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A study of the entrepreneurship of Taiwanese youth by the Chinese Entrepreneur Aptitude Scale

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Abstract

Purpose – The purposes are as follows. First, this paper aims to explore the reliability and validity of the Chinese Entrepreneur Aptitude Scale (CEAS) and to establish a normative score among surveyed students. Second, this paper seeks to compare the scaling scores differences between the genders, departments, and classes in the sample. Finally, this paper aims to compare the student sample's CEAS results with models of Taiwanese entrepreneurial youth.

Design/methodology/approach – Completed questionnaires from 1,053 students from the Transworld Institute of Technology in Taiwan and the CEAS, constructed by Chen and Wu, formed the basis of the empirical analysis.

Findings – This paper tests the performance of the CEAS for Taiwanese students at a technological institute that puts entrepreneurial education into practice. The results match those of Chen and Wu, which used qualitative methods to conduct a content analysis of the biographies of models of entrepreneurial youth in Taiwan. Both groups rank high in autonomy and self-discipline, indicating that entrepreneurial models and potential entrepreneurs have a high sense of mission and responsibility to society. And, this paper finds significant differences between the two groups; the entrepreneurial models rate higher overall on CEAS constructs than the institute students. In particular, the sample students score low on social networking, indicating that the undergraduates lack social and networking experience.

Originality/value – The main contribution of this paper has been to test the applicability of the CEAS in Taiwanese Institute of Technology students, including comparisons between genders, grades, and colleges. The results offer insights for institutes and universities seeking to improve their entrepreneurial education offerings. Moreover, the results offer lessons for fostering entrepreneurial abilities and behavioral traits in undergraduates.

Keywords Entrepreneurialism, Youth, Taiwan, China

Paper type Research paper

Introduction

In the age of the knowledge economy, elevating entrepreneurship and improving domestic innovation systems are the keys to promote a country's productivity, competitiveness, and economic growth. Nations have made it a priority to support entrepreneurial ideas, policies, services, and laws in the service of building a developmental environment. In recent years, the Taiwanese Government has particularly made vigorous efforts to improve the domestic environment for entrepreneurship. Toward this end, it has

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implemented the Asia-Pacific Entrepreneurial Center Plan and the Project for the Realization of Entrepreneurial Dreams, which focused on providing services, training, and funding for business startups (Wang, 2005).

Audretsch and Thurik (2001) documented the fundamental shift that was taking place in the Organization for Economic Co-operation and Development countries. It pointed out that improved economic growth rates plus reduced unemployment rates were accompanied by greater entrepreneurial activity within a country, and vice versa. Entrepreneurial activities foster economic growth through innovation, reform, and knowledge spillover. Therefore, every dominant country or regional economic organization values policies that promote enterprise startups, such as reforming labor and capital markets; reducing governmental controls and administrative barriers; adopting competitive policies for new enterprises, special plans, and services for helping startups; and enhancing the teaching of entrepreneurship in educational systems.

With the rise of the entrepreneurial economy, the issue of entrepreneurial management has attracted a great deal of attentions from academics and practitioners. Within academia, entrepreneurial education and research have become a fundamental training. Elucidating complex entrepreneurial phenomena with tested theories and cultivating an entrepreneurial spirit within motivated students through well-designed instruction infuses strength into the innovation and entrepreneurial activities of Taiwan. Numerous signs indicate that the Taiwanese people are eager for such knowledge: more and more Taiwanese universities have set up entrepreneurial programs, the Taiwanese Government has increasingly encouraged entrepreneurial education, and countless books have been published on entrepreneurial experience. Nonetheless, the development of entrepreneurial study in Taiwan remains in its infancy (Tsai *et al.*, 2007). The goal of entrepreneurial education is to cultivate future entrepreneurs and to develop students' entrepreneurial spirit such that they will be motivated to develop a business, enterprise, or other form of commerce (Chou, 2005). While not all students will start up a business immediately after graduation, this type of education plants an entrepreneurial seed and helps them perform in future occupations. Smith (2003) has mentioned that the ability to start an enterprise would somehow become essential for students in vocational schools in the future.

For practitioners, due to high level of competition in global markets and an ever-shortening product life cycle, entrepreneurial survival depends upon how to rapidly respond to the environment and to innovate continuously. Highly flexible new ventures have increased sharply because of the growing variety and new demands of markets (Dollingers, 2003). Various types of entrepreneurship have emerged and become enormously popular (Liu and Hsieh, 2006). Individuals who have an entrepreneurial spirit are no longer content to simply be on a payroll. To understand the importance of entrepreneurship in Taiwanese society, consider the popular Chinese motto: "It's better to be the head of a dog than the tail of a lion." The desire to be a boss is quite widespread in Taiwanese society. Moreover, entrepreneurship is no longer an exclusive advantage of experienced workers. As more students graduated with the goal of starting their own enterprises, Taiwanese entrepreneurs are becoming younger and younger. Small and medium enterprises now constitute the majority of Taiwan's businesses, and entrepreneurship lies at the heart of these enterprises.

McDougall and Oviatt (1997) suggested that entrepreneurs play a vital role in producing economic growth because they accelerate the generation, dissemination, and

application of innovative ideas. Can people be taught to be entrepreneurs? Traditionally, entrepreneurial drive and success have been viewed as rooted in individual motivation and talent. Some researchers, however, believed that entrepreneurship is an ability that can be cultivated. What factors determine entrepreneurial success or failure? Scholars and professionals have expressed differing opinions on this issue. However, a review of past literatures suggested that entrepreneurs' personalities play a crucial role in the entrepreneurial process (Doutriaux, 1992). Because personality traits such as persistence and consistency deeply influence personal behaviors, understanding and assessing entrepreneurial personalities can offer advice to help coach prospective entrepreneurs to choose their careers and begin their businesses.

To analyze the characteristics of Chinese entrepreneurs, Chen and Wu (2007) have constructed the Chinese Entrepreneur Aptitude Scale (CEAS), the reliability and construct validity of the instrument were relatively high. That study pointed out that the four conceptual constructs can be successfully used in analyzing Chinese entrepreneur's characteristics. The major findings regarding Chinese entrepreneurs were consistent with research on Western entrepreneurs, with one significant exception: Chinese entrepreneurs placed more emphasis than Western entrepreneurs on business ethics and social responsibility.

The primary goal of this paper is to determine how students at the University of Science and Technology in Taiwan, which emphasizes entrepreneurial education, perform on the CEAS. Empirical data are collected from Transworld Institute of Technology in Taiwan. Further analysis will consider whether students with different genders, grades, and courses perform differently on the CEAS. Finally, samples from this research will be compared with the CEAS performance by the model of Taiwanese entrepreneurial youth as studied by Chen and Wu (2007).

Literature review

Entrepreneurs and entrepreneurship

The first formal theory of entrepreneurship was developed by Richard Cantillon in 1725. He defined entrepreneurship as self-employed persons, and bearing the risk of buying at certain prices and selling at uncertain prices. Later, in 1803, the definition of entrepreneurship was broadened to include the concept of bringing the factors of production together. "An entrepreneur transfers resources from locations in which resources relatively abundant to locations with scare resources," wrote the eighteenth-century French economist J.B. Say (Stevenson *et al.*, 2000, p. 4). As societies and the fundamentals of business administration evolved over the next three centuries, scholars failed to reach agreement on a definition of entrepreneurship (Brockhaus, 1981), instead taking a broad perspective (Wartman, 1987). Bygrave and Hofer (1991) regarded entrepreneurs as people who can recognize opportunities and follow through on creating new business organizations. Others have viewed entrepreneurs as playing a critical role in enhancing a firm's productivity and helping it recover from an economic slump (Drucker, 1985; Liu, 2002). Entrepreneurship also has been described as the chief engine of innovation (Drucker, 2002).

In recent years, scholars have focused the study of entrepreneurship on starting new businesses, which has lent greater consistency to entrepreneurship as a concretely study concept (Chen and Wu, 2007). Most scholars have commended the economic development contributions of entrepreneurs, whose entrepreneurial behavior has

commonly been attributed to personalities and behavioral traits. Lumpkin and Dess (1996) further divided entrepreneurship into five indicators:

(1) autonomy;
(2) innovativeness;
(3) risk-taking;
(4) proactiveness; and
(5) competitive aggressiveness.

More specifically, the entrepreneurship literature has defined entrepreneurship in terms of five factors:

(1) active, brave, and adventurous innovation, reform, and creation;
(2) willingness to accept risks, uncertainty, and responsibilities;
(3) planning and management of new organizations;
(4) appropriate resource integration and use of social networks; and
(5) the ability to detect and seize opportunities to create new business faster than one's competitors (Chen and Wu, 2007).

In sum, scholars have viewed entrepreneurs as people who create new businesses, take risks, and achieve their goals.

Scholars have taken two broad approaches to entrepreneurial research. One emphasizes a psychological approach, which explores entrepreneurial traits and tries to identify individuals who are qualified to start new businesses. The other takes a sociological approach that explains how social backgrounds impact on entrepreneurial decisions (Liu and Hsieh, 2006). Therefore, we next discuss entrepreneurial personalities and social backgrounds.

The personality and backgrounds of entrepreneurs

Many factors influence entrepreneurial behavior, including social background and psychological and behavioral traits. Brockhaus (1982) argued that age and level of education would influence the likelihood of starting an enterprise, while Stanworth *et al.* (1989) argued for the influence of status, gender, and familial history. In terms of familial history, a great number of male entrepreneurs turn out to have been raised in poverty, although female entrepreneurs often come from middle- and upper-class families (Chen and Wu, 2007). In addition, researches have revealed that entrepreneurs in the American high-tech industry have tended to have parents who were high-ranking executives or entrepreneurs. These high-tech entrepreneurs seem to have been influenced and inspired by the independent, autonomous, and flexible careers of their parents. Furthermore, some scholars have emphasized the overall influence of work experiences upon entrepreneurial success or failure (Hisrich and Peters, 1989; Larson, 1992).

Aside from demographic variables, over the past few decades, entrepreneurial researches have tried to identify personality factors that differentiate entrepreneurs from non-entrepreneurs (Basu and Altinay, 2002; Krueger, 2000). Starting a new enterprise is a difficult job, one that requires the ability to attract aid and sponsorship from others. According to Etzkowitz (2003), entrepreneurship was presumed to be

a cultural and psychological characteristic found among particular ethnic and religious groups. Past researches had identified successful entrepreneurs most commonly as innovative, risk-taking, and proactive (Miller, 1983; Stevenson and Jarillo, 1990; Barringer and Bluedorn, 1999; Lumpkin and Dess, 1996). Prior researches had also identified entrepreneurs as having a high need for achievement (Murray, 1938), *locus* of control (Lee and Tsang, 2001), and self-efficacy (Wood and Bandura, 1989); a high tolerance for ambiguity; and a low need for conformity (Liou *et al.*, 2003; Shane and Venkataraman, 2000). Although a great deal of researches had identified entrepreneurial psychological and behavioral traits, the results had been unsystematic and inconclusive.

Using the CEAS, we will try to explore the performance and entrepreneurial traits of students at the University of Science and Technology. Chen and Wu (2007) developed the CEAS through a literature review of entrepreneurship and entrepreneurial traits, a content analysis of the biographies of Taiwanese entrepreneurs, consultation of foreign and domestic entrepreneurial aptitude tests, and experiences at several professional meetings. The 56-item CEAS includes four conceptual constructs, which are autonomy and self-discipline, social networking, innovation and breakthrough, and leadership and communication. The construct of autonomy and self-discipline emphasizes the process of starting a business; entrepreneurs can be autonomic and self-disciplined, value business ethics and social responsibilities, maintain the beliefs needed to achieve their goals, and make adjustments to cope with pressures. The construct of social networking concerns the ability to manage relationships well and promote opportunities for success. The construct of innovation and breakthrough concerns entrepreneurs' own proactive insights and creativity in improving the competitiveness of their organization. The construct of leadership and communication stresses the ability of entrepreneurs to manipulate leadership and communication skills to stakeholders inside or outside the organization.

Method

Participants

This study tested the CEAS with first- and fourth-year students (freshman and seniors) enrolled in a Taiwanese Institute of Technology that offers entrepreneurial programs. Among questionnaires distributed, 1,053 complete questionnaires were returned, and the valid return rate was 74 percent. The sample had more females (61.4 percent) than males (38.6 percent), a distribution similar to the overall population of the institute. Among the students, 64.8 percent were in their first year and 35.2 percent were in their fourth year. Sampled students ranged in age from 19 to 24 years old.

There are four colleges in the institute. The College of Business Administration includes a Department of Finance, an Account Department, a Department of Information Management, a Graduate School of Strategic Management for Small and Medium Enterprises, a Department of Business Administration, and a Department of Marketing Management. The College of Applied Science and Technology includes a Department of Commercial Technology Management, a Graduate School of Environmental Resources Management, a Department of Environmental Resources Management, and a Department of Biotechnology. The College of Design includes a Department of Visual Communication Design, a Department of Public-Relations Design, and a Department of Product Design. The College of Humanities and Applied Life Science includes a Department of Applied Foreign Languages, a Department of Early Childhood

Education, a Department of Styling and Cosmetology, and a Department of Tourism and Hospitality. Among the completed questionnaires, 34.7 percent of respondents were enrolled in the College of Business and Management, 29.7 percent were enrolled in the College of Humanities and Applied Life Science, 20.1 percent were enrolled in the College of Design, and 15.5 percent were enrolled in the College of Applied Science and Technology.

Measures

We adopted Chen and Wu's previously described 56-item CEAS, which includes four conceptual constructs and nine measured traits. The construct of autonomy and self-discipline includes three factors: persistence, social responsibility, and self-discipline. Examples of the construct are: "At work, I always lead by personal example," "I am willing to exert social responsibility and give feedback to society," and "I am seldom late." The social-networking construct includes two factors: ability to manage networks and need for social relationships. Examples include: "Before making decisions, I often consult professionals' opinions," and "While attending school, I participate in association activities actively at each stage." The construct of innovation and breakthrough includes two factors: proactive and ambitious. Sample items were, "I am curious about everything surrounding my life," "I am a very ambitious person," and "I enjoy the achievement of completing work." The construct of leadership and communication includes two factors: communication ability and influence on others. Sample items were, "I am very confident of my own opinions and thoughts" and "In a group, everyone respects my opinions." All variables were measured on a Likert-type scale with these six points: extremely disagree, disagree very much, disagree, agree, agree very much, and extremely agree. Points were scored on a scale of 0-5, and reverse tests were scored backward. The higher the scores on the scale, the clearer the entrepreneurial traits were.

Results

From Table I, we can see the reliability analysis of the conceptual constructs and factors of the CEAS. Based on Nunnally (1978), when the Cronbach alpha is higher than 0.7 represents acceptable reliability, lower than 0.5 shows that reliability is low and the factor should be rejected. Merchant (1985) pointed out Cronbach alpha of 0.5-0.6 represents the lowest acceptable reliability. The Cronbach's alpha for the factors fall between 0.54 and 0.88, the values of all Cronbach's alpha were higher than 0.5, the "self-discipline" got a Cronbach's alpha value of 0.54, which is also higher than 0.5 and within the acceptance range. Besides, high reliability of all constructs would have been ranges consistently above 0.83. Our study has provided a suitable internal consistency for each of the measure. Furthermore, we conducted a confirmatory factor analysis to understand the linear relationship between every construct and observed variable. Table I shows that all fit indexes (goodness of fit (GFI), adjusted goodness of fit (AGFI), normed fit index (NFI), comparative fit index (CFI)) of the construct of CEAS demonstrated a good fit as well as the ideal value of relative scholars (Anderson and Gerbing, 1988; Bagozzi and Yi, 1988; Bentler, 1990, 1992). It shows every construct has a good unidimensionality.

Table II displays the mean values and standard deviation of the measured factor of CEAS. In the nine measured factors of CEAS, the mean of social responsibility from the autonomy and self-discipline construct scored the highest; next highest were foresight

The name of construct	The name of factor	Number of item	Cronbach's α of factors	Cronbach's α of construct	CFI	GFI	AGFI	NFI
Autonomy and self-discipline	Persistence	10	0.88	0.87	0.97	0.93	0.91	0.96
	Social responsibility	5	0.68					
	Self-discipline	3	0.54					
Social networking	Network management ability	11	0.86	0.87	0.95	0.90	0.87	0.94
	Need of social relationships	3	0.61					
Innovation and breakthrough	Proactive	6	0.72	0.85	0.96	0.93	0.90	0.95
	Ambitious	6	0.77					
Leadership and communication	Communication ability	6	0.78	0.83	0.95	0.92	0.88	0.95
	Influence on others	6	0.66					
Total		56		0.95	–	–	–	–

Table I.
Reliability analysis of CEAS

Rank by mean	Measured factor	Construct of belonging to	Mean	SD
1	Social responsibility	Autonomy and self-discipline	3.36	0.78
2	Proactive	Innovation and breakthrough	3.28	0.74
3	Ambitious	Innovation and breakthrough	3.19	0.74
4	Self-discipline	Autonomy and self-discipline	3.04	0.88
5	Persistence	Autonomy and self-discipline	3.04	0.66
6	Communication ability	Leadership communication	2.70	0.70
7	Network management	Social networking	2.67	0.70
8	Influence on others	Leadership communication	2.59	0.63
9	Need of social relationships	Social networking	2.39	0.93

Note: $n = 1053$

Table II.
Analysis of the measured factor of CEAS

and ambitious from the innovation and breakthrough construct. The result is the same as that of Chen and Wu (2007), which used a qualitative method and conducted a content analysis of the biographies of models of Taiwanese entrepreneurial youth. The measured CEAS factors from the institute parallel those of the strongest characters of the youth entrepreneurial models in Taiwan.

Table III contains the mean values, standard deviations, and correlations for all construct in the study. The correlations of all study constructs fall between 0.71 and 0.53, and each is significant and positively correlated ($p < 0.01$). The correlation between innovation and breakthrough and leadership and communication is the highest (0.71), while the correlation between autonomy and self-discipline and leadership and communication is the lowest (0.53). Table III also presents the means of the four CEAS constructs. The innovation and breakthrough construct is the highest (Mean = 3.24), followed by autonomy and self-discipline (Mean = 3.15), leadership and communication (Mean = 2.64), and social networking (Mean = 2.53). The ranking result of means of the CEAS is the same as Chen and Wu (2007), which included characteristics of the youth

entrepreneurial models in Taiwan and those of college students. Table III also reveals that the social networking and leadership and communication of the students studied needs to be strengthened.

Table IV presents comparisons between genders in the CEAS. Among the four constructs of the CEAS, men scored higher than women, except for the construct of autonomy and self-discipline. In terms of the constructs of innovation and breakthrough and leadership and communication, which have significant differences ($p < 0.01$), male and female characteristics on the CEAS are obviously different.

Table V shows comparisons between the two different student years on the CEAS. Among the four constructs of the CEAS, the autonomy and self-discipline and social networking of first-year students is higher than that of fourth-year students, except for the construct of innovation and breakthrough and leadership communication.

Construct	Mean	SD	Construct 1	2	3	4
1. Autonomy and self-discipline	3.15	0.59	1			
2. Social networking	2.53	0.73	0.56*	1		
3. Innovation and breakthrough	3.24	0.69	0.67*	0.70*	1	
4. Leadership communication	2.64	0.60	0.53*	0.67*	0.71*	1

Note: *$p < 0.01$

Table III. Means, standard deviations, and correlations of the study constructs

Construct	Gender	*n*	Mean	SD	*t*-value
Autonomy and self-discipline	Male	406	3.14	0.62	− 0.506
	Female	*647*	*3.15*	0.56	
Social networking	Male	*406*	*2.55*	0.76	0.558
	Female	647	2.52	0.71	
Innovation and breakthrough	Male	*406*	*3.31*	0.78	2.387*
	Female	647	3.20	0.63	
Leadership and communication	Male	*406*	*2.71*	0.63	2.698*
	Female	647	2.60	0.58	

Notes: *$p < 0.01$; italics represent the highest mean value of the constructs

Table IV. A comparison between men and women in the four constructs of CEAS

Construct	Grade	*n*	Mean	SD	*t*-value
Autonomy and self-discipline	Fourth-year	371	3.12	0.55	− 1.074
	First-year	*682*	*3.16*	0.60	
Social networking	Fourth-year	371	2.43	0.72	− 3.380*
	First-year	*682*	*2.59*	0.73	
Innovation and breakthrough	*Fourth-year*	*371*	*3.24*	0.68	0.129
	First-year	682	3.23	0.70	
Leadership and communication	*Fourth-year*	*371*	*2.66*	0.60	0.546
	First-year	682	2.64	0.60	

Notes: *$p < 0.001$; italics represent the highest mean value of the constructs

Table V. A comparison between different grades in the four constructs of CEAS

However, among the four CEAS constructs, only social networking reached significant differences ($p < 0.001$). This finding suggests that the social networking of freshmen is greater than that of seniors.

Table VI shows comparisons between different colleges on the CEAS. Within the CEAS constructs of autonomy and self-discipline and innovation and breakthrough, students in the College of Humanities and Applied Life Science received the highest overall score, followed by students from the College of Design, students from the College of Applied Science and Technology, and students from the College of Business Administration. Within the constructs of social networking and leadership and communication, students from the College of Humanities and Applied Life Science received the highest score, followed by students in the College of Applied Science and Technology, students in the College of Design, and students in the College of Business Administration.

The students from the College of Humanities and Applied Life Science scored the highest mean value on every construct; students from the College of Business Administration had the lowest mean scores. Between the different colleges, differences were significant ($p < 0.05$) for three of the four constructs: autonomy and self-discipline, social networking, and innovation and breakthrough. In all four colleges, students received similarly low scores on the construct of leadership and communication, suggesting that students should be trained to actively improve their leadership and communication abilities in the future.

Next, we compared our sample students to the outcome of Chen and Wu's (2007) 27 Taiwanese entrepreneurial models in the performance of CEAS. Table VII indicates that there are significant differences between the sample students and the

Construct	College	*n*	Mean	SD	*F*-value	*p*-value
Autonomy and self-discipline	Business Administration	365	3.07	0.57	5.155**	0.002
	Applied Science and Technology	163	3.12	0.58		
	Design	212	3.15	0.60		
	Humanities and Applied Life Science	*313*	*3.25*	0.58		
Social networking	Business Administration	365	2.45	0.73	3.567*	0.014
	Applied Science and Technology	163	2.58	0.73		
	Design	212	2.52	0.76		
	Humanities and Applied Life Science	*313*	*2.62*	0.69		
Innovation and breakthrough	Business Administration	365	3.15	0.74	3.913**	0.009
	Applied Science and Technology	163	3.21	0.69		
	Design	212	3.29	0.67		
	Humanities and Applied Life Science	*313*	*3.32*	0.64		
Leadership and communication	Business Administration	365	2.59	0.63	2.374	0.069
	Applied Science and Technology	163	2.65	0.62		
	Design	212	2.63	0.59		
	Humanities and Applied Life Science	*313*	*2.71*	0.56		

Table VI.
A comparison between the different colleges on the four CEAS constructs

Notes: *$p < 0.05$, **$p < 0.01$; italics represent the highest mean value of the constructs

entrepreneurial models in the four CEAS constructs ($p < 0.001$). All of the CEAS constructs for the entrepreneurial models are significantly higher than those of the sample students. The score of social networking for the sample students is especially low, suggests that the undergraduates lack social experience and do not pay much attention to social networking.

Conclusions and discussion

In many countries across the globe, entrepreneurship is considered the key driver of socioeconomic growth and development, providing millions of job opportunities, offering a variety of consumer goods and services, and generally improving national prosperity and competitiveness. In the 60 years since Japanese colonization, Taiwanese citizens have been encouraged to meet their full potential by starting their own businesses. Today, most Taiwanese would prefer to manage a small firm than to be employees of a large company, resulting in a phenomenon that has led some scholars to dub Taiwan the "Boss Island" (Shieh, 1992). Indeed, statistics show that one in every 19 people in Taiwan manages a firm, creating the highest density of entrepreneurs in the world as well as enormous growth in Taiwan's economy. *Business Week*, for example, reported that many of the founders of Taiwanese information science and technology manufacturing companies (such as Tai-Ming Guo, Bai-Li Lin, and Wen-Long Xu) made their fortunes from scratch. While successful entrepreneurs in Korea and Japan mostly get their start in corporations, successful entrepreneurs in Taiwan work their way up through apprenticeships (Yu *et al.*, 2007).

Within the trend that the generation of product/service is rapidly being replaced, a product life cycle is inevitably becoming shortened, entrepreneurial survival depends upon responding rapidly and innovating endlessly. In previous decades, large-scale enterprises did not occupy as many markets as they did before. Highly flexible new ventures have increased sharply because of the growing variety and new demands of markets (Dollingers, 2003). The popularity of entrepreneurial activities in today's business world makes an entrepreneurial education all the more worthwhile (Liu and Hsieh, 2006).

This paper tested the performance of the CEAS for Taiwanese students at a technological institute that puts entrepreneurial education into practice. The results matched those of Chen and Wu (2007), which used qualitative methods to conduct a content analysis of the biographies of models of entrepreneurial youth in Taiwan.

Construct	Group	*n*	Mean	SD	*t*-value
Autonomy and self-discipline	*Entrepreneurial models*	*27*	*3.81*	*0.37*	9.19382***
	Sample students	1053	3.15	0.59	
Social networking	*Entrepreneurial models*	*27*	*3.56*	*0.39*	13.5045***
	Sample students	1053	2.53	0.73	
Innovation and breakthrough	*Entrepreneurial models*	*27*	*3.92*	*0.47*	7.454928***
	Sample students	1053	3.24	0.69	
Leadership and communication	*Entrepreneurial models*	*27*	*3.80*	*0.51*	11.64387***
	Sample students	1053	2.64	0.60	

Notes: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; italics represent the highest mean value of the constructs

Table VII.
A comparison between entrepreneurial models and sample students on the CEAS

Specifically, measured features of the sample school parallel the strongest characters of these models of entrepreneurial youth. Both groups ranked high in autonomy and self-discipline, indicating that entrepreneurial models and potential entrepreneurs have a high sense of mission and responsibility to society. Notably, however, the concepts of business ethics and social responsibility are less prevalent in studies in other countries. Thus, we further compared our sample students with Taiwanese entrepreneurial models on CEAS performance. We found significant differences between the two groups; the entrepreneurial models rated higher overall on CEAS constructs than the institute students. In particular, the sample students scored low on social networking, indicating that the undergraduates lack social and networking experience. In order to strengthen the students' social networking and leadership and communication skills, the curriculum should emphasize on nurturing the students with diverse ability, such as self management, innovation planning, leadership and communication, experience sharing, and the pressure adjustment. Colleges should design the diverse field teaching, providing the practice chance for students to increase their social experience. Furthermore, promote the student's social communication ability through the group activity, develop student's interpersonal competence to work with others and maintain significant relationships with partners and friends. Also build up strong communication skills to facilitate teamwork and leadership. Through working with network members, they can cooperate with each other and learn from others to make their ability complementary. To train students to become excellent leaders with global perspectives and the awareness of others' needs. Pascarella and Terenzini (1991) indicated that colleges with opportunities for extracurricular engagement expose students to social networks that promote achievement, greater interpersonal skills, and self-confidence.

Among the four CEAS constructs, we found that men scored higher than women on all constructs except autonomy and self-discipline. This result matches past research, which indicates that most entrepreneurs are male. In a comparison of the two different grade levels on the four constructs of the CEAS, only social networking reached significance ($p < 0.001$), with freshmen scoring higher than seniors. This result seems to contradict the conventions that entrepreneurs usually start their first business at 25-45 years of age. Moreover, the result that social networking was higher among freshmen than seniors corresponds to Chen and Lai's (2007) observation that entrepreneurs are becoming younger and younger nowadays. This difference needs to be investigated further to identify whether the sample composition (freshmen and seniors) was too dissimilar or whether environmental factors prompt younger people to improve their social networking abilities.

Comparing the four CEAS constructs across different colleges of the institute, we found that students in the College of Humanities and Applied Life Science performed best. This may be due to student characteristics. It could be that students in this college have more experience than others in developing a variety of technical skills and training licenses that make them more confident in their ability to become entrepreneurs. The lower performance of students from the College of Business Administration confounds expectations, given that this college produces the most entrepreneurs. Further investigation could determine whether this result is related to students' entrance exam grades or other personality characteristics.

In the era of the knowledge-based economy, innovation and entrepreneurship will increasingly pervade social behavior, such that every young person will face choices and

challenges concerning entrepreneurship (Liu, 2002). Shepherd *et al.* (2000) pointed out that education can decrease the entrepreneurial risks at the management level for entrepreneurs and their teams. Experienced entrepreneurs or well-trained "quasi-entrepreneurs" will have the ability to ensure the survival of their enterprises. Through appropriate teaching and curricula, the entrepreneurial spirit and ability can be nurtured (David, 2004). Moreover, Peterman and Kennedy (2003) noted that entrepreneurial curricula can increase students' entrepreneurial tendencies and improve feasibility. For this reason, developing entrepreneurial ability not only is important to economic development as a whole, but also has a great influence on an individual's career. The most important goal of an entrepreneurial education is to develop the technical abilities that entrepreneurs need to succeed (Chen and Lai, 2007).

The main contribution of this study is to test the applicability of the CEAS in Taiwanese Institute of Technology students, including comparisons between genders, grades, and colleges. The results offer insights for institutes and universities which seeking to improve their entrepreneurial education offerings. Moreover, the results offer lessons for fostering entrepreneurial abilities and behavioral traits in undergraduates. Future researches might focus on other Chinese regions (such as Hong Kong, Singapore, China) to implement cross-regional and cross-cultural entrepreneurial research that could reveal whether or not significant differences exist between Chinese entrepreneurs in different regions. In addition, the characteristics of entrepreneurs in different industries could be compared to identify the importance of each construct in order to measure factors and influences needed to successfully start a business. In sum, this research is just a first step in analyzing innovation and the entrepreneurial spirit within small and medium enterprises that continue to produce great contributions to Taiwan's economy.

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