

# Practice of Entrepreneurship Education in California Institute of Technology

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**Abstract:** As the leader of entrepreneurship education, Caltech has formed a unique entrepreneurship education ecosystem with excellent teachers, flexible entrepreneurship organizations, perfect curriculum structure and rich entrepreneurship resources. However, entrepreneurship education in Colleges and universities in China started late, has a narrow vision and has some limitations. By learning from the successful experience of Caltech, we can build a cooperative department of entrepreneurship education, create high-quality innovation and entrepreneurship education courses, and integrate innovation and entrepreneurship education resources to promote the vigorous development of entrepreneurship practice activities in Colleges and universities.

**Keywords:** Entrepreneurship Education; Entrepreneurial Practice; California Institute of Technology

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## Introduction

As one of the world's leading entrepreneurial universities, Caltech benefits the society by promoting scientific progress. "Scientific research is the source of technological progress. If the source is exhausted, technological progress will no longer exist." Said Arthur Amos Noyes, co-founder of Caltech. Caltech has always worked hard to build itself into a research and education center, promote the vigorous development of academic freedom, explore basic science and develop advanced technology.

From 1995 to 2019, Caltech disclosed more than 4200 inventions, granted more than 3700 patents, obtained 869 licenses in total, executed 40-50 licenses on average every year, established 276 start-ups, and established 8-10 new companies on average every year.<sup>[1]</sup> From exploring the big bang to studying the human genome, teachers at Caltech led students to break the rules and extend innovation and entrepreneurship to the furthest range understood by mankind. This remarkable achievement is mainly due to the construction of a systematic and comprehensive entrepreneurship education ecosystem by Caltech.

## 1. Experience in entrepreneurship education at California Institute of Technology

### 1.1 Excellent teachers

The teacher-student ratio of Caltech is very low. The school has about 300 professor level teachers, providing strict courses and various learning opportunities and practical research for about 1000 undergraduates and 1250 postgraduates. The entrepreneurship education teachers of Caltech are not only professional scholars, but also entrepreneurs or angel investors with rich entrepreneurial experience. For example, Andre beltz, lecturer in the Department of engineering and Applied Sciences at Caltech, holds a bachelor's degree in physics from the University of Maryland at College Park, a doctor's degree in physics from Caltech, and an MBA in finance from Pepperdine University. She has multiple roles. She is a resident

entrepreneur (EIR) at the University of Southern California. She also teaches at Marshall School of business, Viterbi School of engineering and Rosky School of design. She also works in the Jet Propulsion Laboratory of California Institute of technology and engaged in the early development of astrobiological flight instrument concepts. At the same time, she is also a member of Pasadena angels. In addition, Andreltz also provides consulting services to Athena foundation, BP, California Institute of technology, Korea Institute of technological progress, NASA Jet Propulsion Laboratory, University of California, Los Angeles, and other companies and venture capital foundations. These teachers adhere to the long-standing tradition of innovation and Entrepreneurship of California Institute of technology, and set up new companies at the rate of an average of 8 start-ups every year. California Institute of technology obtains nearly 120 U.S. patents every year. From GPS drivers and cell phone cameras to DNA sequencers used to map the human genome, these technologies and applications are diverse. This provides a strong personnel guarantee for the improvement of students' innovation and entrepreneurship practice ability.

## **1.2 Complete organization**

In order to ensure the development of innovation and entrepreneurship education and improve the efficiency of University Science and technology transfer, Caltech has set up a technology transfer and partnership office at the school level (ottcp). One is the technology transfer and partnership office. Compared with the old entrepreneurial universities, Massachusetts Institute of technology and Stanford University, the technology transfer and enterprise partnership Office of California Institute of technology has a short history. It was founded in 1995 and originally named the technology transfer office (OTT). In 2013, the technology transfer office (OTT) was merged with the enterprise relations office, The office of technology transfer and enterprise partnership (ottcp) was established.

## **1.3 Improvement of entrepreneurship curriculum system**

Caltech offers a variety of entrepreneurship and business courses for undergraduate and graduate students to gain entrepreneurship and business experience, develop network skills, and understand the commercialization of University Science and technology.

There are two types of courses. One is science and technology entrepreneurship. In the course, experienced professors will introduce students to the concept and framework of entrepreneurship, entrepreneurship analysis methods and the measures needed to create a successful technology-based company. Specifically, in the course, students can learn the methods of evaluating new technologies, the business philosophy of commercialization, clarify the resources needed to attract new enterprises, understand the steps of organizing and operating start-ups, build important business relationships and negotiate, and lead the healthy development of start-ups. One is entrepreneurship development course. Such courses focus more on offline entrepreneurial activities based on teamwork. The tutor provides some business ideas. Students form teams around these ideas and submit entrepreneurship plans based on the topics being studied. Students can go to institutions cooperating with the school for entrepreneurship activities. After the course, external experts will select the best business plan from each team plan.

## **1.4 External entrepreneurial resources are integrated and abundant**

Caltech also provides students with rich resources outside the school, including Caltech Entrepreneur Club, art center design school, Marshall Business School of the University of Southern California, Anderson Business School of UCLA, IARPA (Los Angeles Regional Technology Alliance), IAVA (Los Angeles venture capital alliance) Innovative Pasadena, technology coast angel investment, Pasadena angel investment, etc.

## **2. Enlightenment of entrepreneurship education of California Institute of technology to colleges and universities in China**

## **2.1 Building a double qualified teaching team**

Teachers are enlighteners and guides for students. At present, the teachers of entrepreneurship education in China are relatively weak, which is reflected in: the number of teachers is small, which is in great contrast to the huge demand of students; Although some teachers have received training related to innovation and entrepreneurship, most of them belong to short-term training and lack of professional teachers; Schools do not pay enough attention to teachers' technology transfer, and there is a tendency of formalization. Therefore, to improve the quality of entrepreneurship education and accelerate the transformation of scientific and technological achievements, we must cultivate a group of teachers who attach equal importance to entrepreneurship theory and entrepreneurship practice ability, or cooperate with enterprises and hire experienced entrepreneurs or investors to teach. At the same time, colleges and universities must create a good environment for teachers to make them feel that they are an indispensable part of the process of knowledge commercialization, Everyone is committed to fulfilling their full potential for every invention and research project.

## **2.2 Build a mature and professional entrepreneurial organization**

The achievement of entrepreneurship education in Caltech can not be achieved without the support and help of technology transfer and enterprise partnership Office (otcep) of Caltech. In order to improve entrepreneurship efficiency, it is necessary for Chinese universities to learn from Caltech and create an executive innovation and entrepreneurship office with its own characteristics.

## **2.3 Create excellent courses of entrepreneurship education**

Under the national call of "mass innovation and entrepreneurship", many colleges and universities have set up entrepreneurship courses, but most entrepreneurship education in Colleges and universities is a mere formality, mostly in the form of optional courses or lectures. Students can not apply the theory to entrepreneurship practice. Ed Zschau, a professor of California Institute of technology, once said: "entrepreneurship is not a business, but a way of life. It will leave footprints in students' life journey." Therefore, the establishment of entrepreneurship education courses in Colleges and universities in China should not only stay on the surface, but should combine theory with practice and carry out courses in many forms inside and outside the school.

## **2.4 Integrate external resources of entrepreneurship education**

Caltech performed particularly well in bringing together external resources. In the process of entrepreneurial practice, cooperation is the key to progress. Entrepreneurship Education in Colleges and universities in China is facing the challenges of professional, integrated and scientific development. <sup>[3]</sup> in order to realize the vigorous development of entrepreneurship education in Colleges and universities, we must give full play to the power of external resources, absorb the external nutrition of entrepreneurship education in Colleges and universities in multiple directions, and build a public governance mechanism of entrepreneurship education with local colleges, government, enterprises and society division of labor and cooperation, resource sharing and effective interaction. <sup>[4]</sup> Through the communication and cooperation among academia, industry and government, strive to eliminate the barriers between industries, attract and retain entrepreneurs, innovators and investors through the strong technology and design innovation center and entrepreneurship education ecosystem of colleges and universities, and promote the transfer of science and technology and the transformation of scientific and technological achievements of colleges and universities with the coordinated support of off campus resources, Deepen the training path of entrepreneurial talents, continuously improve the social and economic benefits of colleges and universities, and even cultivate a strong sustainable innovation economy in a wider range.

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