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Research on "STI +" Model in College Entrepreneurship Education

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Abstract
The current state attaches great importance to college entrepreneurship education, but entrepreneurship education should combine with college students' professional learning. Different professional learning backgrounds have commonalities in entrepreneurship education, there may be differences, too. Various professional knowledge background and professional characteristics make different students possess diverse knowledge structure and skill resource, so the key factors needed in the entrepreneurship process may be different. This article proposes "STI+" model, the so-called STI refers to professional learning and can be divided into social science, technical science and natural science. The "STI+" model is based on various profession to carry out entrepreneurship education. Based on this, we separate "STI+" model into three types and select representative universities to do analysis and research, then sum up how schools of diverse professional background develop entrepreneurship education.
Keywords: Social science, Technical science, Natural science, "STI+" entrepreneurship education

1. Introduction

Entrepreneurship education has expanded rapidly in higher education institutions around the world (Fretschner and Weber 2013). This expansion has been driven by entrepreneurship's promise as a vehicle for promoting economic renewal and growth (Greene and Saridakis 2008). The college students who possess high knowledge become the main force of entrepreneurship. As an important way to cultivate high-level entrepreneurial talents, college entrepreneurship education is of great significance to promote the innovation-driven development of entrepreneurship and economic. But college students with various professional backgrounds differ in terms of knowledge and skills, and the markets and resources required for entrepreneurship are also different. Therefore, entrepreneurship education also has similarities and differences. Some colleges carry out different model of entrepreneurship education for different professional students. For example, Babson College develops all-round entrepreneurial training for business students, Stanford University relies on Silicon Valley to develop technology and entrepreneurship, Cambridge University takes advantages of basic disciplines to cultivate students' innovative and entrepreneurial ability.

Previous research about entrepreneurship education mainly focus on the setting of curriculum (Cheung 2008) and curriculum system (Hai-zong and Yu-dan 2010), the training and teaching mode (Fayolle and Gailly 2008; Subotzky 1999). The study of different disciplines' entrepreneurship education is scarce, and lack of integration of various disciplines to deeply study the influence of professional differences on entrepreneurship education, and the discussion about how to solve these differences.

Therefore, this article theoretically explores the differences between various disciplines' entrepreneurship education, and chooses Babson College, Stanford University and Cambridge University as typical cases to study social science, technology science and natural science's different entrepreneurship education model respectively. From STI perspective, this paper also puts forward "STI +" entrepreneurship education model which is based on professional knowledge and skills, and divides it into SSE, TIE and NSE modes according to social science, technical science and natural science disciplines. Besides, we take three typical colleges for example to sum up the problem-solving ideas and specific methods to different types of entrepreneurship education model, and put forward the corresponding countermeasures.

2. "STI +" entrepreneurship education model

2.1 STI model

Lundvall et al. (2004) proposed STI (Science, Technology, Innovation) which uses the knowledge and technology of applied science as main source of innovation. For college students, that is the use of scientific methods to obtain (or create) scientific knowledge and technology to explore and solve practical problems, such as science and technology transformation, patent application, research and development are STI behavior. With

the advent of knowledge economy, social development has proposed new requirements for college education. Entrepreneurship education as a kind of innovative talents training model, which is based on scientific knowledge and technology, conforms to the needs of science and technology and social development. Therefore, based on STI model, we divides the professional background into three types: social science, technical science and natural science. And put forward "STI +" entrepreneurship education model - SSE (Social Science Innovation Entrepreneurship), TIE (Technical Science Innovation Entrepreneurship) and NSE (Natural Science Innovation Entrepreneurship).

2.2 Problems and challenges

"STI +" entrepreneurship education model mainly concentrates on how different disciplines of high-tech professionals carry out entrepreneurship education, and the problems and challenges of three different types of training models are different. (1) The SSE model combines knowledge and methods of social science with innovation and entrepreneurship, instilling entrepreneurial spirit and ideas in the process of teaching knowledge and skills, fostering students' ability to discover business opportunities, taping potential markets, operating new businesses, and providing support of market and resources. But these students lack technical and practical experience, how to combine their professional advantages to develop entrepreneurship education is SSE's main problem. (2) TIE model focuses on the transformation and innovation of technological achievements. According to professional knowledge and skills of engineering students, entrepreneurship education is involved into the development of professional disciplines, cultivating students' knowledge and technological transformation ability, promoting science and technology entrepreneurship, constructing entrepreneurial atmosphere and environment. But engineering students' management and communication ability is weak, and they don't pay attention to excavate entrepreneurial market. How to carry out entrepreneurial training for technical personnel is the challenge TIE encountered. (3) NSE model refers to the introduction of entrepreneurial spirit in teaching and research process of basic disciplines such as natural sciences, spreading entrepreneurial culture, cultivating students' innovation and entrepreneurship ability and macro vision. But this model concentrates on basic disciplines learning, students' market sensitivity is poor, lack of cooperation and innovation capacity, these are problems to be solved for NSE model.

3. SSE- Babson College

3.1 Entrepreneurship education mode

As world's famous business school, Babson College is a leader in entrepreneurship education (Katz 1999). Since founded in 1919, Babson has played an important role in entrepreneurship education area. The unique set of courses and teaching methods have been the learning model of others. Babson emphasizes the combination of tradition and innovation, focusing on the cultivation of students' practical ability, meanwhile allowing students make continuous exploration during the development of entrepreneurial learning and practice.

Faced with problems and challenges in business entrepreneurship education, Babson innovates the mode of entrepreneurship education based on characteristics of business students. On the one hand, Babson sets up entrepreneurial curriculums through the whole process of entrepreneurship to enhance students' ability of integrating financial and market resources. On the other hand, increases entrepreneurial practice inside and outside classroom to enhance practice experience. (1) Entrepreneurial courses. Babson's curriculum system is designed for undergraduates and MBA, mainly focus on cultivating entrepreneurial spirit and skills, training business management, financial and operational capacity through courses and activities. Entrepreneurial curriculum system not only covers a wide range, but also follows the process from shallow to deep. The MBA program is divided into three basic levels, such as basic entrepreneurial skills, in-depth new venture knowledge, and support courses for specific areas. All courses mainly enhance students' ability to discover and exploit opportunities and develop a strong business foundation and practical skills. (2) Entrepreneurial practice. The "entrepreneurial spirit" course simulates all the problems that might encounter in entrepreneurial process via "Rock Pitch" assessment method, and providing solutions to problems, training communication and financing skills. "Entrepreneurial Accelerated Track" course's complex application procedure and assessment model are initial experience to begin entrepreneurship, and ensure the usage of resources effectively, thus excellent ideas and projects have been fully supported. Besides, Babson provides abundant entrepreneurial practice and support projects for students to experience entrepreneurial scene and environment, enhancing their entrepreneurial skills and achieving business goals.

3.2 Solutions

The characteristic and expertise of Babson in entrepreneurship education are recognized by the world. According to entrepreneurial process, curriculums are divided into hours and modules to help students understand dynamic process of entrepreneurship, curriculum assessment focuses on practical results, involving entrepreneurial knowledge and practical skills. Faced with problems and challenges of SSE model, main solutions include two

aspects: (1) In the course teaching system, pay more attention to cultivate financing and market resource integration ability, which are important premise of entrepreneurial activities. (2) Build various practical platforms to enhance entrepreneurial ability and cultivate future entrepreneurs with entrepreneurial ability and innovation awareness.

4. TIE-Stanford University

4.1 Entrepreneurship education mode

Stanford University is engineering college which carries out entrepreneurship education earlier in United States. Relying on adjacent to Silicon Valley and teaching advantages, Stanford advocates practical application-oriented and school-enterprise cooperation, holds the concept of practical education and principle of learning to use. As a well-known engineering college, "Silicon Valley cradle" Stanford University has cultivated many technology entrepreneurs and formed unique entrepreneurship education model (ZHANG and GAO 2006).

According to advantages and disadvantages of engineering entrepreneurship, Stanford integrates professional knowledge and technology to carry technology entrepreneurship courses to cultivate ability and skills, promote transformation of knowledge and technological achievements. Meanwhile, Stanford blends education into external science and technology entrepreneurial environment to discover potential business opportunities and markets. (1) Entrepreneurship courses. Stanford's distinctive technical entrepreneurship project establishes corresponding technology entrepreneurship courses to students of different levels and connects entrepreneurial learning with discipline knowledge and skills. The project is committed to promote the development of high-tech entrepreneurship, create new ideas and technologies and cultivate market awareness and management skills. The establishment of Technical Licensing Office in 1970 was an important milestone in the development of entrepreneurship education, which provides convenience and support for entrepreneurial activities, protects patent rights of scientific and technological achievements and promotes the development of technology entrepreneurship. (2) Entrepreneurship practice and support. Stanford involves entrepreneurship education into practical curriculum design, establishes technology entrepreneurship practice and support activities for engineering students. For example, high-tech club conducts seminars, dinners and other activities regularly, combining learning with Silicon Valley and outside high-tech environment, so that students involve into the real atmosphere of science and technology entrepreneurship. Venture capital club builds platforms between students and technology companies or enterprises to provide business consulting and support for students who are interested in high-tech and venture. United States and Asia Science and Technology Management Center often holds series lectures, inviting entrepreneurs from different industries around the world to share business problems encountered and solutions. Meanwhile, Silicon Valley technology companies and new ventures establish research stations and laboratories as practice bases to provide incubation and support platform to technology transformation.

4.2 Solutions

As a college with typical engineering characteristics, whether develop entrepreneurship course or practice activities, Stanford units engineering students' knowledge structure and professional skills to carry interdisciplinary exchanges and cooperation, develop technology and entrepreneurship relying on Silicon Valley. As for the problems and challenges of SSE model, there are some solutions (1) Combine classroom teaching with scientific research and technology development, pay more attention to cultivate market awareness, as well as the management and communication skills, in order to seek internal partners and adapt external competitive environment during entrepreneurship process. (2) Involve entrepreneurship education into high-tech entrepreneurial environment, cultivate students' keen insight into market, transfer scientific and technological achievements into productive forces, then promote the development of related industries.

5. NSE-Cambridge University

5.1 Entrepreneurship education mode

As "natural science" cradle, Cambridge University's development of entrepreneurship education is closely related to natural science. Except MBA business courses, most entrepreneurship courses are established for computer, bio-engineering, physical chemistry and other professions. In the process of developing entrepreneurship education, Cambridge insists unique concept and creates a cultural environment to encourage entrepreneurship, struggle for goals, tolerant failure in campus. And gradually forms a good entrepreneurial atmosphere.

As for the problems encountered with natural science entrepreneurship education, Cambridge conducts flexible entrepreneurship courses to cultivate awareness and ability to find potential markets. And combines the courses with practice to enhance innovation ability and creativity. (1) Entrepreneurship courses. Courses include both credit and non-credit. There are two types of credit courses: MBA-oriented courses are highly specialized; others mainly conduct discussion and learning according to different professions, and encourage students to take

advantage of professional knowledge and skills to start new venture. Different disciplines' entrepreneurship courses are different in content and practice, biochemistry is shorter, while physics and computer science are relatively long. Non-Credits courses are more flexible. Students can participate and withdraw class by interest and need. Then university makes continuous reduction and optimization based on the popularity and election of courses to promote school-wide entrepreneurial awareness and train entrepreneurial skills. (2) Entrepreneurship practice. Cambridge combines traditional knowledge with practice, involving entrepreneurial competition, business simulation, as well as entrepreneurial business internships and other practical activities. Cambridge also found "Cambridge Enterprise" to provide teachers and students with entrepreneurial training, consulting, seed funding support services and practice opportunities, thus promoting the development of innovation and entrepreneurship education. The Herman•Hauser Expert Center provides students with entrepreneurial education activities and funding to promote transformation of scientific and technological achievements. The agency also provides technical services and internship training platform, hence builds students' market and cooperation business awareness, combining innovation with entrepreneurship.

5.2 Solutions

Cambridge University adheres to traditional concept of management, attaching importance to basic disciplines and scientific research, achieving transformation and adaptation of entrepreneurial culture through various ways, and maintaining a high level of teaching and research. In order to solve the problems and challenges of NSE model, the solution includes (1) Cultivate students' market consciousness, seek potential market and business opportunities for entrepreneurial projects, and work closely with different disciplines to integrate knowledge and skills of all aspects of entrepreneurship. (2) Improve innovative ability and creativity, discovery and solve practical problems creatively through the usage of scientific research knowledge to cultivate entrepreneurial awareness and enhance entrepreneurial skills.

6. Contrast and conclusions

This paper puts forward "STI +" entrepreneurship education model which is based on the knowledge of subject and combination of entrepreneurial education and professional learning, then summarizes three different entrepreneurial education modes: SSE, TIE and NSE. Because different profession's various knowledge background and professional skills, entrepreneurship education model is distinct. We study entrepreneurship education practices of Babson College, Stanford University and Cambridge University, then analysis problems, solutions and concrete approaches. Finally, summarize challenges and solutions of different models. As shown in the following table:

Table 1. A Comparison of Problems and Solutions of Entrepreneurship Education models

	Babson college	**Stanford University**	**Cambridge University**
Problems and Challenges	-Lack of technology -Lack of practice experience	-Poor market sensitivity, -Lack of communication, management and leader skills	-Worse market sensitivity, -Lack of cooperation and innovation awareness
Solutions	-Integrate financial and market resources, drive others to start business -Build practical platforms for entrepreneurship	-Cultivate market awareness , management and communication skills -Create a technology entrepreneurship environment	-Cultivate market and cooperation awareness -Improve innovation capacity and creativity
Measures	-Carry out courses related to the whole process of entrepreneurship -Increase entrepreneurship attempts and practical activities inside and outside classroom	- Combine professional knowledge and technology to carry out technical entrepreneurship courses -Rely on Silicon Valley to provide technology-related business support and practical activities	-Set up highly flexible entrepreneurship courses -Combine knowledge transformation with practice

7. Policy suggestion

7.1 For different disciplines, develop different entrepreneurship education training mode

Social science students have comprehensive expertise in management, economics, politics, society and culture. The main objective of entrepreneurship education is to foster entrepreneurship practice and capability to discover and exploit potential entrepreneurial opportunities. As for lacking technology and experience, we should encourage social science students to integrate available resources, participate in practice projects, take the advantages of management and economic to drive others start business together. Higher engineering education

has an important position in the process of entrepreneurship education. Engineering students are expert in research and technology development, their entrepreneurship education mainly promotes technology transformation, identify potential markets and business opportunities, thus increasing market awareness and management skills and promoting the development of productive forces. Natural science focuses on learning and application of basic knowledge. These students have systematic professional knowledge and abundant social practice, but they are far away from products and markets, it is not conducive to discover business opportunities. Therefore, their education should improve market awareness and cooperation innovation ability to solve problems creatively, and promote the formation and transformation of entrepreneurial behaviour.

7.2 Entrepreneurship education is based on professional knowledge learning, promote mutual integration

Entrepreneurship education is a new training mode, which conforms to the trend of higher education development (Subotzky 1999). Based on professional education model, entrepreneurship education is the integration of professional education and entrepreneurial knowledge, ability cultivation. Entrepreneurial education model links closely with the development of professional disciplines. It is based on professional learning and their integration is a mutual promotion process. Entrepreneurship education relies on the study of professional knowledge. It reorganizes the professional teaching process, combines professional theory and practice to design corresponding entrepreneurial curriculums. Besides, it integrates entrepreneurship education with professions to help students launch entrepreneurial activities according to their professional knowledge and skills. Entrepreneurship education can promote the learning and development of professional knowledge, too. Involving entrepreneurship education with professional learning contributes to understand innovation and entrepreneurship area, cultivate innovative ideas and entrepreneurial spirit, thus enhancing entrepreneurial and professional skills, making entrepreneurship be a part of knowledge learning and enhancing the understanding of disciplines development. It also contributes to the consolidation of professional knowledge and transformation of skills.

7.3 Promote knowledge and technological transformation, encourage high-tech entrepreneurship

"STI +" entrepreneurship education model emphasizes scientific knowledge and technology learning, then transfer them into productive forces to promote innovation and entrepreneurship. In the era of knowledge economy, college students not only learn professional knowledge, but also cultivate innovational and entrepreneurial spirit, improve practical experience and skills, and promote the transformation and application of knowledge and technological achievements. Stanford University takes advantages of engineering expertise and skill to connect with Silicon Valley high-tech companies, conduct research and technical cooperation, promote the transformation of scientific and technological achievements, and encourage high-tech entrepreneurship. The founders of Google, Instagram and Dell are Stanford University graduates, they become entrepreneurial leaders in the inspiration of school science research projects and support of Silicon Valley technology. Cambridge University attaches importance to basic research, its discipline research direction is closely related to the trend of times. The application of research results contribute to the development of related industries. Cambridge Science Park is an effective way to transform scientific research and develop industries. College students have solid professional foundation and scientific research ability. Based on professional learning, scientific research and solid academic basis, students can promote knowledge application and skills transformation through entrepreneurial education and business support, thus contributing to develop high-tech entrepreneurship, spread entrepreneurial spirit and entrepreneurial awareness.

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