



To Start or Not: Impact of Engineering Students' Engagement in Entrepreneurship Competitive Activities on their Entrepreneurial Intentions

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Work-In-Progress

To Start or Not: Impact of Engaging in Technological Innovation and Entrepreneurship Competitive Activities on Engineering Students' Entrepreneurial Intention

Abstract: An increased number of technological innovation and entrepreneurial competitive activities have been organized in engineering schools and beyond to raise students' entrepreneurial awareness and cultivate relevant skills. In this study, a mixed method research based on Planned Behavior Theory is being used to explore the outcomes of innovation and entrepreneurial competitions, in particular the influence of engaging in these competitive activities on engineering students' entrepreneurial intention. This work-in-progress first reports the construction of a customized survey, in particular the process of identifying the specific activities in the context of innovation and entrepreneurship competitions that may be relevant when exploring students' entrepreneurial intention. Next, the report proposes hypotheses of possible pathways of how the constructs of PBT may have an impact on engineering students' entrepreneurial intention for later verification.

Introduction

Innovation and entrepreneurship, as major driver and new engine for economic development and growth, have been regarded as critical by countries around the world to facilitate national economic transformation and upgrading as well as international competitiveness [1]. Accordingly, world-class universities devote to cultivating innovative and entrepreneurial talents and current innovation and entrepreneurship education possesses the characteristic of "technology-led, project-based team learning, close ties with the industry". To name a few, Stanford University launches Stanford Technology Ventures Program (STVP), providing customized entrepreneurship courses for engineering students according to their education level, which are given by both school and industry mentor [2]. Technical University of Munich, a paragon of European entrepreneurial universities, sets up UnternehmerTUM and Start TUM to provide students with comprehensive guidance on the whole process of their starting a business, such as providing hands-on entrepreneurship training, basic equipment for producing product prototypes in their start-up period [3]. Numerous School of Entrepreneurship and Innovation have been established in China to undertake specialized entrepreneurial teaching and practice activities, including offering entrepreneurship minor curriculum minor, organizing innovation and entrepreneurship clubs and enterprise practice, holding various innovation and entrepreneurship competition, providing incubator and mentor resources [4]. Amongst the different initiatives and learning activities of innovation and entrepreneurship education, technological innovation and entrepreneurship competitions (TIECs) appear to draw much attention because of its competitive nature and the promising goal of motivating engineering students' entrepreneurship behaviors [5]. Prior research also pointed out that entrepreneurship-oriented competitive activities was useful to increase students' employability [6], professional ethics [7], skills for writing a business plan [8] and the like. Despite of the promotion of these educational efforts, however, the impact of TIECs

on engineering students' entrepreneurship intention and behaviors, remain scarcely answered. Entrepreneurial intention, as the prerequisite and the best prediction of entrepreneurial behavior, have an important impact on actual entrepreneurial behavior. This research focuses on engineering students' entrepreneurial intention and sets out to explore the impact of engagement in TIECs on their entrepreneurial intention. This study aims to examine two research questions: 1) In the context of TIECs, what are the factors that affect the entrepreneurial intention of engineering students? and, 2) What are the specific learning experiences in TIECs that affect engineering students' entrepreneurial intention? A mixed-method study based on Planned Behavior Theory (PBT) is being proposed to explore the outcomes of TIECs, in particular, the influence of engaging in such competitive activities on engineering students' entrepreneurial intention.

Literature Review

At present, scholars have studied the various factors that affect students' entrepreneurial intention. Such factors can be grouped into three arenas: personality characteristics [9],[10] demographics factors [11]-[18], and environmental factors [19]-[27].

As for personality characteristics factors, Fan and Wang (2004) examine the relationship between the Big Five Personality and entrepreneurial intention. The result show that people with traits of openness, conscientiousness and extraversion are more likely to start up business [9]. Li (2010) believes that proactive personality is a reasonable predictor of entrepreneurial intention. To be specific, the personality characteristics of strong willpower, perfect tendency and accurate opportunity recognition significantly drive college students' entrepreneurial intention [10]. A number of demographic background factors were also found to matter in students' entrepreneurial intention, such as gender [11]-[13], education background [14],[15], family background [13], [16], academic achievements in school [17],[18]and the like. What's more, environmental factors, including entrepreneurship policy [19], entrepreneurship education [20]-[23] and entrepreneurial role model [24]-[26] are also been proved to have significant impact on individuals' entrepreneurial intention.

Among all of these influence factors, entrepreneurship education stands as one of the promising factors that can be intervened by colleges and industries. In order to improve students' entrepreneurial intention and stimulate students' entrepreneurial behavior, universities all over the world actively conduct various entrepreneurship education activities and a number of scholars have studied the impacts of entrepreneurship education on students' entrepreneurial intention. For example, Efrata et al. (2016) find that entrepreneurship education can affect students' self-perception of their entrepreneurial ability, which indirectly affects students' entrepreneurial intention [21]. By conducting pretest-post-test towards 452 science and engineering students from UK and France, Souitari et al. (2007) found that participations in entrepreneurship programs can promote students' entrepreneurial attitudes and intention by improving students' understanding of entrepreneurship knowledge, motivating entrepreneurial inspiration and providing students with entrepreneurial resource [22].

Despite the prior explorations of the impact of entrepreneurship education on students' entrepreneurial intention, few studies have examined the impact of the TIECs, particularly on engineering students. One such exception is that Huang (2017) conducted quantitative survey on students who participated in "Creation Youth" National University Student Entrepreneurship Competition, and found that entrepreneurship practice education including entrepreneurship competitions had significant positive impacts on mediating variable of entrepreneurial self-efficacy and therefore can improve college students' entrepreneurial intention [23]. Although the prior study has proven the promoting effect of entrepreneurial competition on entrepreneurial intention, it remains to explore which specific learning experiences in entrepreneurship competitions function. This current study shall continue to explore the specific impact of engaging in TIECs on engineering students' entrepreneurial intention.

Methodology

Theoretical Framework

Built upon the prior series of studies on behavioral intention, which was considered as the direct factor for actual behavior, Ajzen(1985) developed the Planned Behavior Theory which contended that individual planned behavior was influenced by both personal willingness and perception of behavior' complexity and controllability [27]. Since its proposal, PBT has been widely applied to explore entrepreneurial behaviors [28],[29]. Entrepreneurial Intention Model Based on PBT (Table 1), one of the most widely used entrepreneurial intention (EI) model, held that individual's possibility and intention to realize entrepreneurial behaviors are influenced by interactions of three dimensions: Attitude toward Entrepreneurship (AE), Subjective Norm (SN) and Perceived Behavior Control (PBC) [28], whose applicability has been verified by a large number of empirical studies. For example, Ratanavimolchai (2009) used PBT to conduct an empirical study on the impact factors that were associated with the entrepreneurial intention among college students in Thailand. The results suggested that all three dimensions of PBT, that is, AE, SN and PBC, had positive and significant impacts on the entrepreneurial intention of Thai college students [20]. Meanwhile, Mo (2009) also identified some direct and indirect impact of dimensions the PBT on the entrepreneurial intention in the context of Chinese culture [30].

TABLE1 DEFINITIONS OF ENTREPRENEURIAL INTENTION MODEL BASED ON PLANNED BEHAVIOR THEORY

Dimension	Definition
Attitude toward Entrepreneurship	Individual judgment and evaluation of entrepreneurial behavior results.
Subjective Norm	Individuals' perceptions of society, environment and important people' attitude towards their entrepreneurial behavior.
Perceived Behavior Control	Individuals' perception of difficulty degree of entrepreneurial behavior and own self-control towards entrepreneurship.

Survey Construction

This study constructed a survey instrument, which consists of three parts, that is, the scales of PBT (AE, SN, and PBC) and items for EI, prior experiences of participating in TIECs; and demographic information.

In the first part, survey was compiled on the basis of referring to a number of previous quantitative surveys [18], [30]-[35] which was framed in the context of PBT (Table 2). A Five-point Likert scale was used (“Strongly disagree”, “Disagree”, “uncertain”, “Agree”, “Strongly agree” or “Not at all”, “Only a little”, “uncertain”, “Somewhat”, “A great deal”). Beta-testing was conducted to further modify the wording of survey items.

TABLE 2 SAMPLE ITEMS FOR ENTREPRENEURIAL INTENTION AND EFFECT FACTORES SUBSCALE

Dimension	Sample Items	Source
AE	Being an entrepreneur implies more advantages than disadvantages to me.	Liñán et al. [31] (2009)
	Being an entrepreneur can make me focus on a technology that interests me.	Duval-Couetil et al. [33] (2012)
	Being an entrepreneur can have more flexibility and Independence.	
	Being an entrepreneur can solve a social problem.	
	Being an entrepreneur can create and accumulate capital and wealth for me.	Wang, Bo, Lei [18] (2016)
SN	If I decided to create a firm, my close family would approve of that decision.	Liñán et al. [31] (2009)
	If I decided to create a firm, my friends would approve of that decision.	
	When I consider whether to create a firm, I will be largely influenced by the views of important people around me (such as my family, friends, classmates and teachers).	Mo [30] (2009)
	Current economic development situation and trends are conducive to entrepreneurship.	Wang, Bo, Lei [18] (2016)
	My college take measures to encourage and support students to start their own businesses (such as providing office space, mentors, financing channels and entrepreneurial education).	
PBC	I am prepared to start a viable firm.	Liñán et al. [31] (2009)
	I can control the creation process of a new firm.	
	I know the steps needed to place a financial value on a new business venture.	Lucas et al. [35] (2009)
	I can design and build something new that performs very close to your design specifications.	
	To what extent do you agree with the following statements regarding your entrepreneurial ability? · Ability to identify and bear risks. · Ability to cope with setbacks or difficulties. · Creative spirit and creativity. · Ability to identify and seize entrepreneurial opportunities accurately.	Li, Fan, Li [34] (2012)

Entrepreneurial Intention	I am ready to do anything to be an entrepreneur. My professional goal is to become an entrepreneur. I will make every effort to start and run my own firm. I have very seriously thought of starting a firm.	Liñán et al. [31] (2009)
	Compared to being hired by others, I prefer to start my own business.	Revise on Kolvereid [32] (1996)

In the second part, survey items were compiled concerning specific activities in TIECs. Such activities were developed through five semi-structured interviews (Table 3) with engineering students who had prior experiences in such competitive activities. Sample interview questions included, “Could you review the process of your participation in x competition?”; “What different stages/components were included in the competition? What did you do in that stages?” Such questions were asked to gain an understanding about detailed activities and modules in their competition experiences. Through analysis of these interviews, a number of specific activities in TIECs were acquired, such as writing project application or business plan, demand analysis and market research for a new product or technology, prototype production, commercial value evaluation, roadshow and the like (Table 4). Students’ frequency of engagement in these detailed activities were rated on a Four-point Likert scale (“Never”, “Seldom”, “Sometimes”, and “Often”).

TABLE 3 INFORMATION OF INTERVIEWEES HAVING EXPERIENCE IN INNOVATION AND ENTREPRENEURSHIP COMPETITIONS

Interviewee	Major	Grade	Participated Competitions
Brant	Mechanical Engineering	Senior	<ul style="list-style-type: none"> • China College Students’ ‘Internet plus’ Innovation and Entrepreneurship Competition; • China-US Young Maker Competition; • University Student Technology Innovation Competition ; • National University Student Mechanical Innovation and Design Competition
Daniel	Mechanical Engineering	Senior	<ul style="list-style-type: none"> • China-US Young Maker Competition; • University Student Technology Innovation Competition
Tony	Mechanical Engineering	Junior	<ul style="list-style-type: none"> • University Student Business Plan Competition; • National University Student Science Contest on Energy Saving & Emission Reduction
Justin	Mechanical Engineering	Junior	<ul style="list-style-type: none"> • National Undergraduate Curricular Academic Science and Technology Works by Race; • National University Student Science Contest on Energy Saving & Emission Reduction
Robin	Naval Architecture and Ocean Engineering	Senior	<ul style="list-style-type: none"> • Innovation and Entrepreneurship Training Program for College Students

TABLE 4 SPECIFIC ACTIVITIES IN TIECs ACQUIRED THROUGH INTERVIEWS

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- Writing project application or business plan;
 - Demand analysis and market research for a new product or technology;
 - Risk assessment;
 - Feasibility analysis;
 - Experimental test;
 - Prototype production;
 - User acceptance testing;
 - Application for technology patent or intellectual property protection;
 - Application and popularization value analysis;
 - Economic benefit forecast;
 - Marketing strategy analysis;
 - Commercial value evaluation (approval and evaluation of the products by investors or senior experts in the same field);
 - Project defense ;
 - Roadshow;
 - Fundraising (seeking investors or sponsors);
 - Teamwork with members from the same discipline;
 - Teamwork with members from different disciplines;
 - Seeking help from senior schoolmates or others who have successful TIECs experiences;
 - Seeking help from intramural mentors;
 - Seeking help from enterprise mentors;
 - Communication with judges of the competition;
-

Third, items were designed to obtain students' demographic information, such as gender, academic performance, prior experiences in entrepreneurship education and so on.

Hypothesized Model

Base on the literature review and prior studies as related to PBT [28],[29] the following hypotheses were proposed in this study to be further verified.

H1: Participation in TIECs is positively associated with students' self-reported EI.

H2a: Students' attitude toward entrepreneurship will positively affect their Entrepreneurial Intention.

H2b: Students' perception of Subjective Norm will positively influence their Entrepreneurial Intention.

H2c: Students' Perceived Behavior Control will positively impact their Entrepreneurial Intention.

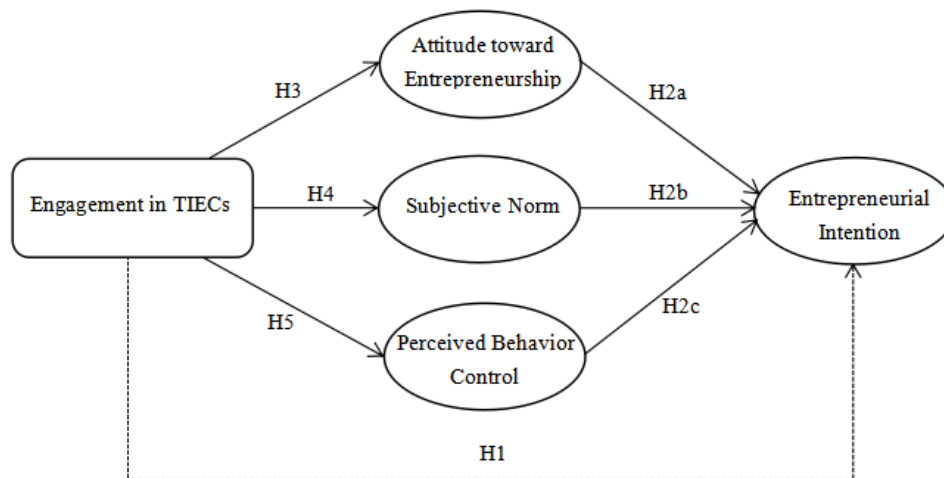
H3: Students' engagement in TIECs is positively associated with students' enhancement of Attitude toward Entrepreneurship (AE).

H4: Students' engagement in TIECs is positively associated with students' perception of Subjective Norm (SN).

H5: Students' engagement in TIECs is positively associated with students' Perceived Behavior Control (PBC).

In general, the hypothesized model and the relationships between various constructs is shown in Figure 1.

FIGURE 1 HYPOTHESIZED MODEL



Future Work

Next, this study will further examine structural validity of the survey via exploratory and confirmatory factor analyses. The survey will then be administered to engineering students from a research-intensive leading university. In addition to the survey, thirty semi-structured interviews will also be conducted to together explore the impact of engaging in TIECs on engineering students' entrepreneurial intention. We expect that such an exploration of how engaging in technological innovative and entrepreneurship competitive activities affects students' entrepreneurial intention can facilitate multiple stakeholders to design and adopt suitable activities in such competitions for engineering students via a quantitative study and then semi-structured interviews aimed at students who have experienced in such competitions to further explore specific learning experiences influencing students' entrepreneurial intention.

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