	3.684	**0.065**
	Yes	4.581		3.932	

In short, the engineering students who were exposed to the entrepreneurship course had significantly more favorable perception than those who were not. This may imply that the entrepreneurship course significantly improved the entrepreneurial attitudes and intentions of the students. Some demographic factors, such as, age, year of study, and work experience were not significant to the entrepreneurial perceptions, while gender and role model had certain significant effect on these perceptions. The results will provide important implications for developing teaching strategies for entrepreneurship. The detailed explanation of the effect of demographic factors will be discussed in **Chapter 6**.

5.3. Model Testing

The TPB model is employed as the theoretical basis of this study. Before testing our conceptual model, we have to test if the TPB model is appropriate in the context of this study. By doing so, we tested the TPB model for both the

entrepreneurship group and control group. So this section includes two parts. The first part illustrates the test results of the TPB model (multigroup test) and the second part presents the test results of the education-entrepreneurial intention model.

5.3.1. Testing the TPB model for both groups

The TPB model was tested using SEM path analysis with AMOS 18.0. In the path model, subjective norm was defined as an exogenous variable and attitude toward entrepreneurship, perceived behavioral control and entrepreneurial intention were endogenous variables. Raw data (both groups) were input to the structural equations.

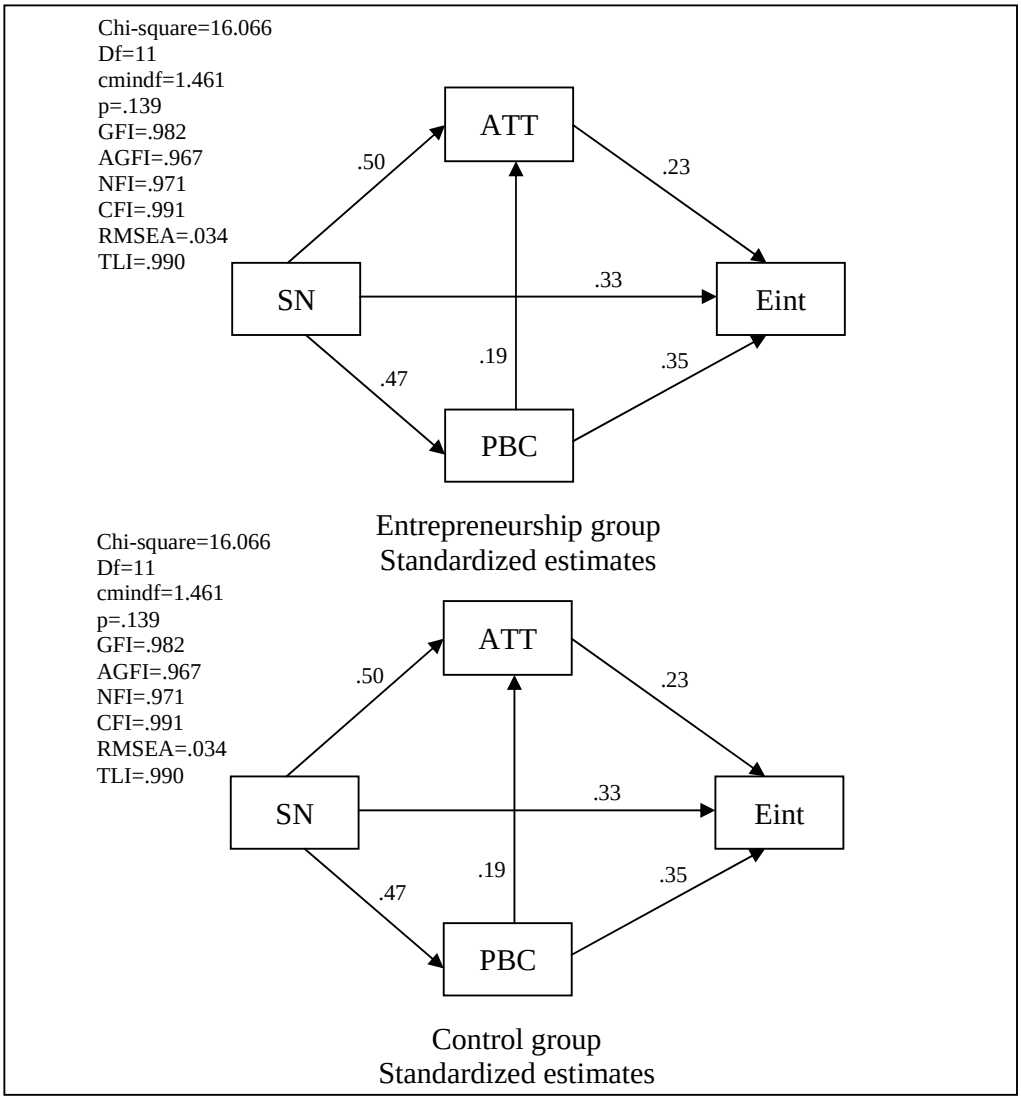

Figure 13. Testing the TPB model for the two groups

According to the results, as shown in **Figure 13**, the multigroup model testing for configural invariance revealed that chi-square value was 16.066, which was not significant (p>0.1). Other indices suggested good model fit: GFI=0.982, NFI=0.971, CFI=0.991, TLI=0.990. AGFI (0.967) indicated adequate fit and RMSEA (0.034) indicated mediocre fit. From this information, we can conclude that the hypothesized multigroup model of TPB was fitting both the entrepreneurship group and the control group. Next, we will consider if the structure of the TPB model differs from one group to the other.

Having established goodness-of-fit for the unconstrained model, we further proceeded to test for *the invariance of structure* across the two groups. **Table 33** shows the comparison of the unconstrained model and two constrained models: structural *weights* and structural *residuals* models, where the structural weights and residuals are set to be equal across two groups (Byrne, 2010). The results indicated that even the parameters of the model were constrained, the three models had no significant difference (delta chi-square = 2.209 with 6 degrees of freedom, p>0.05; delta chi-square = 6.059 with 9 degrees of freedom, p>0.05) (Byrne, 2010). Further, when the structural *weights* model was assumed to be correct, the structural *residuals* model was also not significantly different (delta chi-square = 3.85 with 3 degrees of freedom), providing further evidence that the three models were homogeneous. Thus, the TPB model under study was **invariant** across the two groups. That is, the TPB model is robust and valid across different groups of students. Therefore, it is appropriate to use TPB to study the entrepreneurial intention of the engineering students regardless of whether or not they have been exposed to entrepreneurial education.

Table 33. Comparing the unconstrained and constrained models

Model	DF	CMIN	P	NFI Delta-1	IFI Delta-2	RFI rho-1	TLI rho2
Assuming model Unconstrained to be correct							
Structural weights	6	2.209	0.899	0.004	0.004	-0.076	-0.077
Structural residuals	9	6.059	0.734	0.011	0.011	-0.077	-0.079
Assuming model Structural weights to be correct							
Structural residuals	3	3.85	0.278	0.007	0.007	-0.001	-0.001

5.3.2. Testing the education-entrepreneurial intention model

In the path model, know-what was defined as exogenous variable. Know-why, know-who, and know-how, attitude, subjective norm, perceived behavioral control and entrepreneurial intention were defined as endogenous variables in the model. The purpose of the model was to study the specific influence of the education components on the antecedent attitudes and intention toward entrepreneurship. The test results are shown in **Figure 14** and **Table 34**.

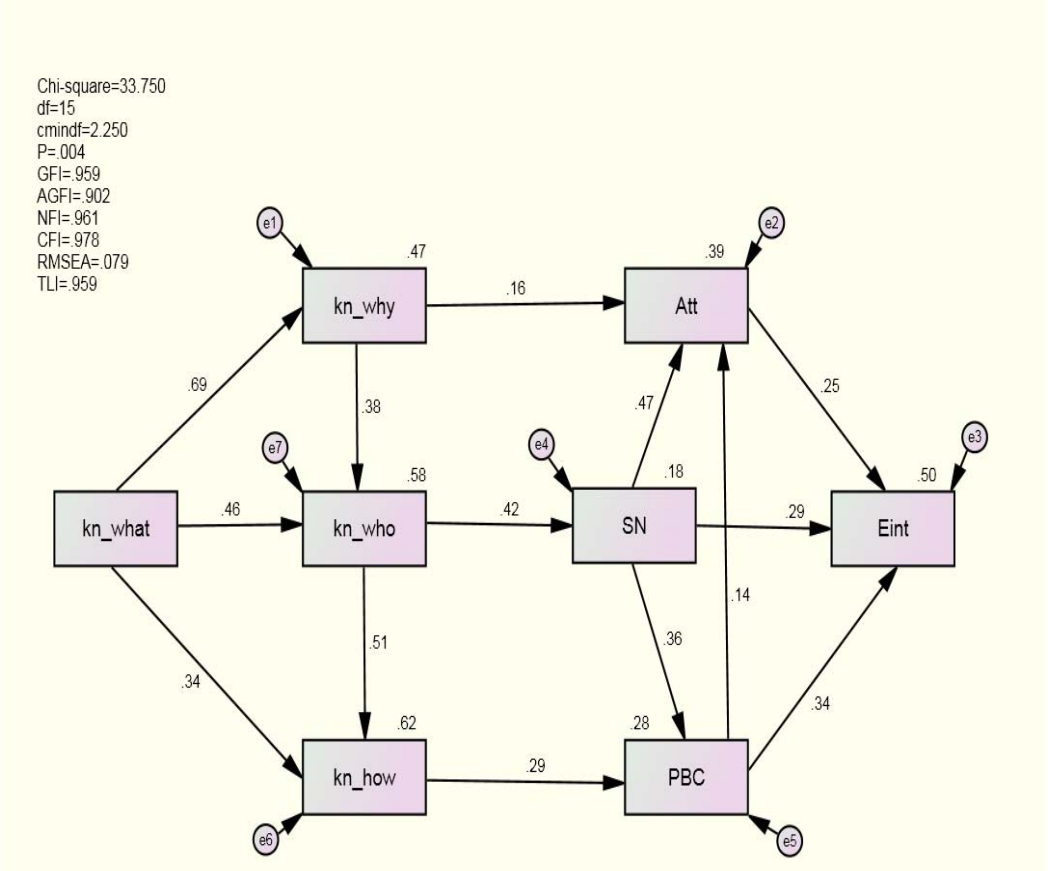

Figure 14. Test results of the entrepreneurship education model (Standardized estimation)

Table 34. Test results of the hypotheses

Hypothesis				Estimate	S.E.	C.R.	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

The path analysis process revealed the chi-square statistic to be 33.750 with 15 degrees of freedom ($p<0.05$). The chi-square 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-square=2.250.

Next, we proceeded in analyzing the specific relationships among the variables. As indicated in **Table 34**, 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.

The generalization of the model was further analyzed. The ECVI (Expected Cross-Validation Index) was used. ECVI examines the cross validation of a sample across samples with similar size in the same population (Browne & Cudeck, 1989). According to Byrne (1998), ECVI measures the differences between the fitted covariance matrix of a sample and the expected covariance matrix of a same sized sample. In path analysis, ECVI values are calculated for three models: the null model, the hypothesized model, and the saturated model. The first and the last model contain two extreme values of ECVI and the hypothesized model contains a value in between. The null model is completely independent of all variables in the model and is the

most restricted. The saturated model assumes that the estimated parameters are equal and is the least restricted. If the ECIVI of the hypothesized model is between the two extremes, it is evidenced that the hypothesized model fulfills the generalization requirement (Byrne, 1998). 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-entrepreneurial intention. That is, the education-entrepreneurial model is considered valid. The squared multiple correlation of the model was R^2=0.50 that 50% of variance in entrepreneurial intentions were explained by this model.

To further study the effects of the variables, we tested the direct effect, indirect effect and total effect of the variables, as shown in **Table 35**. The unstandardized direct effects are equal to the regression weights, while the indirect effects are estimated statistically as the products of the direct effects that constitute them (Kline, 2005). The statistical significance of indirect effects of the endogenous variables through a mediator was checked by Sobel Test (Sobel, 1986). Sobel test examines if a mediator variable significantly affects the relationship between an independent variable and a dependent variable.

The results of Sobel test are shown in **Table 36**. As can be seen, all the indirect effects (through one mediator) were significant at a level of 0.05. That is, all the mediators were significant. The statistical significance of indirect effects through two or more mediators was assessed by the rule of thumb by J. Cohen and P. Cohen (1983). According to this approach, if all the constituent unstandardized path coefficients are significant at the same level of alpha, then their overall indirect effect can also be considered significant at this alpha level. As illustrated in **Table 34**, all the constituent unstandardized coefficients of any path among the variables were all significant at a level of 0.05. According to the rule of thumb, all the total indirect effects among the variables can be considered statistically significant at a level of 0.05. These provide further support that the education-entrepreneurial intention model is robust.

Table 35. Effects decomposition for the entrepreneurship education model

	k_what	k_why	k_who	SN	k_how	PBC	Att
Direct Effects							
k_why	0.685	0	0	0	0	0	0
k_who	0.455	0.376	0	0	0	0	0
SN	0	0	0.421	0	0	0	0
k_how	0.339	0	0.508	0	0	0	0
PBC	0	0	0	0.354	0.285	0	0
Att	0	0.164	0	0.469	0	0.146	0
Eint	0	0	0	0.285	0	0.339	0.248
Indirect Effects							
k_why	0	0	0	0	0	0	0
k_who	0.257	0	0	0	0	0	0
SN	0.300	0.158	0	0	0	0	0
k_how	0.362	0.191	0	0	0	0	0
PBC	0.306	0.110	0.294	0	0	0	0
Att	0.297	0.090	0.240	0.052	0.042	0	0
Eint	0.263	0.145	0.279	0.249	0.107	0.036	0
Total Effects							
k_why	0.685	0	0	0	0	0	0
k_who	0.712	0.376	0	0	0	0	0
SN	0.300	0.158	0.421	0	0	0	0
k_how	0.701	0.191	0.508	0	0	0	0
PBC	0.306	0.110	0.294	0.354	0.285	0	0
Att	0.297	0.254	0.240	0.521	0.042	0.146	0
Eint	0.263	0.145	0.279	0.534	0.107	0.375	0.248

Table 36. Results of Sobel test

Paths (with one mediator)	Sobel test statistic
k_what→k_why→k_who	5.454***
k_what→k_who→k_how	5.418***
k_why→k_who→k_how	4.824***
k_what→k_why→Att	2.767**
k_who→SN→Att	4.929***
k_how→PBC→Att	2.063*
SN→PBC→Att	2.142*
k_why→k_who→SN	4.420***
k_what→K_who→SN	4.863***
k_what→k_how→PBC	3.485***
k_who→k_how→PBC	3.960***
k_who→SN→PBC	4.273***
k_why→Att→Eint	2.297*
k_who→SN→Eint	3.688***
k_how→PBC→Eint	3.577***
SN→ATT→Eint	3.480***
SN→PBC→Eint	4.051***
PBC→Att→Eint	1.997*

***<0.001, **<0.01, *<0.05 (2-tailed sig.)

5.4. Chapter Summary

The results showed that the entrepreneurship group had significantly higher levels of entrepreneurial intention, attitude toward entrepreneurship, subjective norm and perceived behavioral control than control group. That is, students who were exposed to the entrepreneurship course had more positive perceptions about entrepreneurship than those who were not exposed to the entrepreneurship course. This indicated that the entrepreneurship course was effective to improve the attitudes and intention of students toward performing entrepreneurial activities. As a result, further analysis on how the specific education components influenced the entrepreneurial perceptions of students was meaningful.

Moreover, the influences of demographic factors on the entrepreneurial perceptions of the two groups were also compared. Five demographic factors were involved: age, year of study, work experience, gender and role model. Three of them (age, year of study and work experience) had no significant effect on the entrepreneurial variables across the two groups (entrepreneurship group and control group), while gender and role model showed certain significant effect. For example, gender significantly influenced subjective norm and perceived behavioral control in control group, whereas it affected subjective norm and entrepreneurial intention in entrepreneurship group. Role model had significant impact on entrepreneurial intention, subjective norm and perceived behavioral control in control group. However, for the students who had completed the entrepreneurship course, the effect of role model on attitude toward entrepreneurship, subjective norm and entrepreneurial intention was significant.

Prior to testing the education-entrepreneurial intention model, the robustness of the TPB model was first verified across the entrepreneurship group and control group. In this case, multigroup test was used and the results indicated that the TPB model was fitted across the two groups, suggesting the model was valid in the context of this study and it was appropriate to be applied to study the entrepreneurial intention of the engineering students regardless of whether they had been exposed to entrepreneurial training.

The test results of the education model which was developed based on TPB revealed that all hypotheses were supported at a significance level of 0.05, with a

squared multiple correlation of 0.50. Attitude toward entrepreneurship, subjective norm and perceived behavioral control were significantly related to entrepreneurial intention. And know-what was found significantly influencing know-why, know-who, and know-how, which respectively influenced the three attitudinal antecedents of entrepreneurial intention. In addition, the inter-relationships among the three antecedents as well as the inter-relationship among the education components were also confirmed. For example, subjective norm had significant impact on both attitude toward entrepreneurship and perceived behavioral control; perceived behavioral control also had a significant effect on attitude toward entrepreneurship; know-why significantly influenced know-who, which had positive effect on know-how.

The generalization of the conceptual model was also supported with the ECVI value between that of the saturated model and the independence model. Moreover, the indirect effect of the variables of the model was confirmed to be significant at a level of 0.05, providing further support that the education-entrepreneurial intention model was robust.

Chapter 6: Discussion and Implications

This thesis aims to propose an entrepreneurship education model by empirically investigating how specific education components influence the entrepreneurial intention of engineering students. Having an extensive review on literature on entrepreneurship and education, TPB (Theory of Planned Behavior) was employed as the theoretical basis of this thesis. Based on TPB, we developed a conceptual model of education-entrepreneurial intention to explain the effect of specific education components on entrepreneurial attitudes and intention.

Prior to testing the conceptual model, it is important to confirm that entrepreneurship education is effective in terms of improving the attitudes and intention of students toward entrepreneurship. In sense of this, a comparison study was conducted between the entrepreneurship group students and control group students. That is, we investigated whether the entrepreneurship students had higher level of attitudes and intention toward entrepreneurship than the control group students who did not touched upon the entrepreneurship course. Having ascertained the effectiveness of the entrepreneurship training course on improving the entrepreneurial intention and its antecedent attitudes, the specific effect of the four key education components could be analyzed. Accordingly, the extent to which the specific education contents influence the entrepreneurial intention through its three antecedents (attitude toward entrepreneurship, subjective norm and perceived behavioral control) was examined.

In the following sections, we will first discuss the results presented in previous chapter (**Chapter 5**). Then the implications (both theoretical and practical) derived from the findings will be presented.

6.1. Discussion

This section elaborates the main findings of the thesis. We will firstly discuss the effectiveness of the entrepreneurship education course, which is the basis of investigation on the specific impact of education on entrepreneurial intentions. The effects of demographic factors on entrepreneurial variables are then discussed across the entrepreneurship group and control group. Next, discussion on the pertinence of the theory of planned behavior in entrepreneurship education and how the theory helps to develop the education-entrepreneurial model is presented. Finally, the findings regarding the test of the education-entrepreneurial intention model proposed in this thesis are interpreted.

6.1.1. Effectiveness of the entrepreneurship course

In order to study the effectiveness of the proposed entrepreneurship course, we conducted a comparison study between the entrepreneurship group and the control group regarding their attitude toward entrepreneurship, subjective norm, perceived behavioral control, and entrepreneurial intention. The comparison results allow us to achieve the second objective (which is about the effectiveness of the entrepreneurship education). As the results shown in **Table 25,** the average scores of the four entrepreneurial variables of the entrepreneurship group were all higher than those of the control group. The t-test results indicated that the differences between the two groups were significant at the level of p=0.01, suggesting that those students who were exposed to the entrepreneurship course were more entrepreneurship oriented in terms of their attitude toward entrepreneurship, subjective norm, perceived behavioral control, and entrepreneurial intention. This finding supports the results of Hood and Yong (1993) and Souitaris et al. (2007) that entrepreneurship education enhances students' attitudes and intention toward starting a business. Therefore, entrepreneurship education is useful to enhance the entrepreneurial attitudes and intentions. Compared with the control group students who did not touch upon the entrepreneurship course, the entrepreneurship students were more likely to have favorable attitude toward entrepreneurship, gain encouragement from significant others, perceive higher control over the entrepreneurial event, and finally have greater intention to create businesses.

Findings of the comparison study are valuable as they provide empirical evidence that the entrepreneurship course under study significantly increased the antecedent attitudes and entrepreneurial intentions of the students. Consequently, it was meaningful to further investigate how the specific education components influence these entrepreneurial variables. The impact of the education components is explained by the test results of the education-entrepreneurial intention model, as discussed in **section 6.1.3**.

6.1.2. Impact of demographic factors

The effect of demographic factors (age, year of study, work experience, gender and role model) were also compared between the two groups. In both groups, age, year of study, and work experience did not have significant effect on the four entrepreneurial variables (entrepreneurial intention and its three antecedent attitudes) or education components (know-what/-why/-who/-how) (as shown in **Table 28**).

The insignificant impact of age and work experience could be attributed to the short span of these two factors. The students were of a similar age. Around 90% of them were between 20 and 25 (about 60% of them aged between 20 and 22, and about 30% were 23-25), with an overall average of 22 years old. The insignificant effect of age would be probably explained by the short age span. Similarly, over 80% of the students had less than 2 years of work experience (over 60% of them worked for less than 1 year, and over 20% of them worked for 1 to 2 years). The small dispersion (or short span) of the work experience probably led to the insignificant effect of this factor on the entrepreneurial variables. A new study of the general population with wider span may be needed to assess the role of age and work experience in a more accurate way.

Year of study did not have significant effect on the entrepreneurial attributes. That is, the response of final year students (year 3) (about 40%) and those in their year 2 study (about 55%) was not significantly different. The results might indicate that entrepreneurship is not necessary to be taught at a late stage to final year students. It should be offered throughout the university education curricula.

Gender and role model had certain significant effect on the entrepreneurial variables of the two groups (as presented in **Table 29**-**Table 32**). The results are interpreted as follows.

Effect of Gender:

In both the entrepreneurship group and control group, **attitude** of male students toward entrepreneurship was relatively higher than that of females, but not significantly. That is, the attitude of the males and females was *not* significantly *different*. In other words, gender was not a significant factor for attitude toward entrepreneurship.

The effect of gender on **subjective norm** was consistent across the entrepreneurship group and control group. The subjective norms of male and female students were significantly *different.* Male students had higher subjective norm than the female students regardless of if they took the entrepreneurship course. This could be related to the issue of culture as subjective norm is highly related to the cultural norms. Values shared within a culture, according to the TPB, would affect the antecedent attitudes of intention. A supportive culture would help to promote entrepreneurship (Etzioni, 1987). Among the three antecedents, subjective norm might have the strongest relationship with cultural values, as this factor concerns the perceived social pressure to create a new business (Ajzen, 2001). Accordingly, Begley and Tan (2001) and Kristiansen and Indarti (2004) reported that the influence of subjective norm on entrepreneurial decision is much more salient in collectivist cultures than in individualistic cultures. In Chinese culture, which is man power oriented, males are generally considered more suitable than females to engage in risky or challenging activities such as creating their own businesses. Hence, even though the entrepreneurship training course significantly increased the subjective norm of the students (i.e., the students who took the entrepreneurship course perceived that they were more likely to get referents' approval of creating own businesses, as shown in **Table 29**), it did not change the social norm (i.e., opinions of other people) that males should pursue an entrepreneurial career rather than females.

For the control group students, gender had a significant impact on **perceived behavioral control**, but, this effect was not significant in the entrepreneurship group. Perceived behavioral control reflects the self-capability. According to this, male students generally have significantly greater perceived behavioral control over the

entrepreneurial event than the female students do probably because of the traditional masculine social culture (Zhang et al., 2001). This would be changed through the entrepreneurship education. After completing the entrepreneurship course, the entrepreneurship students (both boys and girls) had a higher level of perceived behavioral control than the control group students, and the female and male students perceived a similar level of capability to carry out the entrepreneurial activities. These findings indicated that the entrepreneurship course successfully reduced the difference between male and female students in their perceived control over an entrepreneurial behavior. The students learnt entrepreneurial knowledge, skills and techniques through the course and recognized that whether one has control over the entrepreneurial event is not because he is male or female, but the knowledge and skills he/she has acquired. This probably explains why the perceived behavioral control of the entrepreneurship group between male and female students was not significantly different.

The **entrepreneurial intention** of entrepreneurship group students was significantly higher than that of the control group students (as shown in **Table 25**). The same result was obtained when considering the gender of the students (as shown in **Table 29**). For example, male students in entrepreneurship group had significantly higher intention than did those males in the control group. It was also true for female students in the two groups. When looking at the effect of gender within each group (as shown in **Table 30**), the **entrepreneurial intention** of male students, in control group, was slightly higher than that of female students in the same group. However, in the entrepreneurship group, the difference between females and males became significant. These results indicated that the entrepreneurship course increased the entrepreneurial intention of the students. In particular, male students, after completing the course, tended to show higher intention to create new businesses. That is, it seems easier to stimulate male students to start up than female students. This suggests that males are more likely to take up risky/challenging behaviors. Females are less likely than men to pursue their own business probably because females are more likely to prefer the low-risk jobs. These findings are in accord with the results of previous studies (Brush, 1992; Haber, 1987) which showed that there is a higher prevalence of entrepreneurship for men than that for women. This gender difference has been found to be consistent across cultural and national boundaries, such as in Israeli (Lerner et

al., 1997) and Singapore (Kim & Ling, 2001). The lower prevalence for women entrepreneurs in various countries points out the significant effect of gender on the likelihood to create own business.

In terms of possible reasons for the lower rate of women entrepreneurs, some researchers argued that women encounter more difficulties than men in the entrepreneurial process, such as seeking financial support (Boden & Nucci, 2000) and are more likely to have time constraints to balance household/family responsibilities and their business (Loscocco, 1991). Marlow and Patton (2005) claimed that the generally-held gender stereotypes against women could be another reason. For example, masculine characteristics [2] usually possessed by men typically facilitate entrepreneurship (Ahl, 2006; Lewis, 2006). Given these stereotypes, females are more likely to self-impose some barriers to be entrepreneurs which decrease their entrepreneurial intentions (Langowitz & Minniti, 2007). Therefore, when designing entrepreneurship courses, the factor of gender should be considered. More attention should be put on the psychological issues (e.g., fostering entrepreneurial characteristics which are related to masculine characteristics) of students, especially female students who require more encouragement to break the psychological constraints.

Effect of role model:

In the control group, students who had entrepreneurial models perceived a more favorable **attitude** toward entrepreneurship, though not significant, than those who did not have the entrepreneurial models. However, through the entrepreneurship course, the effect of role model became significant. This finding suggests that through understanding of the entrepreneurship phenomenon as well as the learning of entrepreneurial knowledge and skills, the students who had entrepreneurial role models perceived a stronger interest in (desirability to) creating own business.

The effect of role model on **subjective norm** was similar to that of gender. Both in the entrepreneurship group and the control group, students who had entrepreneurial models (entrepreneur parents/close friends) were more likely to receive approval of starting own business than those who did not have such models.

[2] Masculine characteristics include such as competitive, active, independent, decisive, self-confident; feminine characteristics are socieo-emotional in nature and include understanding, warm, emotional and caring (Spence & Helmreich, 1978).

This suggests that role model is an important factor of subjective norm that parents' entrepreneurship or closer friends' entrepreneurship encourages individuals to become entrepreneur (Aldrich & Kim, 2007; Sorenson, 2007). Although the entrepreneurship course successfully improved the level of subjective norm of role-model students and non-role model students (as shown in **Table 31** and **Table 32**), the entrepreneurship students who had no entrepreneur models believed that they were less encouraged to create new business than those who had entrepreneur models (i.e., the role-model students were considered more suitable to pursue entrepreneurship). This is probably because the students believed that people who have entrepreneur parents/friends more easily to develop social networks and obtain resources and other support, thus they are more suitable to engage in entrepreneurial activities. In this sense, developing "entrepreneur role models" (other than parents or close friends entrepreneurs) is important in entrepreneurship education to enable students to establish social networks with practicing entrepreneurs and obtain resources necessary for entrepreneurial endeavors.

The effect of role model on **perceived behavioral control** was similar to the results of gender. In the control group, those who had entrepreneur parents or close friends had stronger control belief about the entrepreneurial event than those who did not have such entrepreneurial models. However, in the entrepreneurship group, whether one had entrepreneurial models was not significantly influencing their perceived behavioral control. This could be explained by two reasons. First, through the entrepreneurship course, the students recognized that entrepreneurial knowledge and skills were more important for strengthening their entrepreneurial capability than role models. Second, during the entrepreneurship course training, the students have identified alternative entrepreneurial roles to their entrepreneur parents or close friends, such as guest speakers (practicing/successful entrepreneurs), teachers and other entrepreneurship professionals. Hence, the influence of entrepreneur parents/friends became insignificant to the perceived behavioral control in entrepreneurship group.

Entrepreneurial intention exhibited consistently across the two different groups (role model group and non-role model group). Those who had entrepreneur parents or close friends had stronger intention to create own business ($p<0.1$) and through the training of entrepreneurship, the difference of entrepreneurial intention

between these two subgroups became more obvious ($p<0.05$). This was because that through the understanding of the entrepreneurship phenomenon, the role model group students explored more their interests in entrepreneurship and hence improved their entrepreneurial intention more than the non-role model group. It may also be because of the significant difference in attitude toward entrepreneurship of the students through the entrepreneurship course.

In short, the comparison between the entrepreneurship group and control group indicated the effectiveness of the entrepreneurship course on nurturing the entrepreneurial attitudes and intentions of the engineering students. The results showed that the entrepreneurship group students significantly had higher level of perception about attitude toward entrepreneurship, subjective norm, perceived behavioral control, and entrepreneurial intention than the control group students. The finding revealed that the entrepreneurial course successfully improved the entrepreneurial attitudes and intentions of students, leading to a meaningful investigation on the effect of specific education components on entrepreneurial intentions.

The comparison results also illustrated the effect of demographic factors (age, year of study, work experience, gender and role model) on the entrepreneurial perceptions of students. In particular, age, year of study, work experience did not have significant impact on entrepreneurial attitudes or intentions, while gender and role model showed certain significant effect. For example, gender had significant impact on subjective norm and perceived behavioral control in control group, while after the entrepreneurship course, it impacted subjective norm and entrepreneurial intention. On the other hand, role model was found significantly influencing subjective norm and perceived behavioral control and marginally significantly influencing entrepreneurial intention in control group, whereas, in entrepreneurship group, it had significant effect on attitude toward entrepreneurship, subjective norm, and entrepreneurial intention. These findings demonstrate how these demographic factors function in the entrepreneurial learning process and offer important implications for entrepreneurship education which will be discussed in **section 6.2**.

6.1.3. Model Testing

Having confirmed that the entrepreneurship courses increased the antecedent attitudes and entrepreneurial intentions of engineering students, a step further was to answer the third research question regarding how the specific education components influence these variables. To answer this inquiry, the thesis developed an education-entrepreneurial intention model based on TPB and tested the model by SEM path analysis. The findings on both the TPB model and our hypothesized model are discussed below.

6.1.3.1. Findings on TPB model

TPB was adopted as the theoretical basis of this thesis. The results showed that TPB model was valid in the context of the engineering students. That is, attitude toward entrepreneurship, subjective norm, and perceived behavioral control predict entrepreneurial intention. For example, the multi-group analysis (as illustrated in **Figure 13** and **Table 33**) revealed that data from both the entrepreneurship group and the control group supported the TPB model. Adequate model fit was obtained and the significant paths from the three antecedents to entrepreneurial intention were also found. The inter-relationships among the three antecedents were supported by the data. Subjective norm had a positive impact on attitude toward entrepreneurship (both groups: path coefficient=0.50, $p<0.001$) and perceived behavioral control (path coefficient=0.47, $p<0.001$). Perceived behavioral control could also enhance the entrepreneurial attitude (path coefficient=0.19, $p<0.05$). Therefore, the TPB model was considered robust and valid across different groups of students in predicting their intention to start up through attitude, subjective norm and perceived behavioral control. The results provide valuable insights that that the TPB model is appropriate to be the basis of our education-entrepreneurial intention model explaining how education affects entrepreneurial attitudes and intention of students.

Results of the whole education-entrepreneurial intention model also revealed that the TPB model was significantly supported (as illustrated in **Figure 14** and **Table 34**). The path coefficients of entrepreneurial intention from its three antecedents of attitude, subjective norm, and perceived behavioral control were 0.248 ($p<0.001$), 0.285 ($p<0.001$), and 0.339 ($p<0.001$) respectively. Thus, our findings support

literature that attitudes predict entrepreneurial intentions (Ajzen, 1991; 2005; Krueger, 1993). The values of the path coefficients are also consistent with the findings of existing studies (Autio et al., 2001; Gird and Bagraim, 2008, Kolvereid, 1996b; Souitaris et al., 2007) on entrepreneurship education. For example, in these studies, coefficients of attitude toward entrepreneurship are between 0.215 ($p<0.001$) and 0.306, coefficients of subjective norm vary from 0.028 ($p<0.05$) to 0.356 ($p<0.001$), and coefficients of perceived behavioral control range from 0.16 ($p<0.001$) to 0.380. Our results again confirm that the TPB is suitable to be applied to entrepreneurship education studies.

The relationships among the 3 antecedents were again significantly supported in the conceptual model. Subjective norm exerted a positive impact on attitude toward entrepreneurship (0.469, $p<0.001$) and perceived behavioral control (0.354, $p<0.001$) respectively. Perceived behavioral control was also found to significantly influence entrepreneurial attitude (0.146, $p<0.05$). The results confirm the argument of Ajzen (2005), Chang (1998), and Taylor & Todd (1995) that the three antecedents of intention are not independent. However, we know little about how the three antecedents influence one another in the formation of entrepreneurial intention. The findings of this thesis provide valuable insight in the impact of the three antecedents on one another. The influence of subjective norm on attitude toward entrepreneurship provides empirical evidence on the persuasion theory (Eagly & Chaiken, 1993) and cognitive dissonance theory (Festinger, 1957) that the recommendations/opinions of others regarding an entrepreneurial behavior can be received and internalized by a person influencing his/her consequent decisions on that behavior; or a person may change his or her attitude toward entrepreneurship in order to feel affiliated with significant others. The impact of subjective norm on perceived behavioral control confirms Bandura's (1986) social cognitive theory that social persuasions (or social pressure) play an important role in one's capability beliefs. The significant effect of perceived behavioral control on attitude toward entrepreneurship indicates that higher degree of control over an entrepreneurial event one perceives is more likely to result in positive evaluation or attitude toward it (Eagly & Chaiken, 1993; Feather, 1982).

It is noted that the contribution of subjective norm in the TPB was generally found weak in previous research (Autio et al., 2001; Krueger et al., 2000). In this thesis, subjective norm is found strong and is probably related to the issue of culture

as subjective norm is highly related to the normative considerations (i.e., the opinions of other people) (Ajzen, 1991). Values shared within a culture, according to the TPB approach, would affect the attitudinal antecedents of intention. And as subjective norm reflects the perceived social pressure to start up, it is highly related to cultural values (Ajzen, 2001; Begley & Tan, 2001; Kristiansen & Indarti, 2004). Thus, a supportive culture is important to promote entrepreneurship. Collectivist cultures (e.g., Chinese culture) and individualistic cultures (Western culture) are different. The former concerns social norm or opinions of others much more than the latter does. In this sense, subjective norm may have a stronger impact on entrepreneurial intention in collectivist cultures than in individualistic ones. Therefore, in the context of Chinese students as in this thesis, the influence of subjective norm on the entrepreneurial intention of the students is relatively strong.

The squared multiple correlation (R^2) of entrepreneurial intention is 0.50. That is, 50% of variance in entrepreneurial intention was explained by the three antecedents. This figure is deemed to be high comparing the previous empirical studies applying TPB. Most studies on entrepreneurship have found a value between 20% and 40%: for example, 35% (Krueger et al., 2000), 45% (Tkachev & Kolvereid, 1999), 30.3% (Autio et al., 2001), 32% (Souitaris et al., 2007), 27% (Gird & Bagraim, 2008), and 38% (Gelderen et al., 2008). Our findings imply that integrating the education components and the inter-relationships among the three antecedents to TPB improves the amount of explained variance in entrepreneurial intention. That is, our education-entrepreneurial intention model is effective to explain the formation of the students' intention to start up through entrepreneurship education.

6.1.3.2. Findings on entrepreneurship education components

Up to this point, we have reported two findings: (1) TPB (theory of planned behavior) was an appropriate approach to entrepreneurship education that it effectively measured entrepreneurial intention through three antecedent attitudes: attitude toward entrepreneurship, subjective norm and perceived behavioral control, and (2) the engineering students who were exposed to an entrepreneurship course had significantly more favorable attitude toward entrepreneurship, higher subjective norm, perceived behavioral control and entrepreneurial intention than did the control group students, indicating that the entrepreneurship course being studied in this thesis

effectively improved the entrepreneurial attitudes and intentions of students. Therefore, *objective 1* and *objective 2* of the thesis are achieved.

Next, we are interested in going forward to discuss how the specific education components influence the three attitudes, which in turn determine the intention to start up (i.e., *objective 3*). Therefore, this thesis not only reports the general effect of education (e.g., changes in antecedent attitudes and entrepreneurial intentions), but also provides insights into how the effects or changes are caused by specific education components. The specific effect of the components is discussed in the following paragraphs.

The path analysis results (as illustrated in **Figure 14** and **Table 34**) revealed that the education components were significantly related to the antecedents of entrepreneurial intention. That is, significant indirect effects of the education components were found on entrepreneurial intention through the three antecedents. Know-what respectively exerted significant effect on the other three components: know-why (0.685, $p<0.001$), know-who (0.455, $p<0.001$), and know-how (0.339, $p<0.001$). In turn, the three components significantly impacted the attitude toward entrepreneurship, subjective norm and perceived behavioral control. For example, know-why affected attitude toward entrepreneurship (0.164, $p<0.01$), know-who affected subjective norm (0.421, $p<0.001$), and know-how affected perceived behavioral control (0.285, $p<0.001$). The findings indicated that know-what served as the basic component of entrepreneurship education. Know-what (i.e., entrepreneurial principals and theories) facilitated the development of know-why (i.e., values and motives of entrepreneurship), know-who (i.e., interaction with entrepreneurs and professors), and know-how (skills and abilities).

Know-what includes the learning of specific domains of business and entrepreneurial knowledge, such as business creation, marketing management, financial planning, business planning, process of starting a firm, opportunity identification, strategy development, resource acquisition & implementation, technological innovation, new product development and other business management theories. Through the entrepreneurship education, the students will understand the concepts of entrepreneurship, what entrepreneurs do, what the outcomes and advantages of entrepreneurship are. The students will have better understanding of the reasons behind the entrepreneurial acts, the motives and values of entrepreneurs (i.e.,

know-why). Thus, they will have a clearer picture about entrepreneurship, and develop a better evaluation on whether they should pursue an entrepreneurial career (i.e., attitudes toward entrepreneurship) by identifying own motives and values of entrepreneurship.

Besides, knowing the basic knowledge, the students will have better communication or interaction with entrepreneurial referents (e.g., teachers and professors who are the experts in the field and guest speakers who are successful entrepreneurs, practicing entrepreneurs who have experience in creating and running own businesses) (i.e., know-who). The students will show higher interest in interacting with entrepreneurial people and have more opportunities to collect useful information, comments, and suggestions about entrepreneurship from the entrepreneurial referents. Positive or negative feedbacks/comments of the significant referents on the entrepreneurial behavior will encourage or discourage the students to perform.

Based on the entrepreneurship knowledge, the students will improve their practical skills and abilities required for starting a business (i.e., know-how). These skills including presentation skills, leadership skills, management skills, logical thinking, analytical skills, decision-making skills, goal-setting skills, and abilities to prepare and present a business plan and other skills required to enable students to be more capable to perform entrepreneurial activities. With these skills and abilities, the students will perceive higher level of control over the entrepreneurial activities (Bechard and Toulous, 1998; Henry et al., 2005a; Souitaris et al., 2007). Therefore, entrepreneurial knowledge (know-what) has significant impact on students' attitude, subjective norm and perceived control through the learning of know-why, know-who, and know-how respectively.

The significant relationship between know-why and know-who (0.376, $p<0.001$) suggests that how the students evaluate the values, meanings of engaging in the entrepreneurial activities (i.e., know-why) will affect the interaction or communication with entrepreneurial referents. The results confirm the motivation theory (Deci, 1972; Hunt, 1965; Ryan & Deci, 2000). Believing the rewards or benefits of useful information/comments and entrepreneurial learning and skills that can be obtained through interacting with the entrepreneurial referents, the students will show greater interest in discussing the topics on entrepreneurship with others,

interviewing entrepreneurs, visiting local enterprises, participating in entrepreneurial seminars, workshops and other activities. The results also support the functions of information seeking in goal theory (Butler, 2000) that students with the motives and interest in entrepreneurship appear to be more desired to seek professional opinions and updated information on entrepreneurship. Thus, the development of know-why (motives and values) is important to obtain effective interaction/ communication with the entrepreneurial referents.

The significant relationship between know-who and know-how (0.508, $p<0.001$) suggests that know-who plays an important role in the development of know-how. That is, the information, opinions and recommendations obtained from the entrepreneurial referents as well as their experiences in entrepreneurship can improve students' understanding on what they need to do and how to do in order to perform the entrepreneurial activities successfully (i.e., know-how). These confirm the social learning theory of Bandura (1986; 1997) that social interaction has a significant impact on one's learning. According to Bandura, people not only learn from direct experience, but also from observing others. For our purposes, students learnt behaviors (e.g., entrepreneurial behaviors) and attitudes from successful entrepreneurs and observed their consequences (success or not success in entrepreneurship). Such learning was crucial to their capability beliefs toward entrepreneurship.

The significant impact of the education components on the three attitudinal antecedents (attitude toward entrepreneurship, subjective norm, and perceived behavioral control) confirms the influence of entrepreneurship education on the development of the antecedent attitudes and entrepreneurial intentions.

The result on the relationship between know-why and attitude provides empirical evidence on the adjustment or utilitarian function of attitude (Katz, 1960; Katz & Stotland, 1959) and the probabilogical model (Wyer, 1970; 1974) that people who believe that entrepreneurship is important, beneficial and valuable to them (i.e., know-why) are more likely to have favorable attitude toward entrepreneurship (go for an owned business). The effect of know-who on subjective norm suggests that social learning (Bandura, 1977; Lin, et al., 1981; Portes, 1998) not only affects the skills and techniques of entrepreneurship (know-how), but also the perceptions about social norm on entrepreneurship. The influence of know-who on perceived behavioral

control is in accord with Bandura's (1986) social cognitive theory. The results suggest that entrepreneurial skills and techniques acquired from the entrepreneurship course can improve the students' capability to perform entrepreneurial activities that strengthen their perceptions about control over entrepreneurial behavior.

In summary, the conceptual model of the thesis was supported. The entrepreneurship education components were found indirectly to affect the entrepreneurial intention of students through the attitude toward entrepreneurship, subjective norm and perceived behavioral control. The results imply that the intervention of entrepreneurship training course exerts a positive influence on the three antecedent attitudes, and thus the intention to start up. Implications derived from the results of this study are discussed in the following section.

6.2. Implications of the Study

6.2.1. Theoretical implication for the TPB model

6.2.1.1. Identifying a robust approach for entrepreneurship education

This study provides an extensive review of the literature on entrepreneurship and education. It identifies a robust theoretical approach to entrepreneurship from various models (e.g., trait models and different types of intention-based models). Researchers in the field of entrepreneurship have called for more empirical evidence on the appropriateness of intention models to entrepreneurship (Krueger, 1993; Krueger et al., 2000).

Two major lines of research on entrepreneurship were reviewed in this thesis: trait models and intention models. The former draws on the personality traits to link entrepreneurship, while the latter focuses on entrepreneurial intention derived from attitudinal perceptions. By criticizing the problems of the trait models, this study emphasizes the effectiveness of entrepreneurial intention of predicting entrepreneurial behavior. The revolution of entrepreneurial intention models was reviewed. Six key entrepreneurial intention models were examined and compared. They included (1) EEM, (2) EIM, (3) revised EIM, (4) TPB, (5) EPM, and (6) SMEI. The comparison results suggest that TPB model is more appropriate than others to explain the entrepreneurial intention of students in the context of entrepreneurship education.

Entrepreneurship is a planned behavior; it is seldom created suddenly without planning. Thus it is best predicted by the theory of planned behavior (TPB) (Krueger, 1993; Krueger et al., 2000). In order to encourage students to create own business, it is important to nurture their entrepreneurial intention. Therefore, it is proper to apply the intention model to research on entrepreneurship education which aims to foster the antecedent attitudes and entrepreneurial intentions of students.

The empirical findings of this study show that entrepreneurial intention is effectively explained by the three antecedent attitudes: attitude toward entrepreneurship, subjective norm, and perceived behavioral control. Evidence can also be found in this study that TPB model (Ajzen, 1991; Krueger et al., 2000) is appropriate to be applied to entrepreneurial research in the context of entrepreneurship education for engineering students. Thus, this study adds empirical support to the reliability of intention model (i.e., TPB) in entrepreneurial research.

6.2.1.2. Providing more information on the formation of entrepreneurial intention

This study goes deeper by investigating the inter-dependent relationships among the antecedent attitudes of entrepreneurial intention, identifying how each attitudinal factor acts in the formation process of entrepreneurial intention. Thus, this study provides greater details about intention theory to entrepreneurship, offering important information for researchers to thoroughly disclose how entrepreneurial intention forms.

The findings of the study show that significant dependent relationships exist among the three antecedents of entrepreneurial intention. Subjective norm enhances both attitude toward entrepreneurship and perceived behavioral control. This finding is in accord with the persuasion theory of Eagly and Chaiken (1993) and Bandura's (1986; 1997) social learning theory. That is, persuasive opinions or recommendations of significant others (teachers, guest speakers and practicing entrepreneurs) can evoke existing beliefs and attitudes of students toward entrepreneurship (Eagly & Chaiken, 1993). The acknowledgement or encouragement of the entrepreneurial professionals will also lead to stronger perceptions about self-capability to exert control over the entrepreneurial event (Bandura, 1986; 1997).

Perceived behavioral control significantly influences attitude toward entrepreneurship. That is, the higher level of behavioral control that one perceives

(i.e., the more easily one thinks that he/she is able to carry out an entrepreneurial behavior), the more positive evaluation of the possible outcomes associated with entrepreneurship will be expected (i.e. higher desirability to start up).

In the field of entrepreneurship education, existing studies mainly focused on the direct relationships between the three antecedents and intention (Autio et al. 1997; Fayolle et al. 2006a; 2006b; Kolvereid 1996a; 1996b; Tkachev and Kolvereid, 1999). The inter-relationship among the three antecedents has always been ignored in the field. In fact, the three antecedents of intention are not always equally important in the TPB model (Ajzen, 2005) and they may share the covariance among one another (Ajzen, 1985; 1991; 2005; De Vries et al., 1988). Thus, the relationship among the three antecedents may not be independent (Linan & Chen, 2009).

Linan and Chen (2009) observed that "in the specific area of entrepreneurship research, only 7 out of the 16 studies previously reported included social norms in the analysis and some studies found the insignificant effect of subjective norm" (p. 596). Based on this, the authors proposed that there may be reasons to consider that social norms have an effect on both attitude toward entrepreneurship and perceived behavioral control. Their empirical results finally supported the dependent relationships.

Revealing the inter-relationship among the three antecedents will provide essential clues to how the entrepreneurial intention is formed and thus will offer significant guidelines for designing effective entrepreneurship courses/programs. Acknowledging the importance of this, our thesis investigates the inter-relationships among attitude, subjective norm and perceived behavioral control. Different from the study of Linan and Chen (2009), our research proposes the inter-relationships among all the three antecedents based on psychology theoretical support such as persuasion theory (Eagly & Chaiken, 1993), social learning theory (Bandura, 1986; 1997), and expectation theory (Feather, 1982). The inconsistent relationship between subjective norm and intention reported by previous studies (Autio et al., 2001; Krueger et al., 2000) could be due to methodological issues or measurement issues. Theoretically, according to the TRA (Fishbein & Ajzen, 1975) and TPB (Ajzen, 1991; 2005), subjective norm is indisputably an important factor of intention. Also there are a lot of studies supporting the contribution of subjective norm to intention (Kolvereid,

1996a; Kolvereid & Isaksen, 2006; Tkachev & Kolvereid, 1999). Thus, both the direct and indirect contributions of subjective norm are hypothesized in our thesis.

In the study of Linan and Chen (2009), only the relations of subjective norm →attitude toward entrepreneurship, and subjective norm→perceived behavioral control were considered. In contrast, in this thesis, the dependent relationships cover all of the three antecedents, because, as mentioned, the three factors may share covariance one another (Ajzen, 1985; 1991; 2005; De Vries, 1988) and as evidenced by the psychological theories, the three factors are dependent. Therefore, the intention model considered in this thesis is more theory-driven and more complete.

Therefore, as one of the few studies on the inter-dependent relationship among the three antecedents of entrepreneurial intention in the field of entrepreneurship research, the findings of this thesis obviously provide a valuable insight into how the three antecedents contribute to the formation of entrepreneurial intention. This thesis can be an important reference for future research on disclosing the formation process of entrepreneurial intention.

6.2.2. Theoretical implication for entrepreneurship education

This thesis investigates how specific education components influence the attitudes and intentions of students toward entrepreneurship. The findings provide insights into how to improve entrepreneurial attitudes and intentions of students through entrepreneurship education and training, which derive significant implications for developing approaches to entrepreneurship education.

As intention has been recognized as the most consistent predictor of actual behavior, particular planned behavior, such as entrepreneurship (Ajzen, 1991; 2005; Krueger et al., 2000), nurturing the intention of students to start up is ever important for entrepreneurship education. This thesis provides empirical evidence that entrepreneurial knowledge，skills and acumen are learnable and demonstrates the possibility of changes in entrepreneurial attitudes and intention.

The findings of this thesis suggest **an intention-focus approach to entrepreneurship education**. In order to foster entrepreneurial intention, three attitudinal perceptions of students should be firstly 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 students should be emphasized as it is influenced by different contents. The empirical evidence of this study derives an approach to entrepreneurship education based on TPB. According to TPB, whether one has intention to start up depends on his/her attitude toward entrepreneurship, subjective norm, and perceived behavioral control. The TPB has been confirmed valid and appropriate to be used to predict the entrepreneurship intention of students. Study on improving the entrepreneurial intention of students should focus on how to improve its three antecedents. Thus, an entrepreneurship course aiming to foster entrepreneurial intention should stress nurturing entrepreneurial attitudes. To promote entrepreneurial activities, we need to foster *entrepreneurial intention* of students. To foster entrepreneurial intention, we need to focus on improving *entrepreneurial attitudes* of students, including their attitude toward entrepreneurship, subjective norm, and perceived behavioral control. Changes of these three attitudinal factors can be realized through the development of four key competences: know-what, know-why, know-who, and know-how.

However, in the field of entrepreneurship education, the education content or method designed to improve attitude toward entrepreneurship, subjective norm, and perceived behavioral control has not been well developed. 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 (Bechard & Gregoire, 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 included.

Most entrepreneurship courses/programs stress the development of perceived behavioral control through acquiring entrepreneurial skills, abilities and experiences. In particular, the business plan is over emphasized in this respect (Bechard & Toulouse, 1991; Ronstadt, 1990). In their nationwide survey, Solomon et al. (2002) reported that the most common teaching methods used in entrepreneurship education are the business plan and lectures. Similar findings have been obtained by Honig (2004) who contended that teaching of business plan is one of the most popular curricula formats in entrepreneurship courses. According to the author, 78 of the top 100 universities in the US adopted the business plan approach for teaching entrepreneurship or small business management.

The persistence of the business plan is probably because of its relevance to entrepreneurship. Preparation of a business plan allows students to integrate and apply their learning on entrepreneurial knowledge and skills altogether (e.g., creative ideas generation, business opportunity identification, marketing, organizational behavior, human resources, new product development, accounting, and finance analysis) (Hindle, 2007). In reality, a business plan is critical for entrepreneurs to show their intended future and seek funds from stakeholders. Thus, in entrepreneurship education, providing opportunities for students to learn and practice a business plan is very important to develop their entrepreneurial skills and abilities. Through the business plan approach, students can learn how to forecast the business development, how to make interdependent decisions, and how to get useful information sources.

Is the production of a business plan alone enough for entrepreneurship courses or programs to foster students' entrepreneurial intention? The answer is no. Given the relevance of a business plan, it is a good tool to develop the know-how competence. Students can put their learning on entrepreneurship into practice through developing a business plan interrelating business concepts and skills necessary for initiating a new business. Development of know-how strengthens one's capability to handle entrepreneurial tasks, which consequently improve the level of control over the entrepreneurial event. **However**, to improve the **attitude toward entrepreneurship** and **subjective norm** of students, which is respectively linked to competence of know-why and know-who, the business plan is **clearly not enough**.

In the teaching of entrepreneurship, more effort is required for increasing attitude toward entrepreneurship and subjective norm. The teaching of subjective norm is especially important, as it plays an important role in enhancing attitude and perceived behavioral. Unfortunately, very little is known about how to enhance subjective norm. This study provides significant insights in this respect. Our findings provide significant implication about how to improve **all** the three antecedents and finally the entrepreneurial intention through entrepreneurship education.

Attitude toward entrepreneurship can be developed through the learning of know-why. Understanding of the values and motives for the entrepreneurial endeavor will help the students develop their own attitude toward entrepreneurship. Subjective norm can be improved by know-who and the interaction with entrepreneurship

professionals or models (i.e., entrepreneurial referents) will help the students to collect useful information about creating their own business and obtain the referents' opinions, suggestions and recommendations about the entrepreneurial behavior. Perceived behavioral control can be improved by the development of know-how. By obtaining entrepreneurial skills, techniques or experience, the students will feel more capable to exert control over the entrepreneurial behavior. Know-what, which refers to the learning of basic principles and knowledge of entrepreneurship, will facilitate the other 3 components: know-why/who/how.

Under this education approach, both traditional and non-traditional teaching methods can be used for entrepreneurship education. Traditional methods such as lectures can be used best for delivering entrepreneurial concepts and theories to students (Fiet, 2001a). Thus, traditional methods can be used for the teaching of know-what.

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 on the entrepreneurial endeavor (Fayolle et al., 2006a; 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 interview with successful/famous/student entrepreneurs, and psychology assessment and discussion. The teaching of *know-who* should stress 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. The details on the teaching guidelines of entrepreneurship will be articulated in **section 6.2.3**.

In summary, the **intention-focus education approach** this study proposes allows for the combination of education components and the entrepreneurial intention in a theory-driven framework. Such teaching framework provides a bridge between fostering the entrepreneurial intention of students and teaching the specific components and it seeks to stress a systematic approach to entrepreneurship education. Although some researchers have investigated the influence of education/training on the entrepreneurial attitudes and intention of participants (Autio et al. 1997; Fayolle et al. 2006a; Kolvereid 1996a; 1996b; Tkachev and Kolvereid, 1999), they did not consider how the specific education components work in the formation process of entrepreneurial intention of students. 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, know-why and know-who. Thus, this approach provides more complete teaching content for an entrepreneurship course/program to foster the entrepreneurial intention 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.

6.2.3. Practical implication for entrepreneurship education

The practical significance of this thesis is reflected on its implication for the teaching of entrepreneurship. The empirical results of the education-entrepreneurial intention model provide useful guidelines for educators or teachers to design effective entrepreneurship courses/programs and establish teaching guidelines for the subject. For example, what teaching contents should be included in an entrepreneurship course, what should the teaching procedures be (i.e., which components should be taught first, which one should be last), what effect will be induced on the

entrepreneurial attitudes and intentions through the development of particular component, what teaching methods should be used for different components as well as the assessment methods for the entrepreneurship course. A guideline for all these teaching issues can be derived from the findings of this study. Based on the results, know-what is the very fundamental element. It exerts a positive impact on the other three components: know-why, know-who and know-how, which have direct effects on the three antecedents of entrepreneurial intention. The findings imply that all the four components are significant in the training process for fostering entrepreneurial intention. A curriculum design approach in entrepreneurship can be developed focusing on how to teach these components in order to develop the entrepreneurial intentions of the students.

6.2.3.1. Entrepreneurship curriculum design approach

In contrast to the traditional education which over stresses the transmission of knowledge and skills, entrepreneurship education should be based on a systematic model for enhancing entrepreneurial attitudes and motivations (Hansemark,1998). This study suggests an approach to entrepreneurship learning, which is presented as a curriculum template, as shown in **Figure 15**. This entrepreneurship curriculum design is student-centered and theory-based, allowing the students to learn entrepreneurship theories and skills through various proactive learning activities (such as guest lecture, seminars, company visit, creativity/innovation games) and to integrate the knowledge and techniques acquired into business projects.

This curriculum design template is **a target shooting approach** to building an entrepreneurship curriculum, particularly for awareness education of entrepreneurship (Linan, 2004), not for pursuing the number of businesses created by students. In this approach, the core target (the innermost circle) of the entrepreneurship course is to foster the entrepreneurial intention of students. Anchoring to this target, key education components (know-what, know-why, know-who, and know-how) are included in the curriculum design. The impact of these components on the three antecedent attitudes of entrepreneurial intention is also considered.

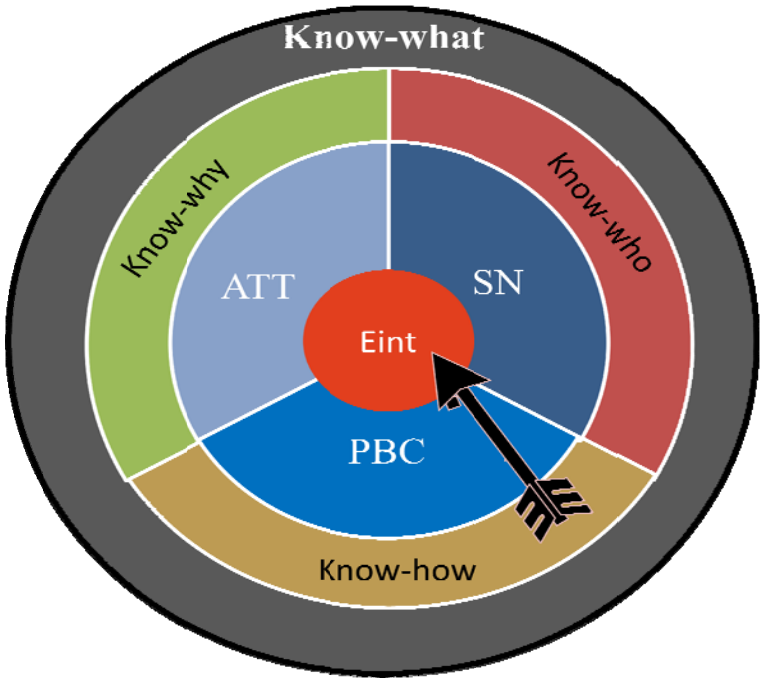

Figure 15. A target shooting template for building an entrepreneurship curriculum

Eint: entrepreneurial intention; ATT: attitude toward entrepreneurship; SN: subjective norm; PBC: perceived behavioral control

As shown in the figure, the most fundamental component of the entrepreneurship curriculum is know-what, the outermost circle. This component includes sets of entrepreneurial knowledge and skills, such as concepts and definitions of the entrepreneurial phenomenon, creativity, innovation, and business and management functions (marketing, new product development, commercial strategies, opportunity evaluation, accounting and finance, leadership, and communication and social skills). These knowledge and skills are interrelated and fully utilized when the students are working on a business project (Solomon et al., 2002).

The fundamental role of know-what in entrepreneurship education is necessary. “Without knowledge and theories, we really do not have very much to teach students because we do not know how to teach students to be lucky or intuitive” in the entrepreneurial world (Fiet, 2001b, p.103). Students who are not prepared in advance with basic knowledge of entrepreneurship (e.g., concepts and theories) may not understand the experiences and behaviors of the entrepreneurial models (successful entrepreneurs). The students may misinterpret the success stories of the

entrepreneurial models or improperly develop the blueprint of their own entrepreneurial careers which could be very different from the circumstances of the entrepreneurial models. All these may be because that the students do not have sufficient entrepreneurial knowledge to understand and evaluate the decisions of the entrepreneurs (Fiet, 2001a). Therefore, the basic and knowledge and theories about entrepreneurship are necessary for students to understand the entrepreneurial phenomenon, learn from entrepreneurial models, and develop entrepreneurial acumen and skills.

Typical business education or conventional entrepreneurship education usually stop at the level of know-what (Green, 2010), 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, which are placed in the **next circle** of the target shooting template.

Unlike the “know-what” which concerns what entrepreneurship is, know-why refers to a set of questions about why to perform entrepreneurship: Why there is entrepreneurship? Why should I learn entrepreneurship? Why should I engage in entrepreneurial activities? How exciting/challenging is entrepreneurship? How do the entrepreneurial experience, skills, knowledge, and abilities will benefit my career development or job performance or increase my competency?

The learning of know-why includes understanding of the values, motives, importance and benefits of entrepreneurship to both the society and individuals. Students are expected to develop own motives and values of performing entrepreneurial activities (Johannisson, 1991). This component is an important part of entrepreneurship education. Green (2010) argued that traditional entrepreneurial education overemphasized the theoretical aspects of entrepreneurship and business management, i.e., “know-what”. As the author stressed, why to start a business (i.e. know-why) should also be an important part of entrepreneurship education. With the learning of know-why competence, the students will evaluate their own profiles relating to entrepreneurship and develop their own motives and values of pursuing entrepreneurial career. Know-why significantly impacts one’s beliefs or perceptions about entrepreneurship concerning the subjective evaluations of the entrepreneurial outcomes. Thus this competence is important to improve the attitude toward entrepreneurship of students (e.g., a favorable attitude toward entrepreneurship). The

importance of know-why also reflects on its effect on know-who. With the understanding of the motives, values of entrepreneurship, the students will interact or communicate with the entrepreneurial referents (teachers, guest speakers, and practicing entrepreneurs) in a more effective way.

Know-who refers to the interaction with those people such as entrepreneurs and teachers, who are likely to bring significant messages and opinions about entrepreneurial events to the students. Know-who provides opportunities of interaction between the students (who are learning it), entrepreneurs (who are doing it), and teachers/professors (providing related guidance). According to our findings, entrepreneurial learning is dependent on the interaction with the significant people; the recommendations/suggestions of these people give a strong impact on whether the students should pursue entrepreneurship as a career (i.e., subjective norm). Thus, know-who plays a key role in entrepreneurial curriculum design.

The importance of know-who is also relied on its positive impact on know-how. Interaction with others is a powerful influence in entrepreneurial learning process. Meaningful interaction with the significant people helps the students understand what are required to do and how to do while performing entrepreneurial activities. Share of successful entrepreneurs (entrepreneurial experience and life stories) and observing their entrepreneurial behaviors and good habits help the students to understand the entrepreneurs' personal theories used in entrepreneurial decision-making and learn techniques from these models, and consequently help develop know-how. Development and organization of personal theory are highly significant in entrepreneurial learning (Rae & Carswell, 2000). According to the authors, personal theory governs individual decision-making and it is highly relevant in social learning process. Understanding the personal theories of entrepreneurs will help students to comprehend how the entrepreneurial success was attained. Through observational learning, students can learn from the successful entrepreneurs' experiences, understand their personal theories, and develop own theories and approaches to deal with entrepreneurial challenges.

The three antecedents of entrepreneurial intention (attitude toward entrepreneurship, subjective norm and perceived behavioral control) constitute the **next inner circle**. Entrepreneurial education has significant effect on the three antecedent attitudes. Understanding the strong values and motivational forces of

entrepreneurship would help students identify a clear image of entrepreneurship and evaluate their own values and motives to engage in entrepreneurial activities, and thus their attitude toward entrepreneurship. The comments/ opinions/ suggestions of the significant referents will result in encouragement or discouragement for the students to engage in entrepreneurship. This relates to the subjective norm, which links to social pressure suffered by the students regarding engaging in entrepreneurial activities. Besides, the enhanced entrepreneurial skills and techniques increase the student's capability beliefs and control beliefs. Changes in the three antecedents lead to changes in entrepreneurial intention (Ajzen, 1991; 2005).

Thus, the target (**the center of the circles**) of the entrepreneurship curriculum design is to foster the entrepreneurial intention of students. This aim can be achieved through the development of three attitudinal factors: attitude toward entrepreneurship, subjective norm, and perceived behavioral control. These three attitudinal factors, in turn, can be improved through the teaching of the four education components (know-what/-why/-who/ -how).

In short, the curriculum design emphasizes what target the entrepreneurship course is to shoot (i.e., entrepreneurial intention), what education components should be included in an entrepreneurship course (i.e., know-what/-why/-who/-how), what effect these components will produce and how they finally increase the intention of students to start up. This curriculum template leads to the attention to the teaching *process* (or procedures) and *methods* to be used in the entrepreneurship course/program. The details of these two parts are discussed in the following section.

6.2.3.2. Teaching process and methods for entrepreneurship

The teaching of the entrepreneurship is to transmit students the basic knowledge of entrepreneurship and tools to perform entrepreneurial tasks. It emphasizes developing the key competences in entrepreneurship through proactive learning activities. The detailed teaching process and methods are illustrated in a teaching model, as shown in **Figure 16.** The model presents the four key components (know-what/-why/-who/-how) and their corresponding teaching methods. Further, it also identifies the teaching process of these components one by one. Finally, the influence of the components on entrepreneurial intention is presented.

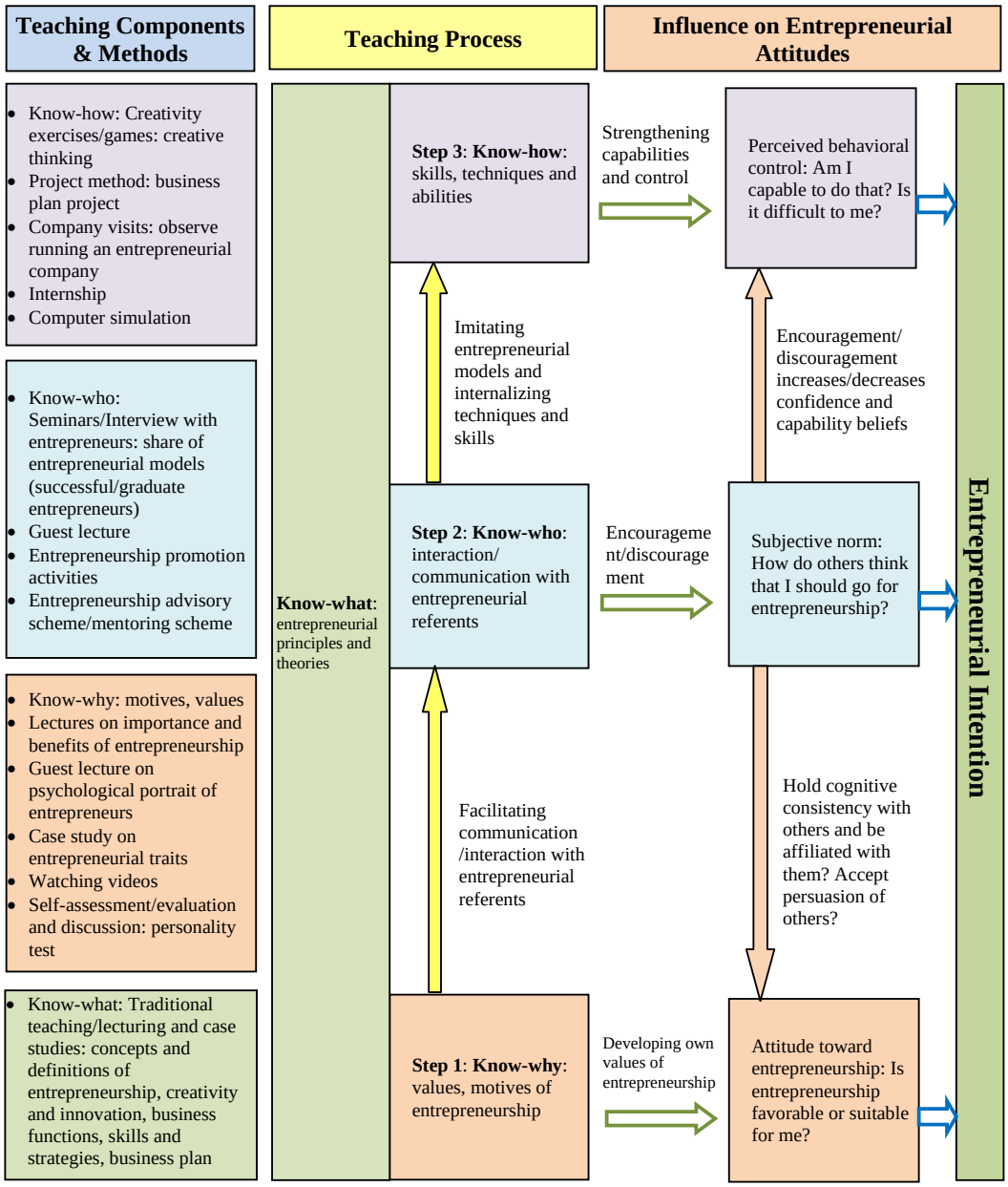

Figure 16. Teaching model of entrepreneurship

Teaching of know-what

In **Figure 16**, know-what is considered as the most fundamental element of an entrepreneurship course, as it significantly influences know-why, know-who, and know-how. The teaching purpose of know-what is to convey 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 (e.g., definitions of entrepreneurship, basic process and principles of entrepreneurship) to advanced ones (e.g., marketing strategies and financial planning).

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 deliver theories to students (Ahiarah, 1989; Fiet, 2001a; 2001b), and case studies, for example, discussion of cases and real life examples of enterprises in Hong Kong or other countries, can be applied in the classroom to convey entrepreneurial principles and theories (Ahiarah, 1989; James & Clare, 2004).

Teaching of Know-why

Based on the learning of know-what, the first 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 own values, motives to perform entrepreneurial behaviors. Teaching of this component thus emphasizes the values, importance and benefits of entrepreneurship to both the society (e.g., creation of job opportunities and increased wealth) and individuals (e.g., money, social status, entrepreneurial spirits, and innovative thinking). Even the students do not engage in entrepreneurial career, developing entrepreneurial sprits and skills is also important to them because being creative, innovative and adapted to change are useful for people in all occupations to solve problems and deal with risks and uncertainties. It is important to teach students how entrepreneurship is important to them and develop their 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 and self-assessment or evaluation on personalities. When 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. Further, teachers should consider the effect of gender on attitude toward entrepreneurship and intention.

It is noted that our results suggest that the entrepreneurship education can increase the entrepreneurial intention of students including males and females. However, male students may have higher level of intention than female students do. Thus, during the entrepreneurship course, teachers should pay more attention to female entrepreneurship. For example, equality between female and male entrepreneurs should be stressed; both of them have equal opportunities to raise financial capital (Buttner & Rosen, 1989; Rosa et al., 1994). Emphasis should also be put on whether they are females or males, or whether they will pursue an entrepreneurial career or not, entrepreneurship is important to them and they will be benefited from entrepreneurial learning. Besides, some facts and examples of woman entrepreneurship should also be introduced in the entrepreneurship course, for example, some popular woman entrepreneurial businesses including retailing and services, sectors with relatively low risk and capital investment, and part-time entrepreneurship (EIM/ENSR, 1996). Teachers or instructors should also stress the contribution of woman entrepreneurship, for instance, women entrepreneurs contribute to the diversity in entrepreneurship using different approaches and strategies to create and run their businesses (Verheul & Thurik, 2001). The purpose that we underline woman entrepreneurship is to break the image that “entrepreneurs are usually males” and provide a perception that it is also possible and common for women to create new business and they can perform as well as male entrepreneurs do.

Lecturing method is used to introduce the importance and benefits of entrepreneurship to the students. Successful companies and famous successful entrepreneurs can be used as examples. Video of interviews of well-known successful or young entrepreneurs (male and female) is also helpful to attract the attention of students to the entrepreneurship phenomenon and help them understand more the values of entrepreneurship.

The lecturing method can also be used to introduce the psychological concepts related to entrepreneurship. This is relevant because the development of know-why competence is related to one’s psychology, such as personalities (Ajzen, 2005; McClelland et al., 1985). The psychological portrait of entrepreneurs should be taught to students and this can be done by guest lecture that allow the guest teachers (including female practicing entrepreneurs) to share their image of entrepreneurs and attitudes toward creating their own business with a close interaction with the students.

The method of case study (Bennett, 2006) on entrepreneurial traits and discussion are useful to help the students understand the motives and values of and psychological predispositions to entrepreneurial acts. The teachers can discuss the personal characteristics of successful entrepreneurs. They can also discuss and share the psychological barriers to engaging in entrepreneurial activities, especially those barriers perceived by females. The ways to overcome the barriers should be discussed. In addition, self-assessment or evaluation on the students' personalities (such as need for achievement, locus of control, risk-taking propensity, & creativity) can also be used. Understanding their own personalities related to entrepreneurship will help the students evaluate their own profiles relating to entrepreneurship and develop their values, motives and attitude toward entrepreneurship.

Through the learning of know-why, the students are expected to understand the values and benefits of entrepreneurship and develop own values and motives about performing entrepreneurial behaviors. These will directly influence their attitude toward entrepreneurship (e.g., Is entrepreneurship favorable or suitable for me?).

Teaching of know-who

The second step is to teach know-who by offering opportunities for the students to interact and communicate with entrepreneurial models (successful/practicing entrepreneurs, female entrepreneurs, young/graduate entrepreneurs) through seminars or interviewing entrepreneurs, guest lectures. The purpose of this component is to develop effective interaction/communication between students and the entrepreneurial models, such 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 lead to 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 (either local or overseas), young and graduate entrepreneurs, and experts in the research field. Share of 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.

The teaching method of seminars, interview with entrepreneurs and guest lecture could be used to make dialogues with the entrepreneurs and share any ideas and opinions about entrepreneurship. The guest speakers or entrepreneurs could articulate their insights into creating a business venture sharing the means and qualities required to start and run a business. They might also share their success experiences as well as failure experiences with means of coping with the failures. Also, they may discuss the opportunities, challenges and tendency of entrepreneurship in Hong Kong or other regions, and the opportunities for young engineers to enter the entrepreneurship world. This offers good opportunities for students to discuss with practicing entrepreneurs and learn with them (e.g., the theories and practical skills they used). Further, the guest speakers can emotionally influence students by qualifying and encouraging the students to join the exciting business journey.

It is noted that role models (entrepreneur parents/close friends) have significant effect on entrepreneurial intention and that people who have entrepreneur parents or close friends are usually considered more suitable to perform 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.

Under the effect of entrepreneur parents/close friends, students will be more confident and capable to follow the entrepreneurial attempts after closely observing how these role models perform and receiving guidance from them (Veciana, 2007). Entrepreneurship courses/programs, although do nothing with the background factor of entrepreneurial parents/close friends, can “provide alternative role models”. As the existence of successful entrepreneurship examples may facilitate new firm creation, entrepreneurship courses/programs should provide opportunities to help students to develop networks with successful entrepreneurs, entrepreneurship project mentors (entrepreneurship schemes) and other entrepreneurial professionals. Institutes should create entrepreneurial atmosphere or culture within the campus through a series of promotion activities on entrepreneurship (e.g., seminars by famous entrepreneurs,

business project competitions (business plan competition, new product design competition), and entrepreneurial workshops). In an environment with entrepreneurial culture, it is more likely to have higher entrepreneurial attitudes and intentions and start-up rate (Veciana, 2007). Provision of entrepreneurship advisory scheme/mentoring scheme that offers professional entrepreneurial opinions/information to students is also important.

Teaching of know-how

Know-how should be considered as the last step, as it refers to the application of the entrepreneurial knowledge and skills acquired throughout the course. This component links to 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 (Martin & Laing, 1998). Thus, an interactive pedagogy is very important to enhance know-how (Duchenaut, 2001; Martin & Laing, 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, 1987) can be developed through creativity exercise, games. Divergent thinking and brain storming skills will be practiced by students to discover alternative solutions (Sternberg & 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.

As mentioned before, a business plan is an important way to teach entrepreneurship (Solomon, 2007) as it is effective to integrate and apply the entrepreneurial knowledge and skills learnt. The learning process and activities of know-how should follow both the progress of know-what and the project cycle. These methods allow students to initiate their own learning. In this approach, teacher is that of “guide and partner in the learning process” (Gibb, 1993, p. 22). 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-base team to initiate

entrepreneurship. The feedback of professors, entrepreneurs, and other entrepreneurial experts will further enhance the learning experiences of the students.

In addition, internship can also be an effective way to equip students with practical entrepreneurial experience (Dilts & Fowler, 1999). Students can obtain practical experience in working with entrepreneurs, observing and participating in performing entrepreneurial activities in the company. This will offer good opportunities for the students to learn personal theories and entrepreneurial techniques from the entrepreneurs. Internship takes a long time and it is not suitable for a short entrepreneurial course, but can be used by an entrepreneurship program which lasts 2-4 years. Company visits and computer simulations can also be used to strengthen know-how. During company visit, the students have opportunities to observe how to run an entrepreneurial company and also get opportunities to talk and listen to practicing entrepreneurs. Simulation can be a good way to teach small business and entrepreneurial skills (Wolfe & Brunton, 1994) by providing the students with experiences of making simulated business decisions and instant feedback (Brewer et al., 1993). This pedagogy method is expensive and depends on the resources of particular universities.

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. Based on the above discussion, we suggest a teaching outline of an entrepreneurship course, as discussed in next section.

6.2.3.3. Teaching outline of an entrepreneurship course

Following the discussion in the previous section, a teaching outline of an entrepreneurship course is developed, as shown in **Table 37**, **Table 38** and **Table 39**. The teaching outline is suggested for an entrepreneurship course that lasts for one semester. The aim of the course is to foster entrepreneurial attitudes and intention of students. The course conveys entrepreneurial knowledge and skills to students and equips them with (1) the basic theories and concepts about entrepreneurship, creativity and innovation, (2) the key skills and knowledge (including managerial, strategic, and financial) required for effectively pursuing and planning a business and

developing a new product, (3) values and motives for entrepreneurial endeavor, (4) effective communication/interaction with entrepreneurial professionals or models, and (5) experiences in preparing a business plan.

Table 37. Course intended learning outcomes (CILOs)

	CILOs	Weight
Know-what	To describe the basic process and principles of entrepreneurship and product/process innovation. The students will learn creative and critical thinking skills and integrate managerial issues like marketing, finance, and team management into a business project development. They will learn to conduct an innovation project from an entrepreneurial perspective rather than an engineering perspective.	25%
Know-why	To understand the motives and values of entrepreneurial endeavor. Students will learn values and importance of entrepreneurship and characteristics of innovators and entrepreneurs. A psychology test will be conducted allowing the students to explore their psychological portrait and interest in entrepreneurship. These will help the students develop their own values, motives and attitudes toward entrepreneurship.	15%
Know-who	To understand how to effectively interact/communicate with entrepreneurial professionals or models. The students will learn to imitate and internalize the practical entrepreneurial skills and personal theories used by the entrepreneurial professionals or models. This objective will answer questions: Who will give useful information, comments and suggestion to the students? How to communicate with the entrepreneurial professionals in a more effective way? How do the professionals consider the students' entrepreneurial ideas or behaviors?	20%
Know-how	To understand the practice of running an entrepreneurial company and combine all the relevant entrepreneurship theories and methods and apply them in preparing and presenting a complete business plan. The students will integrate their creative ideas, product design, marketing plan and financial plan into a complete entrepreneurial package.	40%

Table 38. Teaching and learning activities (TLAs)

CILO	Lecturing	Class activities	Group project and tutorial	Guest lecture /seminar/ Company visit	Total time
CILO1 (Know-what)	10	1			**11**
CILO2 (Know-why)	3	3			**6**
CILO3 (Know-who)				6	**6**
CILO4 (Know-how)		3	8	5	**16**
Total	**13**	**7**	**8**	**11**	**39**

Class activities: including case discussion, Q&A, participation in games and exercise, class assessment, watching videos and psychology test
Group project: including business plan consulting and presentation and feedback
Guest lecture/seminar/company visit: local entrepreneurs will be invited to deliver a lecture on business opportunities recognition and share their practical experience in innovation and entrepreneurship; students will visit a local enterprise to observe running an entrepreneurial company

Table 39. Assessment tasks/activities

	Exam	Class Activities	Case studies	Group project
CILO1 (Know-what)	10	1	8	15
CILO2 (Know-why)	5	2	2	5
CILO3 (Know-who)	5	3	8	5
CILO4 (Know-how)	10	4	2	15
Total 100 %	50	10	10	30

The course intended learning outcomes (CILOs) are depicted in **Table 37**. The learning outcomes are centered by the four education components: know-what, know-why, know-who, and know-how. These learning outcomes regarding these four competences have different weightings in the course according to their functions and contents. Know-what, referring to entrepreneurial knowledge and theories, is the basic part of the entrepreneurship. It accounts for one-fourth (25 percent) of the learning throughout the entrepreneurship course. Know-why refers to the values, benefits and importance of entrepreneurship, attracting the attention of students to the entrepreneurship world. It has a relatively lower weigh of 15 percent. Know-who referring to social interaction with entrepreneurial professionals, occupies about 20 percent of learning throughout the course. Know-how, which refers to integrating all knowledge and skills learnt to practice has a relatively higher weight in the course (40 percent).

Upon successful completion of this course, students should be able to describe the basic process and principles of entrepreneurship and product/process innovation. The students will learn creative and critical thinking skills and integrate managerial issues like marketing, finance, and team management into a business project development. Also, they will learn to conduct an innovation project from an entrepreneurial perceptive rather than an engineering perspective. These learning reflect the competence of "**know-what**" the basic part of entrepreneurship education.

Further, the students are also expected to develop **"know-why"** competence after completion of this course. They should be able to understand the motives and values of entrepreneurial endeavors. They will learn values and importance of entrepreneurship to the society as well as to individuals. The characteristics of innovators and entrepreneurs are also included in the learning outcomes. A psychology test/self-assessment will be conducted allowing the students to explore their psychological portraits and interest in entrepreneurship. These will help them

develop their own values, motives and attitudes toward entrepreneurship. This objective will answer the following questions: Why is there entrepreneurship? Who are entrepreneurs and what are their characteristics? How students will benefit from learning and engaging in entrepreneurship? Can the students become entrepreneurs?

Moreover, the learning outcomes related to **know-who** will enable students to understand how to effectively interact/communicate with entrepreneurial models (e.g., entrepreneurship teachers, project mentors, guest speakers (practicing entrepreneurs)). They are also expected to learn to imitate and internalize the practical entrepreneurial skills and personal theories used by these entrepreneurial professionals. This objective will answer the following questions: Who will give useful information, comments and suggestions to the students? How to communicate with the entrepreneurial professionals in a more effective way? How do the entrepreneurial professionals consider the students' entrepreneurial ideas or behaviors?

The learning outcomes of **know-how** have relatively higher weight in the entrepreneurship course, as it is about integration and application of all the knowledge, skills, and techniques learnt during the course. On completing the entrepreneurship course, students should be able to understand the practice of running an entrepreneurial company and combine all the relevant entrepreneurship and management theories and methods and apply all of these in preparing and presenting a complete business plan. The students will integrate their creative ideas, product design, marketing plan and financial plan into a complete entrepreneurial package.

The teaching and learning activities (TLAs) are illustrated in **Table 38**. The teaching of the entrepreneurship course includes both lecturing and non-lecturing activities, such as class activities, tutorials, group project, guest lecture seminar, and company visit. The total number of teaching hour is 39, which fits the normal teaching period of an entrepreneurship course that lasts one semester. Among the 39 hours, 13 are used for lecturing, 7 for class activities, 8 for group project and tutorial, and 11 for guest lecture, seminar of successful entrepreneurs, or company visit. Specifically, most of the lecturing hours are spent on **know-what** (10 hours). Further, one hour of class activity (e.g., case study on marketing strategies) is also used to develop know-what competence. TLAs of **know-why** comprise 3 hours of lecturing (importance of entrepreneurship and entrepreneurial portraits) and 3 hours of class activities (watching videos of interviewing successful/famous/student entrepreneurs,

and psychology assessment and discussion). **Know-who** is taught through 3 hours of seminar (share of entrepreneurial experience and suggestions, focusing on: why to start my business venture? how to run a new business (why some people succeed while others fail)? my good habits, challenges and tendency of entrepreneurship and opportunities for your engineers). Besides, 3 hours of company visits (interviewing entrepreneurs) are also included in the teaching of know-who. Most of the non-lecturing hours are spent on **know-how** (16 hours), which of 3 hours are used for class activities (games and exercises), 8 hours for group project and tutorial (consulting business plan and presentation), 2 hours for company visit (observing how to run a company), and 3 hours for guest lecture (entrepreneurship policy in Hong Kong and business support system).

In short, among the 39 teaching hours, know-what accounts for 11 hours, know-why and know-who accounts for 6 hours respectively, and know-how accounts for 16 hours. Non-lecturing TLAs are included for teaching the entrepreneurship course. For example, class activities, which include case discussion, Q&A, participation in games and exercise, class assessment, psychology test, and watching videos; group project, which includes business plan consulting and presentation and feedback from entrepreneurial professionals; guest lecture/seminar/company visit which invites local entrepreneurs to deliver a lecture on business opportunities recognition and share their practical experience in innovation and entrepreneurship. In the course, students also have opportunities to visit local enterprise and observe running an entrepreneurial company.

The assessment of the entrepreneurship course is shown in **Table 39**. Four activities: written examination, class activities, case reports and business plan project are used to assess the learning centered at the four education components. The examination (accounts for 50% of total results) either open book or close book takes around 2 hours including short questions, long questions, case study, and multiple choices. Class activity assessment (10%) includes Q&A and group discussions. A scorecard will be used to measure how active a student is in the class. For the question asked in the class, a score will be given. One case report (10%) will be submitted. The report is about the business strategies for a new product. Finally, the group project (30%) (e.g., business plan) assessment includes both a written report and presentation are included in the project score.

6.3. Chapter Summary

In summary, this chapter discusses the results from the comparison study and the test of education–entrepreneurial intention model. The comparison results between the entrepreneurship group and control group showed that the entrepreneurship course was useful to enhance the entrepreneurial attitudes and intention of students, providing meaningful evidence to further investigate how the specific education components influence the entrepreneurial variables.

The effect of demographic factors was also compared. The results showed that age, year of study, and work experience were not significant factors to entrepreneurial attitudes or intentions. On the other hand, gender and role model had certain impact on the entrepreneurial perceptions. The findings showed that (1) male students had higher subjective norm than the females regardless of their training buckhound on entrepreneurship; (2) the entrepreneurship course reduced the difference between male and female students regarding their entrepreneurial capabilities; (3) although the entrepreneurship course significantly increased the entrepreneurial intention of both male and female students, the male students had higher intention to start up than females did; (4) students who had entrepreneurial role models perceived a stronger desirability in creating own businesses; (5) parents' or closer friends' entrepreneurship encouraged individuals to become entrepreneur; (6) entrepreneurial knowledge and skills acquired influenced more the self-capability to control the entrepreneurial behavior than the role models did; and (7) the role model group students explored more their interests in entrepreneurship and hence improved their entrepreneurial intention more compared with the non-role model group.

The multigroup analysis showed that TPB model was robust across different groups of students in predicting their entrepreneurial intentions through attitude, subjective norm and perceived behavioral control. This was supported by the test results of the education-entrepreneurial intention model. The results were consistent with the findings of existing studies. The significant inter-relationships among the three antecedents confirmed that the three antecedents of intention are not independent. However, we know little about how the three factors influence one another in the formation process of intention. Our findings provide significant insight in this perspective.

Findings on entrepreneurship education components showed that know-what served as the basic component that facilitated the other three components. Through know-what, the students would (1) have better understanding of the reasons behind the entrepreneurial acts, the motives and values of entrepreneurs and thus develop their own values and motives to initiate entrepreneurship; (2) communicate or interact with entrepreneurial professionals more effectively and collect useful information, opinions, comments or recommendations that may result in encouragement or discouragement to perform entrepreneurial behaviors; and (3) be facilitated to learn and practice entrepreneurial techniques and skills that enable them to be more capable to perform entrepreneurial activities.

Both theoretical and practical implications are derived from the findings. Theoretically, this study identifies a robust theoretical approach to entrepreneurship from various entrepreneurship models to explain the entrepreneurial intention of students. It provides more detailed information process of entrepreneurial intention, considering the inter-relationships among the three attitudinal antecedents of intention. This study provides significant implications for the teaching theories of entrepreneurship suggesting an intention-focus approach for entrepreneurship education. Practically, the findings offer useful guidelines for teachers to deliver an entrepreneurship course.

Chapter 7: Conclusions

This chapter presents the conclusions of this thesis. It firstly summarizes the procedures and findings of this study. Then, it moves onto the innovation and features of this thesis, before discussing the contributions of the research (including both theoretical and practical contributions) and limitations. Finally, implication for future research is proposed. The details are depicted in the following five sections.

7.1. Summary of the Research

This thesis began with a discussion on the role and importance of entrepreneurship and new business creation to both the economy and society in general. There is strong evidence that entrepreneurship is not only important to the economy, but also critical to the development of individuals in today's ever changing society. Given the significance of entrepreneurship, constantly supplying entrepreneurial persons to meet the demand of society is essential.

However, a framework or theory of entrepreneurship education has not been well established. Even whether entrepreneurship can be taught is still argumentative (Cunningham & Lischeron, 1991; Fiet, 2001a; Henry et al., 2004). More and more researchers appear convinced that entrepreneurs are not born and entrepreneurship can be taught. They claimed that what we should concentrate on is what to be taught and how it should be taught. There have been a great number of studies on entrepreneurship education, yet it is challenging for educators and teachers to teach the subject as there is a lack of consensus on the teaching contents or methods (Fiet, 2001a; 2001b; Hills, 1988; Norton et al., 1999. The diversity in the field of entrepreneurship education may reveal that entrepreneurship discipline lacks a theory-driven education framework to address the fundamental issues. The purpose of this thesis is to develop an entrepreneurship education model by conducting an in-depth investigation on how specific education components influence entrepreneurial

attitudes and intentions. This model is expected to offer guidelines to design an effective entrepreneurship course.

Having reviewed the theoretical foundation on entrepreneurship and education literature, this thesis emphasizes that TPB (Theory of Planned Behavior) is appropriate to serve as the theoretical basis of entrepreneurship education program. Among the existing intention models, TPB provides most information about the formation process of entrepreneurial intention at both personal level and social level. Entrepreneurship is a planned behavior and that a new business is seldom created suddenly without planning, and thus it is best predicted by entrepreneurial intention. In this sense, TPB, which has been proved valid to explain entrepreneurial behavior (Krueger et al., 2000), is appropriate to be used to examine the entrepreneurial intention of students in this thesis.

Based on TPB, this thesis developed an education-entrepreneurial intention model demonstrating the influence of education components on entrepreneurial attitudes and intention. Ten sets of hypotheses were developed according to this education model. A survey study was conducted in order to test the conceptual education model. A total of 411 engineering students were involved in this study. In particular 201 were exposed to an entrepreneurship course and 210 were control group students who were not exposed to the entrepreneurship course. A comparison study between the entrepreneurship group and control group was performed to assess the effectiveness of the entrepreneurship course. Finally, the education-entrepreneurial intention model was test using SEM path analysis.

From the comparison study between the two groups (entrepreneurship and control group), this thesis found that the entrepreneurship course was effective to improve the entrepreneurial perceptions of engineering students. The results showed that students who had been exposed to the entrepreneurship had significantly higher level of entrepreneurial perceptions (including attitude toward entrepreneurship, subjective norm, perceived behavioral control, and entrepreneurial intention) than the control group students ($p< 0.05$). This indicated that the entrepreneurship course significantly increased attitude toward entrepreneurship, subjective norm, perceived behavioral control, and entrepreneurial intention of the students.

The effect of demographic factors (age, year of study, work experience, gender and role model) were also analyzed in this study. The first three factors were

did not have significant impact on attitude toward entrepreneurship, subjective norm, perceived behavioral control or entrepreneurial intention.

Gender and role model had a certain significant influence on the entrepreneurial variables. Male students had higher level of subjective norm than female students did across both the entrepreneurship group and control group ($p<0.05$), indicating that social norm which is related to values shared within a culture plays an important role in the formation of entrepreneurial intention. Moreover, gender significantly influenced perceived behavioral control in control group, but the effect was not significant in entrepreneurship group. This indicated that the entrepreneurship course successfully improved the entrepreneurial capability of female students and reduced the difference between male and female students. In addition, the effect of gender on entrepreneurial intention was *insignificant* in control group but *significant* in entrepreneurship group that male students had higher level of entrepreneurial intention than female students did. This suggests that more attention should be paid to deal with potential barriers of female students to start up.

The effect of role model on attitude toward entrepreneurship was *not significant* in control group, but became *significant* in entrepreneurship group, indicating that through the learning of entrepreneurship, students who had entrepreneur parents or close friends showed a greater desire to start up. Further, role model significantly influenced subjective norm across the entrepreneurship and control group, indicating that parents' entrepreneurship or closer friends' entrepreneurship significantly encouraged individuals to become entrepreneur (Aldrich & Kim, 2007; Sorenson, 2007). On the other hand, role model had significant impact on perceived behavioral control in control group, while it was not significant upon completion of the entrepreneurship course. That is, through the entrepreneurship education, entrepreneurial knowledge and skills learnt were more important to develop one's entrepreneurial capability other than role models. Role model also had significant impact on entrepreneurial intentions of students across both the entrepreneurship group and control group. This reflects the importance of developing alternative role models, such as entrepreneurial professionals, in entrepreneurship education to foster the entrepreneurial intention of students.

Before testing the conceptual model, TPB was firstly verified through multigroup test and the results showed that the TPB model was robust and valid

across both the entrepreneurship group and control group. The results indicated that the TPB model was appropriate to be applied to study the entrepreneurial intention of the engineering students regardless whether they were exposed to entrepreneurial education.

The test results of the conceptual model showed that the 10 sets of hypotheses were all supported. The results again confirmed the robustness of the TPB model. Further, the dependent relationships among the three antecedents of entrepreneurial intention were also confirmed. The results revealed that subjective norm significantly improved both the level of attitude toward entrepreneurship and perceived behavioral control. Perceived behavioral control also significantly enhanced attitude toward entrepreneurship. Entrepreneurship education components were found significantly influencing the entrepreneurial perceptions of students. Know-what was the basic element that facilitated the development of know-why, know-who, and know-how. Further, know-why significantly influenced attitude toward entrepreneurship. Know-who influenced subjective norm and know-how influenced perceived behavioral control. The results imply that entrepreneurial intentions of students can be developed through entrepreneurship education emphasizing the four key education components by improving their attitude, subjective norm and perceived behavioral control.

7.2. Innovation and Features of This Study

The **most salient feature** of this study is that it bridges specific entrepreneurship education components and entrepreneurial intention, providing significant insight into how the key components influence entrepreneurial attitudes and intentions of students. In the field of entrepreneurship, it has been observed that various contents and methods were used for entrepreneurship education (Fayolle & Gailly, 2008; Koch, 2003), as shown from the review on entrepreneurship education literature from 1980s to 2000s in **section 2.2**. The current diversity seems unnatural that it is too broad to address the appropriateness of entrepreneurship education (Matlay, 2005; 2006). The diversity prompts a need of a theory-driven education model for entrepreneurship education (Fiet, 2001a). Thus, this study aims to propose

an entrepreneurship education model by investigating the effect of specific education components on entrepreneurial intentions.

There have been studies on the impact of education on entrepreneurial intention (Autio et al. 1997; Fayolle et al. 2006a; 2006b; Kolvereid 1996a; 1996b; Tkachev & Kolvereid, 1999). However, these studies only considered the general results or outcomes of entrepreneurship education or training (i.e., changes in attitudes and intention toward entrepreneurship), but failed to answer why and how these changes were resulted. In other words, these studies were trapped at a relatively general level without dealing with what actually caused the changes. Filling the gap in the knowledge required for fostering students' entrepreneurial attitudes and intention through formal academic training, our research is probably the first study to investigate how specific education components influence the formation of entrepreneurial intention. It provides a clearer picture about how the entrepreneurial intention can be fostered through the development of the key education components in an entrepreneurship course. The findings derive significant implications for entrepreneurship course design as well as the teaching practice.

The **second feature** of this study reflects on an extensive review on the revolution of intention models. This study discusses two major lines of research on entrepreneurship (the trait models and intention-based models) and identifies that intention models which capture the link between individuals and their behaviors are more appropriate to explain entrepreneurship. There have been various types of intention model in the field of entrepreneurship. Since 1980s, there have been 6 major models developed: (1) Entrepreneurial Event Model (EEM), (2) Entrepreneurial Intention Model (EIM), (3) revised EIM with self-efficacy, (4) Theory of planned behavior (TPB), (5) Economic-Psychological Model (EPM), and (6) Structural Model of Entrepreneurial Intention (SMEI). This study discusses the evolution of these entrepreneurial intention models and evaluates their appropriateness to explain the formation of entrepreneurial intention of students. Among these models, EMI, EPM, and SMEI provide less information about the entrepreneurial intention acting as the predictor of entrepreneurial behavior is formed at the personal level or social level. Also, they lack empirical tests of entrepreneurial studies. Therefore, these three models are not considered to be the theoretical basis of our study. This leads to shifting our focus to the evaluation of the EEM, revised EIM and TPB. Although the

three models show a certain degree of compatibility, TPB is considered superior to others because it provides more details about intention and has been proved valid to explain entrepreneurial behaviors. The TPB model is employed as the theoretical basis of this thesis. In the research field of entrepreneurship education, this thesis probably provides most comprehensive review on the evolution of the key intention models.

The **third** feature is that this study gives emphasis on the dependent relationships among the three antecedents of entrepreneurial intention in the TPB model. Based on TPB, we developed an education-entrepreneurial intention model. In this model, we emphasized the inter-relationships among the three attitudinal antecedents of entrepreneurial intention. For example, subjective norms were theorized to influence attitude. An attitude towards a specific behavior is likely to be influenced by significant others, according to persuasion theory (Eagly & Chaiken, 1993) and cognitive dissonance theory (Festinger, 1957). Subjective norm was also hypothesized to influence perceived behavioral control based on Bandura's (1986) social cognitive theory which states that social persuasions play an important role in one's capability beliefs. Perceived behavioral control was hypothesized to influence attitude toward entrepreneurship based on the expectancy theory that if one perceives that he/she can carry out the entrepreneurial action successfully (outcomes of a behavior are expected), positive evaluation or attitude will be produced (Eagly & Chaiken, 1993; Feather, 1982). These dependent relationships were confirmed by our empirical results.

Currently, most studies on entrepreneurship education have focused on the direct relationships between entrepreneurial intention and its three antecedents (Autio et al. 1997; Fayolle et al. 2006a; 2006b; Kolvereid 1996a; 1996b; Tkachev and Kolvereid, 1999). Since the three antecedents share covariance and compensate one another in many situations (Ajzen, 2005), it is necessary to consider how they influence one another during the formation process of entrepreneurial intention. This study provides greater details about intention theory to entrepreneurship, providing important information for researchers to thoroughly disclose how entrepreneurial intention forms through attitude toward entrepreneurship, subjective norm, and perceived behavioral control.

The **fourth** feature links to the method of this study. This thesis employed the SEM path analysis to analyze the conceptual model covering the inter-relationships among independent and dependent variables. In this study, the use of SEM path analysis is superior to multiple regression because path analysis helps estimate a series of separate, but interdependent, multiple regression equations simultaneously for modeling the students' entrepreneurial intentions (Kline, 1998).

Existing studies on entrepreneurship education usually used multiple regressions to test the relationships between dependent and independent variables (Audet, 2002; Autio et al., 2001; Fayolle et al., 2006a; 2006b; Gird & Bagraim, 2008; Kolvereid, 1996b; Krueger et al., 2000; Souitaris et al., 2007; Tkachev & Kolvereid, 1999; Veciana et al., 2005). In multiple regression analysis, all independent variables are assumed to affect the dependent variable directly, while path analysis considers all the inter-dependent relationship in the model simultaneously. The path analysis technique reports the performance (or fitness) of the **overall model** (rather than separated relationships) and uses multiple indices (e.g., chi-square statistic, GFI, RMSEA, AGFI, TLI, NFI, CFI, & normed chi square statistic) to examine the goodness of fit of the proposed model (Kline, 1998). Therefore, path analysis can provide more reliable results on revealing how the specific education components influence entrepreneurial intention through the three attitudinal antecedents: attitude toward entrepreneurship, subjective norm, and perceived behavioral control.

7.3. Contributions of the Research

The contribution of this study is mainly to offer an education model to foster entrepreneurial intention of students, explaining how specific education components influence the entrepreneurial intention through its three antecedents. This theory-driven education model and our empirical results have important theoretical and practical contributions, as discussed in the following subsections.

7.3.1. Theoretical contribution

7.3.1.1. Contribution to the TPB model

This study reveals that TPB (Ajzen, 1991; Krueger et al., 2000) is appropriate to apply in entrepreneurial research to explain the entrepreneurial intention of engineering students. Our findings contribute to the reliability of TPB by providing additional empirical evidence on entrepreneurship education research.

The findings of the study also show significant inter-relationship among the three antecedents of intention. Subjective norm facilitates both attitude toward entrepreneurship and perceived behavioral control; and perceived behavioral control facilitates attitude toward entrepreneurship. That is, the recommendations/opinions of others regarding entrepreneurship will be received and internalized by the students influencing their decisions on performing the entrepreneurial behavior (Eagly & Chaiken, 1993). Social persuasions (or social pressures) play an important role in the students' capability beliefs about engaging in entrepreneurial activities (Bandura, 1986). Further, the degree of control over an entrepreneurial behavior the students perceive will impact their attitudes toward it based on their expectation on the behavior (Eagly & Chaiken, 1993; Feather, 1982).

As most studies on entrepreneurship education have only focused on the direct relationship between entrepreneurial intention and its three antecedents (Autio et al., 2001; Fayolle et al., 2006a; 2006b; Gird & Bagraim, 2008; Kolvereid, 1996b; Krueger et al., 2000; Souitaris et al., 2007;Tkachev & Kolvereid, 1999), this study provides more information on how attitude toward entrepreneurship, subjective norm and perceived behavioral control contribute to the formation of entrepreneurial intention. The empirical findings may provide a good reference for future research on the inter-relationships among the three antecedents.

7.3.1.2. Contribution to entrepreneurship education

This study is the first study in the field of entrepreneurship education that provides in-depth insight into how specific education components influence the entrepreneurial intention of students. The findings open possibilities that entrepreneurial knowledge, skills and acumen are learnable and these learning can change the entrepreneurial attitudes which determine the intention to create new

ventures. This study suggests an intention-focus approach to teaching entrepreneurship that emphasizes nurturing entrepreneurial intention of students in a systematic way. In this approach, entrepreneurial intention can be fostered through improving attitude toward entrepreneurship, subjective norm, and perceived behavioral control, which in turn, can be developed through the 4 key components of know-what/-why/-who/-how.

Unusual diversity in entrepreneurship education regarding the teaching contents or methods has been observed, entrepreneurship educators and scholars have longed for a systematic education model for entrepreneurship, which can provide guideline on how to teach the subject and what to teach. The findings of this thesis provide valuable insight into the teaching theory of entrepreneurship. In order to develop entrepreneurial intention, the three attitudinal perceptions of students should be firstly improved; to improve the three attitudes, the competences of know-why, know-who, and know-how should be developed based on know-what.

In this sense, in entrepreneurship education, enhancing the three attitudinal antecedents of entrepreneurial intention is very important. However, the teaching content designed to increase these three factors has not been well developed. Most entrepreneurship course/programs stress the development of perceived behavioral control (through acquiring entrepreneurial skills, abilities and experiences). However, this is insufficient to foster entrepreneurial intention. Content specifically designed to increase attitude toward entrepreneurship and subjective norm should also be included. Especially, development of subjective norm is important as it has a positive impact on both attitude toward entrepreneurship and perceived behavioral control. However, there is lack of findings on how to improve subjective norm.

This study provides significant insights into enhancing all the three factors, and finally the entrepreneurial intention through entrepreneurship education. Attitude toward entrepreneurship can be developed through the development of know-why. Understanding the values and motives for the entrepreneurial endeavor will help the students develop their own attitude toward entrepreneurship. Subjective norm can be improved by know-who. The interaction with entrepreneurship professionals or models (e.g., entrepreneurship professors and successful entrepreneurs) will help the students to collect useful information about creating a new business and obtain the referents' opinions, suggestions and recommendations. Perceived behavioral control

can be improved by the development of know-how. Through attaining the entrepreneurial skills, techniques and experience, the students will feel more capable to control the entrepreneurial behavior. Know-what, which refers to the learning of basic principles and knowledge of entrepreneurship, will facilitate the other three components: know-why/-who/-how.

7.3.2. Practical contribution

The practical contributions of this thesis mainly concern educators, trainers, and teachers in the field of entrepreneurship. Our findings shed a new light on both designing and delivering an effective entrepreneurship course.

The findings suggest a target-shooting approach to building an entrepreneurship curriculum, for awareness education of entrepreneurship, not for start-up training. The target of the entrepreneurship course is to foster the entrepreneurial intention of students. Anchoring to this target, key education components (know-what/-why/-who/-how) are included in the curriculum design and their effects on the three antecedents of intention are also considered.

Know-what including sets of entrepreneurial knowledge is considered as the most fundamental element of entrepreneurship course, as it significantly influences know-why, know-who, and know-how. This component can be taught through a combination of lectures and case studies (Ahiarah, 1989; Bennett, 2006).

Based on the learning of know-what, the first step is to develop know-why. The purpose of the know-why component is to draw the attention of students to the "entrepreneurship world" and help them develop own values, motives to perform entrepreneurship. Learning of know-why will strengthen students' attitude toward entrepreneurship. Methods used for this component may include lectures, watching videos (interviews with successful/young/female entrepreneurs), case study and self-assessment.

The second step is to teach know-who by offering opportunities for the students to interact and communicate with entrepreneurial models (successful entrepreneurs, female entrepreneurs, young/graduate entrepreneurs) through seminars or interviews with entrepreneurs, guest lectures. Students are expected to learn skills/techniques from those entrepreneurial referents and collect useful information

and comments. The comments/ opinions/ suggestions of the significant referents will result in encouragement or discouragement for the students to engage in entrepreneurship.

Know-how should be considered as the last step, as it refers to the application of the entrepreneurial knowledge and skills acquired throughout the course. Teaching of this component may comprise creativity exercises, games, business project, company visit, internship, and computer simulation. The learning of know-how will increase the student's capability beliefs and control beliefs about performing entrepreneurial activities.

It is explicit that an entrepreneurship course only involving delivery of entrepreneurial knowledge (know-what) or application of a business plan (know-how) is not enough to nurture the entrepreneurial intention. An effective entrepreneurship course has to consider the development of all the four key education components (know-what/-why/-who/-how). Through the learning of these components, the entrepreneurial intention of students will be significantly increased by enhancing their 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.

7.4. Limitations

Some limitations are highlighted in this thesis. *First*, this study was not longitudinal. A longitudinal study would add validity to the investigation on entrepreneurial intentions. Our data (from those who had completed the entrepreneurship program and those who had not) suggested the significant differences between these two groups regarding their entrepreneurial attitudes and intentions due to the intervention of entrepreneurship education. Although cross-sectional survey design (as used in this study) is commonly used in the field of

entrepreneurship to test hypotheses, in order to obtain more convinced results, a longitudinal design can be used in future research.

Second, this study focused on entrepreneurial intention, not actual entrepreneurial action. Intention is the best predictor of a behavior that requires careful planning, such as entrepreneurship. Based on this, the main stream of entrepreneurship research has focused on entrepreneurial intentions. To assess the effectiveness of entrepreneurship courses/programs, the most explicit way could be to measure the impact of education components on entrepreneurial intention and finally actual start-up actions. But for introductory level of entrepreneurship education, as in this study, which focuses on the entrepreneurial awareness not start-up training, nurturing students' entrepreneurial intention and its three antecedent attitudes should be enough. In future study, our intentional education model could be extended to higher level of entrepreneurship education (e.g., start-up education) by including the actual entrepreneurial actions.

Third, participants in this study were only undergraduate engineering students from Hong Kong universities. Respondents from other nations, academic disciplines, or levels of education (master students or college students) might have different perceptions about new venture creation and entrepreneurial learning. These students could be taught in different educational settings from those proposed in this thesis. Thus, their entrepreneurial attitudes and learning could be different from our findings. Also, cultural influence could be another factor to the possible difference.

7.5. Future Research

This thesis presents a first study in entrepreneurship education that goes deeper to investigate how specific education components influence the entrepreneurial intention of students. The education-entrepreneurial intention model proposed and tested supports the theory of planned behavior (TPB) and provides guidelines for the teaching of entrepreneurship. Considering the findings of this study as well as the limitations highlighted above, this study opens significant avenues for future research on entrepreneurship education, as discussed in the following paragraphs.

(1) Future research could address research questions related to “intentional education model”

Our education-entrepreneurial intention model could be extended to different education situations, such as different academic disciplines or different level of education. Also these results can be compared. This will help to identify how different educational settings affect the entrepreneurial learning and perceptions of students. Comparison results from other countries are also recommended for investigating the effectiveness of the entrepreneurship programs in different cultures. The results of this study pertain only to the impact of education components on the entrepreneurial perceptions of Chinese engineering students. Multiple-group analysis for students from other disciplines or other countries can be conducted in future to compare the impact of specific teaching strategies and cultural issues on entrepreneurial attitudes and intentions of students.

(2) Future research could address research questions related to “learning process” in entrepreneurship

Researchers could investigate the effect of time on the entrepreneurial learning process. Regarding this, we may have two cases. In case one, scholars could investigate the effect of entrepreneurship education on entrepreneurial intention and on actual venture creation. In this case, the *education-entrepreneurial intention model* of this thesis could clearly be extended to new venture creation by employing a longitudinal research design.

In case two, future studies could focus on the effect of the “duration” of an entrepreneurship course (e.g., several months to 1 year) or program (e.g., several *days* to several *years*) on entrepreneurial attitudes and intentions. This would provide answers to the question: How does the “time” influence entrepreneurial attitudes and intentions of the participants?

(3) Researchers could address research questions related to “teaching model” of entrepreneurship

In this case, our *implicated teaching model* could be further tested *empirically* at an introductory level of entrepreneurship education or higher levels. Future studies could also compare the existing teaching models with the one we suggested. This

would provide more insight into the educational settings and help identify the best practice. In this sense, future research might concern the following questions: What are the general "teaching models" in entrepreneurship? What are the comparison results of the general teaching models and the one suggested in this thesis?

(4) Future research could address the link between "nascent entrepreneurial intention" and "implementation intention"

Another avenue for future research refers to linking the "nascent entrepreneurial intention" studied in this thesis to "implementation intention" (Ajzen, 2005; Gollwitzer, 1999). In this thesis, we have studied the impact of specific education components on entrepreneurial attitudes (attitude toward entrepreneurship, subjective norm and perceived behavioral control), which in turn determines the intention to create new businesses. Since the proposed entrepreneurship education was an introductory-level course that focused on awareness education of entrepreneurship which aimed to foster students' entrepreneurial intentions to perform entrepreneurial activities. The intention the students developed is considered as the "**nascent intention"** that it may fade out with time (Orbell et al., 1997; Sheeran & Orbell, 1999). Probably because of this, the start-up rate of students is generally low (Lujthe, et al., 2003; Gorman et al., 1997). Gollwitzer (1999) argued that developing "**implementation intention"** is an effective way to fill the intention-behavior gap. How to transform the "nascent entrepreneurial intention" acquired through an entrepreneurship course into the "implementation intention" and then the start-up action is challenging, yet an important topic in the field of research. The findings of this thesis could be considered as the first step in this research journey by providing insight into how to nurture the "nascent intentions" in an effective way.

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Appendices

Appendix 1. Review of Entrepreneurial Traits

	Authors	Entrepreneurial Traits																			
		NA	RT	LC	CA	Nau/Ind	TA	SC	PS	EL	Init	P	$	JB	NS	AO /GO	AQ	Re	CS	FB	DF
1	McClelland (1961)	v																			
2	Pickel (1964)								v												
3	Litzinger (1965)		v			v															
4	Schrage (1965)	v																			
5	Schumpeter (1965)				v						v										
6	Atkinson & Feather (1966)	v																			
7	Rotter (1966))			v																	
8	Roberts (1968)	v																			
9	Collins & Moore (1970)					v								v	v						
10	Hornaday & Bunker (1970)	v			v		v			v	v		v								
11	Hornaday & Abound (1971)	v			v	v			v												
12	Whinter (1973)					v															
13	Liles (1974)		v																		
14	Durand (1975)	v		v																	
15	Kirton (1976)				v																
16	Atkinson & Birch (1978)	v																			
17	Sarachek (1978)		v																		
18	Timmons (1978)		v	v	v		v	v	v	v	v	v	v					v	v	v	v
19	DeCarlo & Lyons (1979)	v				v															

Appendix 1. Review of Entrepreneurial Traits (Cont.)

	Authors	Entrepreneurial Traits																			
		NA	RT	LC	CA	Nau/Ind	TA	SC	PS	EL	Init	P	$	JB	NS	AO /GO	AQ	Re	CS	FB	DF
20	Hull, Bosley, & Udell (1980)	v	v	v	v			v					v		v						
21	Lachman (1980)	v				v															
22	Hisrich &O'Brien (1981)									v		v				v					
23	Mescon & Montanari (1981)	v		v		v						v									
24	Brockhaus (1982)	v	v	v										v							
25	Schere (1982)						v														
26	Welsch & Young (1982)		v	v	v			v													
27	Cromie & Johns (1983)			v																	
28	Jennings & Ziethdam (1983)			v																	
29	Long (1983)		v		v																
30	Sexton & Bowman (1983)		v							v											
31	Mill (1984)		v																		
32	Ahmed (1985)	v	v	v																	
33	Drucker (1985)		v																		
34	Sexton & Bowman (1985)		v			v	v														
35	Brockhaus & Horwitz (1986)	v	v	v					v					v							
36	Begley & Boyd (1987)	v	v	v			v														
37	Cromie (1987)	v				v							v								

Appendix 1. Review of Entrepreneurial Traits (Cont.)

	Authors	Entrepreneurial Traits																			
		NA	RT	LC	CA	Nau/Ind	TA	SC	PS	EL	Init	P	$	JB	NS	AO /GO	AQ	Re	CS	FB	DF
38	Fernald & Solomon (1987)				v																
39	McClelland (1987)				v						v	v									
40	Whiting (1988)				v																
41	Bird (1989)	v	v	v	v																
42	Bygrave (1989)							v													
43	Timmons (1989)		v		v																
44	Gartner (1990)				v																
45	Howell and Higgins (1990)	v	v		v																
46	Johnson (1990)	v																			
47	Bonnett & Furnham (1991)	v		v																	
48	Caird (1991)	v	v	v	v	v															
49	Robinson, Huefner, & Hunt (1991)	v		v	v			v													
50	Robinson, Stimpson, Huefner & Hunt (1991)	v		v	v																
51	Shaver & Scott (1991)	v	v	v																	
52	Cromie & O'Donoghue (1992)	v	v	v	v	v															
53	Cromie, Callaghan, & Jansen (1992)	v	v	v	v	v															
54	Ho & Koh (1992)	v	v	v	v		v	v													
55	Carland et al. (1995)		v																		
56	Langan-Fox & Roth (1995)	v		v		v						v		v							

Appendix 1. Review of Entrepreneurial Traits (Cont.)

	Authors	Entrepreneurial Traits																			
		NA	RT	LC	CA	Nau/Ind	TA	SC	PS	EL	Init	P	$	JB	NS	AO /GO	AQ	Re	CS	FB	DF
57	Palich&Bagby (1995)		v																		
58	Green., David & Dent (1996)	v		v																	
59	Koh (1996)	v	v	v	v		v	v													
60	Stewart (1996)	v	v		v																
61	Chen, Greene, & Crick (1998)		v	v	v																
62	Hansemark (1998)	v		v																	
63	Stewart et al. (1999)	v	v		v																
64	Entrialgo, Fernandez, & Vazquez (2000)	v		v			v														
65	Greene (2000)	v			v	v		v	v							v	v				
66	Littunen (2000)	v		v					v												
67	Mueller & Thomas (2000)			v	v																
68	Utsch & Rauch (2000)	v			v						v										
69	Stewart & Roth (2001)		v																		
70	Luthje & Franke (2003)		v	v																	
71	Stewart et al. (2003)	v	v		v																
72	Raab, Stedham & Neuner (2005)	v	v	v			v		v												
73	Zhao, Seibert & Hills (2005)		v																		
74	Gurol & Atsan (2006)	v	v	v	v		v	v													

Appendix 1. Review of Entrepreneurial Traits (Cont.)

	Authors	Entrepreneurial Traits																			
		NA	RT	LC	CA	Nau/Ind	TA	SC	PS	EL	Init	P	$	JB	NS	AO /GO	AQ	Re	CS	FB	DF
75	Frank, Lueger & Korunka (2007)	v	v	v	v																
	Count	42	36	33	30	13	10	9	7	4	5	5	4	4	2	2	1	1	1	1	1

Abbreviations	Full name
NA	Need for achievement
RT	Risk-taking propensity
LC	Locus of control
CA	Creativity
Nau/Ind	Need for autonomy/ independence
TA	Tolerance of ambiguity
SC	Self-confidence
PS	Persistent problem solving
EL	Energy level
Init	Initiative
P	Perseverance
$	Money/Profit
JB	Job satisfaction
NS	Network & sociality/communication
AO/GO	Action orientation/ goal orientation
AQ	Act quickly
Re	Use of resources
CS	Competing against self-imposed standards
FB	Use of feedback
DF	Dealing with failure

Appendix 2. Details of the Entrepreneurship Course Offered in CityU, CUHK, and PolyU

(1) CityU: MEEM4040 Entrepreneurship for Engineers

Part I
Course Duration: One Semester
Credit Units: 3; Level: B4
Medium of Instruction: English
Prerequisites: Students must complete a minimum of 60 CUs to be eligible
Precursors: Nil
Equivalent Courses: Nil
Exclusive Courses: GE2304 Becoming Technology Innovators and Entrepreneurs

Part II
Course Aims:
Entrepreneurship - the creation of value through innovation - brings together the ability to identify promising opportunities for career business development with the skills, knowledge and motivation to realize these opportunities. This course aims to offer engineering students the basic principles and concepts about entrepreneurship as well as creativity and innovation. It then introduces key elements of the complementary skills and knowledge bases, both managerial and engineering, which allow various technological and business opportunities to be pursued and planned effectively. Students will learn individually, and in groups, to integrate knowledge and skills required to identify, plan and seize a business opportunity, ideally based on a new idea in technology and engineering. The development, preparation and presentation of a project and business plan will be a central focus. Students will be directed towards the models with which they can identify opportunities in the context of their chosen career in the future.

Course Intended Learning Outcomes (CILOs)
Upon successful completion of this course, students should be able to:

No.	CILOs	Weigt-ing
1.	To **identify** and **describe** new ideas developed from group discussion and brain storming. Software like CAD can be used to describe the idea and relevant products. The idea can be based on knowledge learned from other engineering and technology courses. Ideas in daily are also accepted. Student will learn how to use creative thinking and techniques in idea generation. The potential of creativity of all students will be released to certain extent.	2
2.	To **describe** the basic process and principle of engineering entrepreneurship and characters of entrepreneurs. This objective also aims to answer the questions like: who are entrepreneurs? Can a student be an entrepreneur later on? What factors influence the intention to be an entrepreneur?	2
3.	To **integrate** marketing theory and method into a practical market research plan for the new product. Students are encouraged to use marketing research techniques in their own project and really find out who are the customers and where is the market of your products.	1
4.	To **analyze** the cost and **predict** the profit of the new product/service. For any product or service, students should try their best to calculate the real cost based on information collected from various sources. Students also need to forecast the profit from their business. This is the base for a profitable company. You will be the managers who run a company you yourselves create.	1
5.	To **combine** all the relevant entrepreneurship theories and methods and **apply** them in formulating a complete business plan;. The final goal is to integrate your creative ideas, physical design, operation plan and financial plan into a complete entrepreneurial package. It will help students to join business plan competition if any.	3

Teaching and learning Activities (TLAs)
(Indicative of likely activities and tasks designed to facilitate students' achievement of the CILOs. Final details will be provided to students in their first week of attendance in this course)

Activity Type	Timetabled Activity (Hours per week)
Lecture/Tutorial/Laboratory Mix	Lecture (2); Tutorial (1)

TLA	Class activities	Group project & tutorial	Total hours
CILO			
CILO 1	6	3	9
CILO 2	6	3	9
CILO 3	2	2	4
CILO 4	2	2	4
CILO 5	10	3	13
Total	26	13	39

Class activities: including lecturing, group discussion, and Q&A.
Group project: including idea generation, product design, market research, financial analysis and overall business plan.

Assessment Tasks/Activities
(Indicative of likely activities and tasks designed to assess how well the students achieve the CILOs. Final details will be provided to students in their first week of attendance in this course)

CILO	Class activities	Group project	Examination (2 hours)	Weighting	Remarks
CILO 1	5	5	10	20%	2
CILO 2	2	5	10	17%	2
CILO 3	1	5	5	11%	1
CILO 4	1	5	5	11%	1
CILO 5	1	20	20	41%	3
Total (%)	10%	40%	50%	100%	

Class activities:	Q&A, and group discussions. A scorecard will be used to measure how active a group will be in the class. For all the questions asked in the class, a score will be given.
Group project:	written report (90%) and presentation (10%). The distribution of the scores will be weight of assessment table.
Examination:	open book examination (2 hours).

For a student to pass the course, at least 30% of the maximum mark for the examination should be obtained.

Grading of Student Achievement:
Please refer to Grading of Courses in the Academic Regulations
This is a Continuing Education Fund (CEF) Approved Courses, to be eligible for reimbursement; students must achieve the following criteria;
- A minimum attendance rate of 75% (Students should sign on the attendance record for every lesson); and
- Grade C+ or above of the reimbursable course.

Part III
Keyword Syllabus:
- Introduction to entrepreneurship and entrepreneur
- Difference between traditional entrepreneurship and technological entrepreneurship
- Starting with a good idea via creativity
- Marketing basics
- Financing your business
- Planning fundamentals
- Preparation of business plan

Recommended Reading:

Coulter, Mary (2000) Entrepreneurship in Action, Prentice Hall, New York.

Dorf, R. C. and Byers, T. H. (2005) Technology Ventures: From Idea to Enterprise , McGraw Hill, Singapore.

Drucker, F. Peter (1985) Innovation and Entrepreneurship, Harper Business, New York

Jack M. Kaplan (2001) Getting started in entrepreneurship, New York : Wiley Smith, D (2006) Exploring Innovation, McGraw-Hill.

Wayne S. Brown & Roy Rothwell (1986) Entrepreneurship & technology: world experiences and policies Harlow, Essex, Eng. : Longman.

Zimmerer, Thomas W. & Norman M. Scarborough, (2005) Essential of Entrepreneurship and small business management (4th Ed.), Pearson Prentice Hall.

Related Links

Department of Manufacturing Engineering and Engineering Management

(2) CHUK: SEG 3600 Engineering Entrepreneurship

SEG 3600 Engineering Entrepreneurship

Entrepreneurship is about innovation: how to create value through new products or services, new technologies, business concepts, transaction mechanisms, etc. The purpose of this course is to explore the many facets of innovation and new venture creation, and the issues relating to the conceptualization, development and management of successful new ventures.

Course Objectives

The main learning objectives of this course are to:

1. Experience the process – develop and/or identify and pursue a business opportunity with a team of motivated peers,
2. Write a plan – develop a business plan for a new venture,
3. Analyze the issues – ponder the basic issues related to new ventures, the risks, challenges and rewards in innovation and new ventures.

The usefulness of the course to you depends on:

- the commitment of you and your team to your selected venture idea,
- the effort you and your team put into your project and how well you work together, and
- the overall sharing and discussion in the classes.

In other words, your dedication and participation are what makes the class worthwhile.

Class Times and Locations

SEG 3600 A:	Tues	2:30 pm to 3:15 pm	ERB 401
	Thurs	12:30 pm to 1:15 pm	ERB 401
SEG 3600 B:	Tues	3:30 pm to 4:15 pm	ERB 401
	Thurs	5:30 pm to 6:15 pm	ERB 401

Lecturer

Janny Leung	ERB 509	2609 8238	janny@se.cuhk.edu.hk

Tutors

Forest Kwan	ERB 711	2609 8461	clkwan@se.cuhk.edu.hk
Miranda Cheng	ERB 905	3163 4241	pcheng@se.cuhk.edu.hk
Kuo Yong Hong	ERB 615	2609 8335	yhkuo@se.cuhk.edu.hk
Katherine Chen	ERB 711	2609 8461	jychen@se.cuhk.edu.hk

Course Web-page: http://www.se.cuhk.edu.hk/~seg3600

Textbooks

Hisrich R.D., M. P. Peters and D.A. Shepherd, *Entrepreneurship,* 7th edition, 2008, McGraw-Hill.

Pinson, L., *Anatomy of a Business Plan,* 5th edition, 2001, Dearborn Trade Publishing, Chicago, USA.

References

Timmons, Jeffry A. and S. Spenelli, *New venture creation: Entrepreneurship for the 21st century* (7th Edition), 2007, Irwin/McGraw-Hill.

Cornwall, J.R., D.O. Vang and J.M. Hartman, *Entrepreneurial Financial Management: An Applied Approach*, 2004, Prentice-Hall.

Worthington, I. and C. Britton, *The Business Environment* (5th Edition), 2006, FT Prentice-Hall.

Assessment:

Class attendance and class participation	15 %
Preliminary venture idea proposal	20 %
Final	65 %

Class attendance (including arriving on-time) is a critical component in the course. Readings should be completed and cases analysed PRIOR to the class session indicated to facilitate discussion during the class. In a case discussion, you should be able to:

1. identify the key issues in the case, including problems and opportunities facing the entrepreneur,
2. articulate and evaluate alternative approaches to the problems, and
3. describe and justify a course of action that you recommend

You are expected to form a new venture team of 3 to 4 students. Each team will submit a Venture Idea Proposal which outlines the product/service to be developed. This proposal will give each team the chance to get an understanding of the size of the business opportunity and the effort required to develop the concept. This should be about 2-5 pages, and should explain the product/service and the business opportunity in detail. One hard copy should be submitted; one soft copy should also be submitted to *CUPIDE*. *A signed declaration of originality (see form at end of syllabus) should be attached to your hard-copy submission.* ***Marks will be deducted for late or non-submission of proposals.***

The Final Exam will be closed book. However, you will be allowed to bring ONE A-4 size sheet with notes (you may write on both sides) to assist you in your exam.

(3) PolyU: ISE376 Entrepreneurship and Innovation

8-24

Subject:	Entrepreneurship and Innovation		
Subject Code:	ISE376		
Co-requisite:	None	**Pre-requisite**	None
Level of Study:	3		

Hours Assigned:

Lecture	= 21 hrs
Tutorial/Seminar/Case Study/Laboratory	= 21 hrs
Total	= 42 hrs

Group Size: 30

Method of Assessment: The assessment will comprise of 100% continuous assessment.
The continuous assessment will comprise of components:

- Test and in-class participation
- Individual assignment on case studies
- Project report and presentation (group project but with individual effort)

Number of Credits: 3

Objectives:

1. To develop an awareness of the sources/processes of innovation
2. To develop an understanding of the managerial and technical processes the entrepreneur experiences in the innovative business
3. To appreciate the models and frameworks in analyzing an innovative business

Teaching and Learning Approach:

1. The teaching/learning approach blends lectures, cases, in-class activities.
2. Each session includes a number of readings (required/optional) pertaining to the theme of the session.
3. The class meetings are in a seminar format – group discussions and case studies.
   - Case discussion and in-class/project activities will take place against a background of conceptual material that is acquired through selected readings and brief lectures.
   - Readings can be taken from the textbook and leading academic publications in strategic management, economics and organization theory.

8-25

Learning Outcomes

It is expected to achieve the following outcomes upon completion of the subject:

1. To enable students to have an overview of types of innovation and its processes. (Objective 1, Syllabus item 1)
2. To enable students to have an overview about discovering entrepreneurial options, and the entrepreneurship process. (Objective 2, Syllabus item 2)
3. To enable students to learn the techniques involved in assessing industry context and the financing of entrepreneurs. (Objective 3, Syllabus item 3)
4. To enable students to gain a strategic and contemporary view of the intellectual property and intellectual capital involved in the management of innovative business. (Objective 2, 3; Syllabus item 4)

Syllabus:

1. Definitions and Types of Innovations:
   a. Technology vs. Business Innovation
   b. Types of Innovation: Product, Process, Marketing and Organizational Innovation
   c. Service Innovation and Business Models
2. Introduction to Entrepreneurship and Entrepreneur:
   a. Entrepreneurial Purpose
   b. Inventing Entrepreneurial Options
   c. The Entrepreneurship process
3. Understanding the Industrial context:
   a. Competitive analysis at the corporate level
   b. Financing of Technology-based Growth Company
4. Securing Innovation:
   a. Technology Transfer and Licensing
   b. Managing the Intellectual Property and Intellectual Capital

References:

1. Coulter, Mary (2000) Entrepreneurship in Action, Prentice Hall, New York.
2. Drucker, F. Peter (1985) Innovation and Entrepreneurship, Harper Business, New York.
3. Jack M. Kaplan (2001) Getting started in entrepreneurship, New York : Wiley.
4. Oslo Manual (2005). Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition, OECD.
5. Siu, Wai-sum; Martin, Robert G. (1992) Successful Entrepreneurship in Hong Kong, Long Range Planning; London, Vol. 25, no.6, pp.87-94.
6. Wayne S. Brown & Roy Rothwell (1986) Entrepreneurship & Technology : world experiences and policies Harlow, Essex, Eng. : Longman.

Appendix 3. Questionnaire Survey on Entrepreneurship Education for Engineering Students

This questionnaire is designed to access the impact of entrepreneurship education on the entrepreneurial intentions of engineering students. Attitudes of the students toward entrepreneurship and the learning from the entrepreneurship course are measured. This questionnaire is anonymous and there is no right or wrong answer to the questions. Please indicate your answers to each of the questions.

Section 1. Attitudes of Students toward Entrepreneurship (Please select only one choice)

Code	To what extent do you agree or disagree with the following statements?	Strongly disagree – Strongly agree						
Att1	I'd rather be my own boss than have a secure job.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Att2	I can make big money only if I create my own business.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Att3	I'd rather create a new firm than be the employee of an existing one.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Sn1	I believe that my family thinks that I should pursue a career by creating my own business.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Sn2	I believe that my closest friends think that I should pursue a career by creating my own business.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Sn3	I believe that other people who are important to me think that I should pursue a career by creating my own business.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Pbc1	If I start my own business, the chances of success would be very high.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Pbc2	I have enough knowledge and skills to start a business.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Pbc3	I am capable to develop or handle an entrepreneurial project.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Int1	I will join on-campus entrepreneurial programs/activities which assist students in creating own business if available.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Int2	I will start my own business after graduation in the future.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Int3	I will work together with good partners to start a new business in the future.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Int4	I will start my own business if financial support is secured	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

Section 2. Entrepreneurship Education

Code	To what extent do you agree or disagree with the learning from the entrepreneurship course?	Strongly disagree – Strongly agree						
Ky1	The entrepreneurship course increases my understanding of the attitudes of entrepreneurs (i.e., how they view entrepreneurship and why they act).	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Ky2	The entrepreneurship course increases my understanding of the importance of entrepreneurship to both the society and individuals.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Ky3	The entrepreneurship course increases my understanding of the personal characteristics of entrepreneurs (e.g., risk-taking, innovation, etc.).	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Ky4	The entrepreneurship course gives me a sense that entrepreneurship is achievable.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

Code	To what extent do you agree or disagree with the learning from the entrepreneurship course?	Strongly disagree – Strongly agree						
Ky5	The entrepreneurship course increases my understanding of the motives of engaging in entrepreneurial activities (e.g., money, self-achievement, social status, etc.).	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kwa1	The entrepreneurship course increases my understanding of generating innovative ideas.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kwa2	The entrepreneurship course increases my understanding of environmental assessment of entrepreneurial ventures.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kwa3	The entrepreneurship course increases my understanding of financial preparation for entrepreneurial ventures.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kwa4	The entrepreneurship course increases my understanding of planning a business.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kwa5	The entrepreneurship course increases my understanding of market research for entrepreneurial ventures.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kwo1	The entrepreneurship course enhances my ability to develop networks (e.g., obtaining useful advice/information from professors, guest speakers or classmates).	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kwo2	The creative atmosphere in the entrepreneurship class inspires my entrepreneurial mind.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kwo3	Views of the professor inspire my entrepreneurial mind.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kwo4	Views of external speakers inspire my entrepreneurial mind.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kow5	Successful stories of local entrepreneurs inspire my entrepreneurial mind.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kwo6	The entrepreneurial experience of the entrepreneurs enhances my understanding of the entrepreneurial process.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kh1	The entrepreneurship course enhances my skills to develop a business plan.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kh2	The course enhances my skills to handle an entrepreneurship project.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kh3	The entrepreneurship course enhances my skills to deal with the risks and uncertainties.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kh4	The entrepreneurship course enhances my skills to allocate resources (e.g., money, personnel, time etc.).	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
Kh5	The entrepreneurship course enhances my ability to identify a business opportunity.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐

Section 3. Background Information

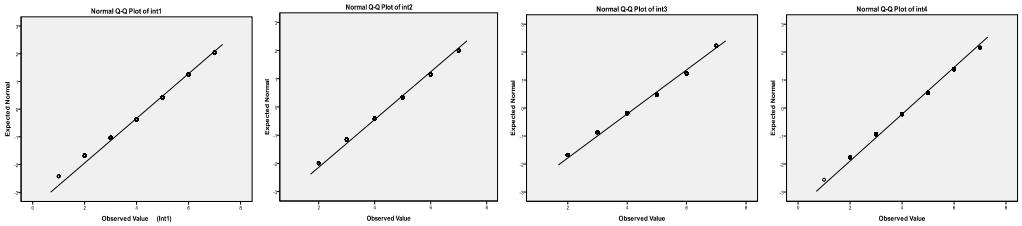
D1. Gender: 1) Male ☐, 2) Female ☐.
D2. Your age: 1) <20☐, 2) 20-22☐, 3) 23-25☐, 4) >25.
D3. Year of study: 1) Year 1☐, 2) Year 2☐, 3) Year 3☐, 4) Other:
D4. Work experience
a) <1 year☐, b)1-<2 years☐, c)2-<3 years☐, d) >=3 years☐.
D5. Exposure to role model
Have your parents or friends ever started a business? 1) Yes ☐ 2) No ☐

All data collected will be kept confidential and used for the research purpose only.
Thank you very much for your help!

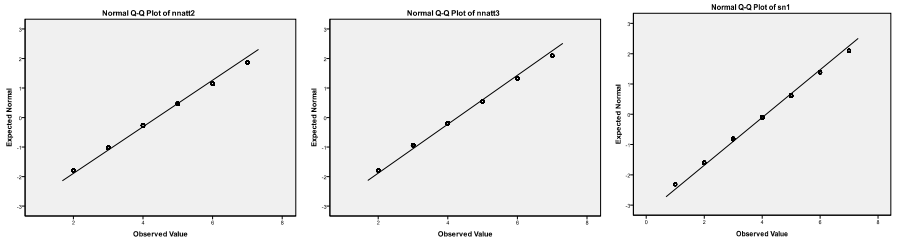
Appendix 4. The Q-Q Plots of the Variables

(1) Entrepreneurship group data

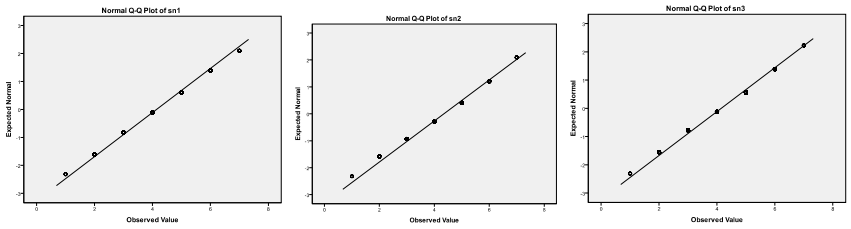
Entrepreneurial intention: int 1-int4



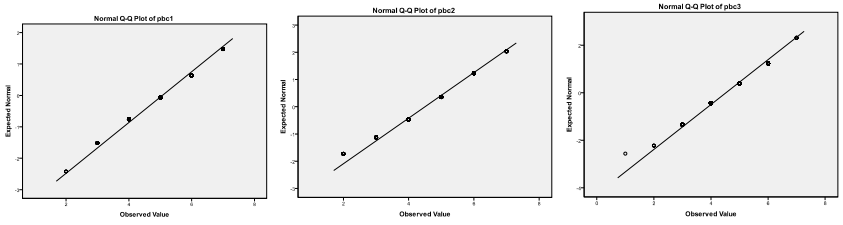
Attitude toward entrepreneurship: att1-att3



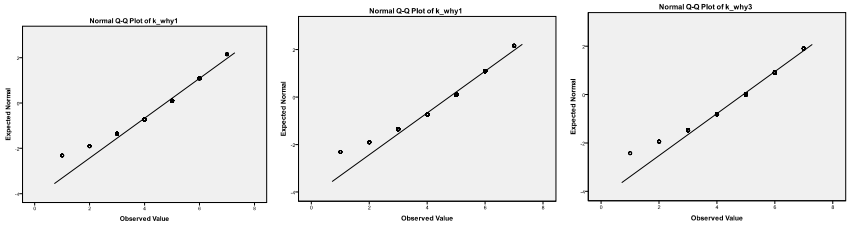
Subjective norm: sn1-sn3

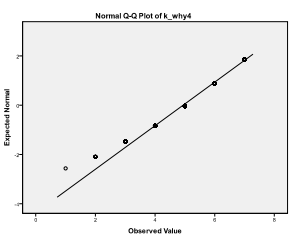


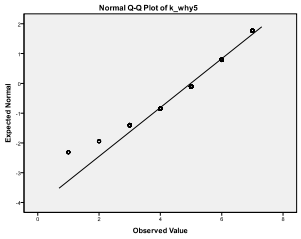
Perceived behavioral control: pbc1-pbc3



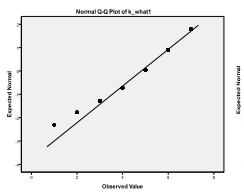
Know-why: why1-why5

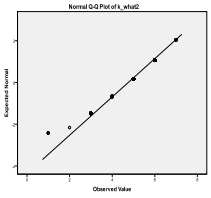


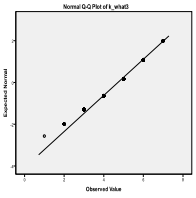


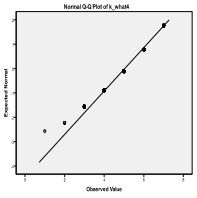


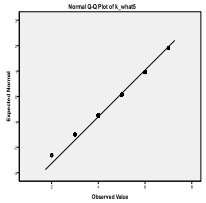
Know-what: what1-what5



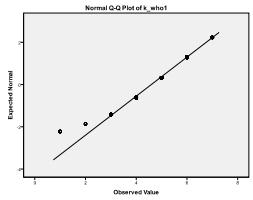


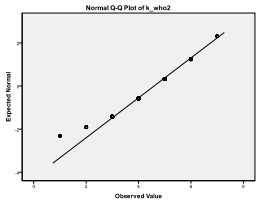


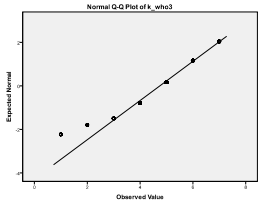


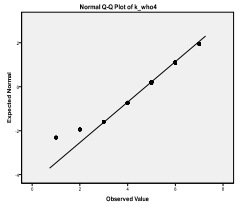


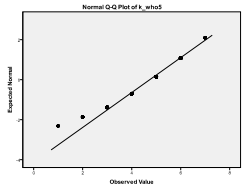
Know-who: who1-who6

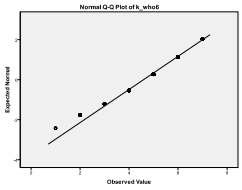




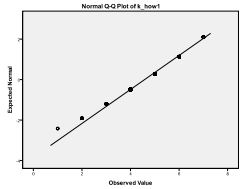


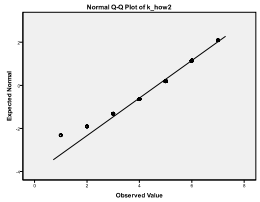


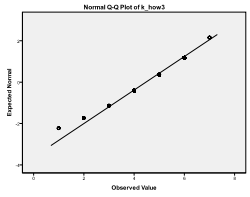


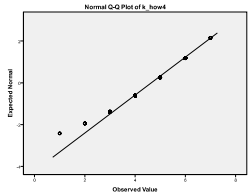


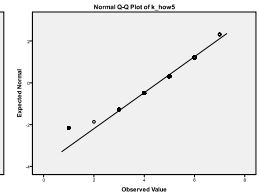
Know-how: how1-how5





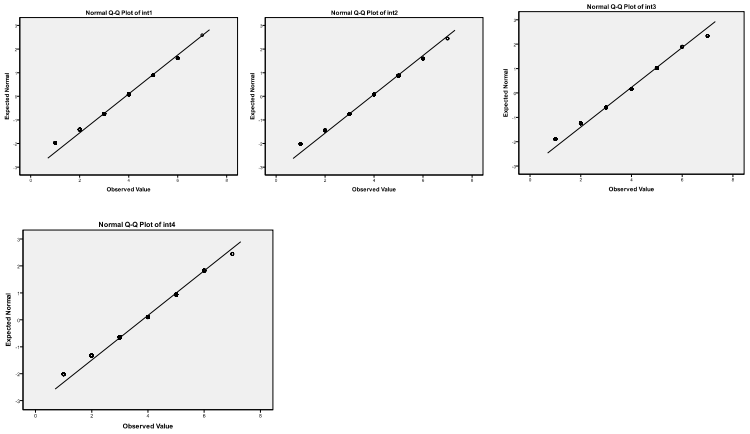




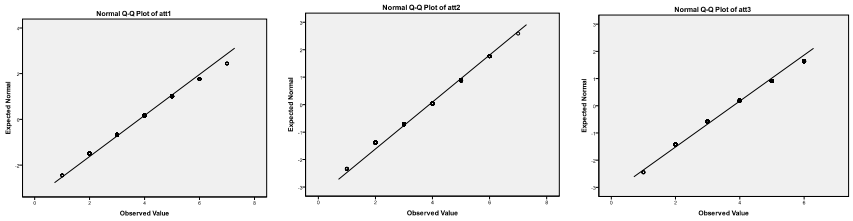


(2) Control group data:

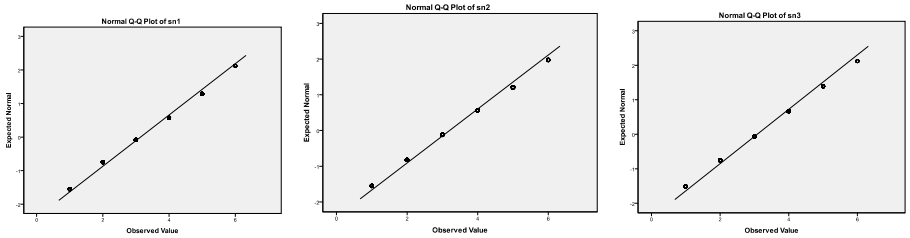
Int1-Int4:



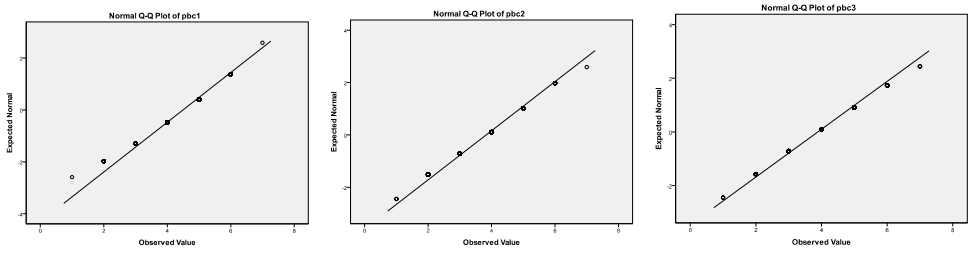
Att1-att3:



Sn1-Sn3:



Pbc1-Pbc3:



Appendix 5. Inter-item Correlation Matrix

(1) Entrepreneurship group (n=201) (all significant at $p<0.01$)

Entrepreneurial intention

	int1	int2	int3	int4
int1	1.000	.639	.650	.628
int2	.639	1.000	.695	.628
int3	.650	.695	1.000	.687
int4	.628	.628	.687	1.000

Attitude toward entrepreneurship

	att1	att2	att3
att1	1.000	.598	.664
att2	.598	1.000	.607
att3	.664	.607	1.000

Subjective norm

	sn1	sn2	sn3
sn1	1.000	.686	.695
sn2	.686	1.000	.723
sn3	.695	.723	1.000

Perceived behavioral control

	pbc1	pbc2	pbc3
pbc1	1.000	.474	.524
pbc2	.474	1.000	.605
pbc3	.524	.605	1.000

Know-what

	k_what1	k_what2	k_what3	k_what4	k_what5
k_what1	1.000	.513	.346	.530	.500
k_what2	.513	1.000	.589	.542	.635
k_what3	.346	.589	1.000	.605	.525
k_what4	.530	.542	.605	1.000	.621
k_what5	.500	.635	.525	.621	1.000

Know-why

	k_why1	k_why2	k_why3	k_why4	k_why5
k_why1	1.000	.790	.632	.563	.456
k_why2	.790	1.000	.678	.605	.516
k_why3	.632	.678	1.000	.535	.566
k_why4	.563	.605	.535	1.000	.581
k_why5	.456	.516	.566	.581	1.000

Know-who

	k_who1	k_who2	k_who3	k_who4	k_who5	k_who6
k_who1	1.000	.508	.569	.594	.556	.534
k_who2	.508	1.000	.640	.544	.496	.505
k_who3	.569	.640	1.000	.684	.578	.584
k_who4	.594	.544	.684	1.000	.657	.560
k_who5	.556	.496	.578	.657	1.000	.623
k_who6	.534	.505	.584	.560	.623	1.000

Know-how

	k_how1	k_how2	k_how3	k_how4	k_how5
k_how1	1.000	.666	.542	.581	.684
k_how2	.666	1.000	.633	.613	.602
k_how3	.542	.633	1.000	.711	.546
k_how4	.581	.613	.711	1.000	.588
k_how5	.684	.602	.546	.588	1.000

(2) Control group (n=210) (all significant at $p<0.01$)

Entrepreneurial intention

	int1	int2	int3	int4
int1	1.000	.583	.508	.508
int2	.583	1.000	.537	.470
int3	.508	.537	1.000	.708
int4	.508	.470	.708	1.000

Attitude toward entrepreneurship

	att1	att2	att3
att1	1.000	.551	.608
att2	.551	1.000	.632
att3	.608	.632	1.000

Subjective norm

	sn1	sn2	sn3
sn1	1.000	.553	.607
sn2	.553	1.000	.633
sn3	.607	.633	1.000

Perceived behavioral control

	pbc1	pbc2	pbc3
pbc1	1.000	.546	.519
pbc2	.546	1.000	.639
pbc3	.519	.639	1.000

(3) All group (n=411) (all significant at $p<0.01$)

Entrepreneurial Intention

	int1	int2	int3	int4
int1	1.000	.636	.603	.588
int2	.636	1.000	.639	.571
int3	.603	.639	1.000	.711
int4	.588	.571	.711	1.000

Attitude toward entrepreneurship

	att1	att2	att3
att1	1.000	.602	.657
att2	.602	1.000	.637
att3	.657	.637	1.000

Subjective norm

	sn1	sn2	sn3
sn1	1.000	.673	.695
sn2	.673	1.000	.723
sn3	.695	.723	1.000

Perceived behavioral control

	pbc1	pbc2	pbc3
pbc1	1.000	.555	.571
pbc2	.555	1.000	.658
pbc3	.571	.658	1.000

List of Publications

Journal papers:

Sun, H., Chow, A., & Lo, C. (2008). Rapid Commercialization of Acquired Innovations: A Collaborative Model Based on Case Studies in Chinese Companies. *International Journal of Innovation and Technology Management , 5* (3), 363-379.

Lo, C., & Sun, H. (2010). The Influence of Entrepreneurship Education on Entrepreneurial Intention of Engineering Students. *US-China Education Review (accepted).*

Leung, K., Lo, C., Sun, H., & Wong, K. (2010). Factors Influencing Engineering Students' Intention to Participate in On-Campus Entrepreneurial Activities. *Journal of Entrepreneurship Education (accepted).*

Lo, C., Chan, H., Sung, H., & Nanthavanij, S. (2006). Fuzzy clustering analysis for color associations of Hong Kong Chinese, Korean, and Thai subjects. *Asian Journal of Ergonomics , 7* (1 & 2), 29-40.

Lo, C., & Sun, H. (2010). The Empirical Relationship among Personal Characteristic and Entrepreneurial Intentions of Engineering Students. *Technovation (3rd revision).*

Lo, C., & Sun, H. Systematic Influence of Personal Characteristics Entrepreneurial Intention: Implications for Entrepreneurship Education. *Journal of Applied Psychology (under review).*

Conference papers:

Lo, C., & Ho, K. (2005). Product Design Features for the Needs and Feelings of People. In A. Thatcher, J. James, & A. Todd (Ed.), *CybErg 2005. The Fourth International Cyberspace Conference on Ergonomics.* Johannesburg: International Ergonomics Association Press.

Lo, C., & Sun, H. (2008). An Empirical Study on Entrepreneurial Intention of Engineering Students: Implications for Entrepreneurship Education. *ICSTEP'08 (International Conference on Science, Technology and Education Policy).* Zhejiang, China, October 23-25.

Lo, C., & Sun, H. (2010). The Influence of Entrepreneurship Education on Entrepreneurial Intention of Engineering Students. *IntEnt Conference 2010 (Internationalizing Entrepreneurship Education and Training).* Arhem, the Netherlands, July 5-8.