

Construction of the Innovation and Entrepreneurship Education Pattern of “Industry-University-Research Collaboration” in Colleges

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Abstract. Innovation and entrepreneurship are not only crucial ways for the cultivation of talents in colleges and universities but also important focal points for the social development. Adjusted by economic society, innovation education in Chinese universities is turning to an educational idea and talent-training mode, which begin to immense in the education process with access to all students. In response to the current problems in innovation and entrepreneurship and based on the knowledge spillover effects of companies, schools, and scientific research institutions, a new model of innovation and entrepreneurship in colleges containing “learning, practice and application” is built in this paper, which will promote the integration of social resources and the strong innovation on industry, universities and research.

1. Introduction

The report of the 19th National Congress of the Chinese Communist Party proposed to promote the strategy of innovation-driven development and enhance the vitality of social and economic innovation and the driving force for development so as to accelerate the construction of innovative country. Under the background of this national development strategy, innovation and entrepreneurship with knowledge as the core factor has become an important determinant of social progress. This has put forward higher requirements for the talent training in the new century.

At present, the main mode of innovation and entrepreneurship education in colleges and universities is generally based on the daily classroom teaching. It also assisted by organizing students to participate in various types of innovation and entrepreneurship competitions so as to cultivate students' innovative ability and enterprising spirit from the theoretical and practical perspectives. With the rapid development of social economy, higher quality requirements have been put forward for innovative talents. At present, innovation and entrepreneurship education for undergraduate students cannot meet the needs of today's innovation and development. The mismatch between university resources and social resources has led to the problems of the shortage of professional teachers on campus and the difficulty in innovation transformation. All relevant social resources should be fully mobilized, such as research institutions, enterprises, etc., to participate in innovation and entrepreneurship education for college students. This article takes industry, universities and research institutes as the research objects to deeply explore the development of innovation and entrepreneurship education for undergraduates under the mode of “industry-university-research collaboration”. It also strives to build an innovation and entrepreneurship education system that integrates a variety of resources both inside and outside the school.

2. The Successful Models of Innovation and Entrepreneurship Education in Foreign Countries

In developed countries such as Europe and the United States, the government attaches great importance to the development of innovation and entrepreneurship. Their governments take the policy as the leading factor to promote related industries to draw closer to the model of

industry-university-research collaboration and have achieved a series of remarkable results.

The U.S. began to cultivate children's awareness of innovation and entrepreneurship through basic education in elementary schools. As early as 1998, the "Financial Literacy 2001 Plan" was implemented. In 2012, the Obama administration proposed the "Star-up America Initiative", which was invested initiated by the National Science Foundation in the establishment of a nationwide center for innovation and entrepreneurship education. In addition, NSF Innovation Corps has built a knowledge triangle among companies, institutes and universities to convert scientific achievements into commercial products [1].

In 1998, the UK implemented a college student innovation and entrepreneurship program which provided innovative courses, entrepreneurship guidance and exchange platforms. In addition, the government funding has established the British Science Entrepreneurship Centre (UK-SEC) and the National College Entrepreneurship Commission (NCGE) to guide university students in fostering innovative entrepreneurial spirit [2].

In 1998, Germany implemented the "EXIST" entrepreneurial plan in areas and supported the establishments of links among universities, government, scientific research institutions and economic circles in some districts to promote the transformation of scientific results. It also established the famous "dual track" vocational education which made people to receive theoretical education in schools and practical training in enterprises [3].

The Japanese government implemented the "Yuanshan Plan" in 2001 to deregulate the management of university professors and scientific researchers as part-time employees. It encouraged professors and scientific researchers to engage in business management, and enrich university teachers' experience in innovation and entrepreneurship [4].

Through successful experience abroad, we can understand that the pattern of industry-university-research collaboration can solve the problem of uneven distribution of resources due to insufficient information in the innovation and entrepreneurship domain. It can improve the quality of innovation and entrepreneurship education in universities and exert great influences on promoting national innovation and development.

3. The Foundation of "Industry-University-Research Collaboration Pattern" for the Innovation and Entrepreneurship Education

Henry Etzkowitz proposed a collaborative innovation theory among universities, industries and the government. These three aspects are independent but closely linked to form a three-helix relationship. Henry Chesbrough proposed an open innovation theory and believed that companies should make full use of external resources and combine with their own internal researches to promote technological innovation [6]. Richard Nelson believed that the national innovation system was co-operated by universities, government, companies and other institutions [7].

The innovation and entrepreneurship pattern of industry-university-research collaboration can be guided by policies, and integrates the social innovation and entrepreneurial resources. It can integrate the ideas of college students and combine with the technology of research institutions to transform the results into commercialization through the platforms of the enterprises. This is the goal of the development of innovation and entrepreneurship education in universities. At the same time, it is also an important foundation for the enterprises' open innovation and national innovation system. It forms the driving force for national innovation and social development. Meanwhile, it forms a positive and effective industry-university-research collaboration pattern, which can effectively promote the development of China's innovation and entrepreneurship.

3.1 Promoting the innovation and entrepreneurship education of Industry-university-research collaboration on the basis of policies

Our Chinese government attaches great importance to the innovation and entrepreneurship education. It drives China's innovation and entrepreneurship development through policies and promotes the integration and innovation of social resources. The State Council has successively issued the Opinions on Promoting Innovation and Entrepreneurial Education in Colleges and

Universities and the Self-starting Work for College Students, the Basic Requirements for Education and Teaching on Innovation and Entrepreneurship in General Undergraduate Colleges (for trial implementation), the Implementation Opinions on Deepening the Reform of Innovation and Entrepreneurship Education in Institutions of Higher Learning and other documents that provide guidelines for the innovation and entrepreneurship education. In addition, during the 11th China Industry-University-Research Collaboration Association Conference, Premier Li Keqiang stated that strengthening cooperation among industry, universities and research is an important support for opening up the innovation chain and promoting innovation development. The government supports the development of innovation and entrepreneurship, but there are still no clear policy regulations and vigorous measures in terms of industry-university-research collaboration. The lack of policy documents on industry-university-research collaboration to promote innovation and entrepreneurship will not lead social resources to develop proactively in the direction of our hope. For the current system of innovation and entrepreneurship, great reforms need to be made to translate the existing models to the Industry-university-research collaboration one. It is difficult for the tripartite sides of industry, universities and research institutes to make up their minds on the collaboration of industry-university-research whether for their own interests or through the negotiations from the universities with the other two sides. Through the government's formulation of powerful incentive policy documents, the three sides will cooperate actively. Universities can provide innovative ideas and motivation. Scientific research institutions will exert the function of the intellectual and practical talents. The enterprises can accelerate the incubation of innovation achievements as they have production platforms and management experience. The spillover effect of knowledge will be produced through the collaboration of the three sides. This will lead to the widespread of knowledge through the sharing, dissemination and transfer to form a new knowledge network. Thereby the advancement of social innovation will be accelerated.

3.2 Focusing on schools and consolidating the foundation of Industry-university-research collaboration

The education of innovation and entrepreneurship for college students not only allows them to master the knowledge of innovation and entrepreneurship, but also cultivates their ability to analyze and solve problems as well as the spirit of innovation and practice. Experiences accumulated during the practice of innovation and entrepreneurship can improve students' ways of thinking on social issues. This can improve their innovative and divergent thinking so that the values of universities will return.

The purpose of colleges and universities is to set high moral values and cultivate people. It is an important period for most students to become interested in innovation and entrepreneurship, cultivate their awareness and put it into practice. It is also the basis for the consolidation of higher education. Therefore, the cultivation of innovative and entrepreneurial talents should take colleges and universities as the training subject. Also, enhancing the comprehensiveness, level and sociality of innovation and entrepreneurship education is an important factor in the development of innovation and entrepreneurship.

3.3 Establishing the comprehensiveness of innovation and entrepreneurship education [8]

Innovation and entrepreneurship education should not be the education of the minority. Innovation and entrepreneurship education, as a subject aiming at cultivating students' innovation and entrepreneurship, should focus on the development of students' innovative thinking. It ought to make innovation a way of their life rather than participating in various competitions or entrepreneurship to reflect the practicability of innovation and entrepreneurship courses superficially. Colleges and universities set innovation and entrepreneurship-related courses as "elective courses" and "General Studies". Most of them are basic teaching courses. All kinds of courses are too shallow for innovation and entrepreneurship which make students feel boring and unable to arouse their interests. Meanwhile, they are too theoretical for those who with innovative and entrepreneurial ideas.

The education of innovation and entrepreneurship should be a course that runs through the

education of university. The developing of innovative and entrepreneurial courses in universities should be more extensive so as to meet the knowledge needs of different types of students. It also must be comprehensive, so that students can learn about the abilities and conditions in practice. This will make innovation and entrepreneurship more realistic and practical for college students. At the same time, courses with richer and more selective content had better to be offered and students from different majors can be taught at the same time. This will reduce the boundaries of disciplines and students from different majors can be grouped together to learn through the professional knowledge in different fields. This enhances the team's innovation and entrepreneurship process and the professionalism in it can also improve students' comprehensive ability.

3.4 Dividing the level of innovation and entrepreneurship education

We can't generalize the needs of students, as they have different needs for innovation and entrepreneurship. Therefore, the design of the curriculum needs to be more targeted. Some students may have just come into contact with innovation and entrepreneurship and tend to have a more interesting and rough understanding. And some require systematic and in-depth study to meet their substantial demands for entrepreneurship. Curriculum design can not only benefit from students who are interested in innovation and entrepreneurship, but also should inspire other students' interest in innovation. Before designing and producing the course, it is necessary to fully understand the needs of the students and encourage students to choose the courses that suit them. This will make the innovation and entrepreneurship system in colleges and universities to be more complete.

In order to nurture innovative spirits of college students, we must first design targeted and progressive professional courses to make them pay more attention on innovation and entrepreneurship. Progressive courses should be offered for different grades of students, from mastering basic knowledge of innovation and entrepreneurship (market selection, problem analysis) to research report, entrepreneurship plan (mastery of necessary basic knowledge), and finally entering innovation and entrepreneurship practice competition (road show and other comprehensive ability training). The courses of different levels enable students to have systematic learning, so that the design will be more in line with actual needs and more comprehensive.

3.5 Improving the sociality of innovation and entrepreneurship education

Insufficient diversity of innovation and entrepreneurship courses and superficiality of teaching content as well as paying too much attention to the cultivation of basic theoretical knowledge and lacking applicability to the contemporary. We should include innovation and entrepreneurship education into the main channel of teaching and emphasis more on teachers from both professional and practical aspects.

Innovation and entrepreneurship education has a higher requirement for teachers. In colleges and universities, teachers generally pay attention to the study of academic theory so that they can teach students rich theoretical knowledge and provide guiding suggestions in related experimental training. However, in actual social practice, teachers or industry experts with relevant experience are required to conduct deeper guidance which is a demand that teachers in universities generally cannot meet.

The basic education of students for innovation and entrepreneurship generally relies on the guiding help provided by teachers. Highly qualified teachers are favorable conditions for the development of social innovation and entrepreneurship education. At the end of 2016, the Central Committee of the Communist Party of China issued the "Several Opinions on Implementing the Policy of Increasing Knowledge Value-oriented Distribution". The release of policies is an effective backup force for the introduction of innovative talents in colleges and universities. It effectively and legally enables researchers to enter into colleges and universities to work part-time. It will impel the social timeliness of innovation and entrepreneurship education in colleges and universities and stimulate the enthusiasm of innovation from researchers simultaneously. At the same times, we also attach importance to the training of innovative entrepreneurship teachers and encourage them to participate in business management to increase entrepreneurial experiences. This will make the combination of teachers and courses practical and realistic.

3.6 Taking “Industry and Research” as the supporting point to improve the professionalism of industry-university-research

The enterprises’ open innovation, that is, its external innovation capability, is one of the theoretical foundations for them to actively participate in the industry-university-research collaboration. The schools cooperate with multidisciplinary industries and talents such as scientific research institutes and entrepreneurial enterprises. This can make up for the disadvantages of lacking practical experience of university teachers by recruiting out-of-school practical and high-tech talents. Conducting professional seminars in different fields regularly can provide more comprehensive guidance.

Secondly, companies, scientific research institutions and schools should cooperate to establish talent pools. For innovation and entrepreneurship projects, companies or scientific research institutions can recommend professional innovative and entrepreneurial talents for authoritative and more valuable guidance according to their research directions. They can also reach agreements with universities and provide professional supports such as venues and technology needed in practice. This will make innovation and entrepreneurship has social value, not only academic researches. The combination of theory and practice will transform innovation into entrepreneurship authentically.

The government has provided strong support for innovation and grant. The industry-university-research collaboration pattern is bound to change the single source of funding to make innovation and entrepreneurship a social development dynamic. The United States Hewlett-Packard Co., Ltd. launched the “HP LIFE” program to fund innovation and entrepreneurship projects, which in turn led to the growth of its own business. Social enterprises’ help for start-ups in innovation and entrepreneurship area can also provide new opportunities for themselves and achieve win-win results.

4. Ideas for the Innovation and Entrepreneurship Education of Industry-University-Research Collaboration

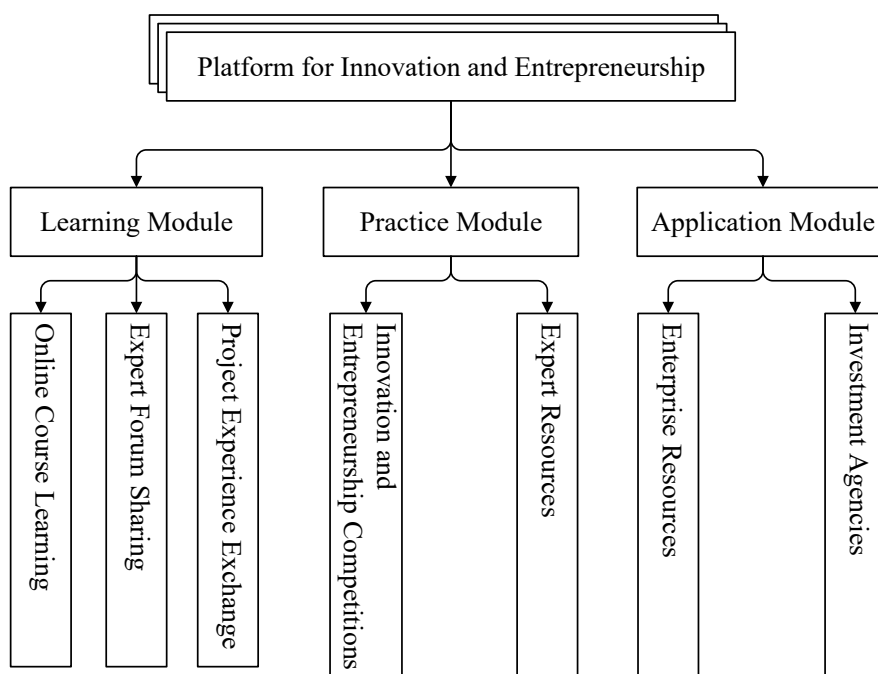


Figure 1. The construction of innovation and entrepreneurship platform

The industry-university-research collaboration promotes the integration of social resources to build a platform for innovation and entrepreneurship. The universities and industry-university-research institutes are closely linked to establish a linkage platform and promote the interest and boom of innovation with a standardized model.

4.1 Learning module

Basic learning of innovation and entrepreneurship is the main focus of social innovation and entrepreneurship education. This can make more people in the society understand innovation and entrepreneurship and master the necessary knowledge, qualities and capabilities of innovation and entrepreneurship. The platform learning module is mainly divided into three parts, followed by online course learning, expert forum sharing, and project experience exchange. Firstly, online courses are based on colleges and universities, bringing innovation and entrepreneurship courses in colleges and universities together to form an online learning platform. This enables the sharing of innovative and entrepreneurial learning resources in colleges and universities and forms an open learning model. Secondly, experts' sharing forums are based on the teaching of universities. They use entrepreneurial experts or outstanding entrepreneurial talents as teachers to share various open class resources. They understand various policies, trends and the opinions of professional teachers in entrepreneurial area so that students can learn about entrepreneurship from a more professional perspective. Thirdly, the exchange of experiences focuses on displaying various successful cases of innovation and entrepreneurship. Through various types of road show videos and business plans, students can learn the experience, entrepreneurial ideas and entrepreneurship from successful people. Innovation and entrepreneurship learning focuses on the teaching and knowledge popularization that lays the foundation for the practice in the later stage.

4.2 Practice module

Practice is an important way to transform learning knowledge into actual business and it can reflect one's own entrepreneurial capabilities. The innovation and entrepreneurship platform provides multiple types of innovation and entrepreneurship competitions. It uses innovation and entrepreneurship competition as a medium to enhance students' practical ability on using theoretical knowledge of innovation and entrepreneurship and to enrich their experience through competitions. In addition, students can provide high-quality ideas and upload their own business plans to the platform to seek the help from professional teachers and the attraction of venture capitalists. The platform brings college teachers, researchers, entrepreneurs, innovation and entrepreneurship experts and other outstanding experts together to feedback on the problems in the business plan timely. They also provide professional help in innovation and entrepreneurship practice and become the second mentor in student innovation and entrepreneurship.

4.3 Application module

The main purpose of innovation and entrepreneurship is to export innovation and entrepreneurial achievements. Commercializing innovation and entrepreneurial achievements and realizing social and economic effects are one of the driving forces for companies to promote industry-university-research. For the transformation from innovative theoretical results to real entrepreneurial achievements, various departments such as universities and governments have failed to make full use of. The platform has high-quality enterprise resources and venture-capital institutions. Entrepreneurs and investors can browse a large number of business plans on the platform. Related companies and investment institutions will evaluate usability and profitability of the projects, and select promising projects to give support on talents, funds and technology. This can provide enterprise platforms to enter into enterprises to make them experience entrepreneurship training. So that the commercialization of innovation and entrepreneurial achievements will be accelerated and the development of the company's production will be promoted [9]. At the same time, the platform will also push projects to relevant companies to encourage students' enthusiasm for innovation and entrepreneurship. This will promote the transformation of project achievements and make innovation become the foundation of entrepreneurship as entrepreneurship is the goal of innovation.

5. Conclusion

The collaboration of industry, universities and research in college students' innovation and

entrepreneurship education means that the innovation and entrepreneurship project can increase the awareness of relevant basic knowledge and the participation enthusiasm in colleges and universities. Through the technical and professional guidance of scientific research institutions, the project will be made in-depth and finally convert to reality in industry. The three links are progressive and in close contact with each other. Through the joint efforts of universities, scientific research institutions, industry and enterprises, innovations on entrepreneurship of undergraduates are promoted in students' cognition, faculty and achievement transformation. This will promote the integration of college students' innovation and entrepreneurship resources effectively and the improvement of the quality of innovation and entrepreneurship training.

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