Construction of Innovation and Entrepreneurship System Based on Material Science: a Case Study of Central South University

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Abstract. In recent years, China is vigorously promoting the public entrepreneurship and innovation, making in-depth implementation of college students’ innovation and entrepreneurship leading plan, thus innovation and entrepreneurship education system has become the current hot spot of the student work in colleges and universities. In this paper, taking material science as an example, we have proposed to build the innovation and entrepreneurship education system at the grassroots level based on the subject background, and made an organic combination of the innovation and entrepreneurship education, material subject background and professional knowledge education. On the one hand, the course system of innovation and entrepreneurship in material science should be established. Besides, innovation and entrepreneurship courses and related cross-disciplinary courses should be added. We can also form a part-time supervisor team of innovation and entrepreneurship and make a school-enterprise joint teaching model to guide students to do the entrepreneurship steadily. On the other hand, we should carry out innovation and entrepreneurship extracurricular credit system management, and organize innovation and entrepreneurship activities with professional characteristics, to develop the students’ innovative thinking and entrepreneurial ability. The potential points of innovation and entrepreneurship in subjects and professions should be excavated. We are also supposed to lay stress on practice and try to innovate. The two-pronged approach must be done to build an innovation and entrepreneurship education model based on the background of material science.

Introduction

In recent years, European countries, the United States and other developed countries in the world have introduced innovative related bills and reports, strengthening the cultivation of innovative talents and making it an important means to improve national economic and social development, personnel training quality and comprehensive quality. China also attaches great importance to innovation and entrepreneurship training, especially the eighteenth national congress of the CPC has made a series of important deployments of innovation and entrepreneurship personnel training, creating a good atmosphere for public entrepreneurship and innovation in the whole society. The State Council has further introduced the “opinions on deepening the higher education innovation and entrepreneurship education reform in colleges and universities”. The document requires of deepening innovation and entrepreneurship education reform comprehensively; forms innovation and entrepreneurship education ideas with Chinese characteristics by 2017; establishes excellent system of innovation and entrepreneurship education in colleges and universities by 2020; and clarifies nine major tasks and measures of innovation and entrepreneurship education in colleges and universities [1]. Overall, the innovation and entrepreneurship education in China has made some encouraging progress, showing a good trend of development in depth, but there are still some prominent issues, such as not tightening with the professional education, divorcing from practice,
the urgent need of formulation of innovation and entrepreneurship education system and so on. If colleges and universities are to cultivate a large number of innovative entrepreneurial talents, to better serve China’s economy and society, they need to learn the successful experience from both home and abroad urgently [2-4], and strengthen the organic integration of disciplinary professional education with innovation and entrepreneurship education.

1. The Necessity of the Combination of Innovation and Entrepreneurship System With Disciplines

At present, the combination of professional characteristics with innovation and entrepreneurship education in colleges and universities is still less. The colleges’ grassroots level innovation and entrepreneurship education systems need to be refined. Most of the innovation and entrepreneurship education in colleges and universities is separate or not closely integrated with disciplines [5], innovation and entrepreneurship education experts do not understand what the result conversion points are in each discipline, and the teachers of professional subjects do not have the awareness to cultivate students’ ability of innovation and entrepreneurship. In fact, the subject professional education and innovation and entrepreneurship education are not contradictory, but complementary. On the one hand, purely professional education is often passive indoctrination of education, lacking direct participation and practical operation of college students, which is not conducive to stimulate students’ awareness of innovative and entrepreneurial thinking, not to mention exploring in-depth innovation development directions and applicative points of disciplines. This directly leads to the poor knowledge, the weak entrepreneurial ability and the low professional recognition of students. On the other hand, the system of innovation and entrepreneurship education, which is completely separated from the discipline specialty, is often “rootless duckweed” and can’t have long and deep development. Especially in the hi-tech field, if there is no discipline as the foundation to support the field, it can’t get good development. Besides, the current successes of innovation and entrepreneurship are mostly concentrated in the field of high-tech, which is precisely the advantage of the discipline. Therefore, the organic integration of subject professional education with innovation and entrepreneurship education is of great importance. On the one hand, with the help of the platforms of innovation and entrepreneurship, students can understand the combination of subject and market, and enhance professional interest, self-exploration consciousness and the practical ability during the disciplinary professional education. The transformation rate of science and technological achievements is improved to some extent in colleges and universities. We can even form a three-party win-win model of production, study and research. On the other hand, innovation and entrepreneurship education based on professional disciplines, can really achieve technological innovation and technological entrepreneurship. With the technical support and personnel, colleges and universities can make innovation and entrepreneurship extensive and effective, promoting employment by entrepreneurship, and there are real results, not only the improvement of students’ ability and quality.

In conclusion, the main task of higher education has gradually changed from imparting knowledge and skills to cultivate knowledge and technological innovation ability, and innovation and entrepreneurship education is undoubtedly the important platform and starting point to transfer the “knowledge imparting” to “ability training” in all subjects. This is an important development direction of China’s higher education reform. Innovation and entrepreneurship education must be integrated with general education and professional education. The professional education is the main part supplemented by a series of innovation and entrepreneurship courses and practices, which can effectively cultivate students’ innovative spirits, awareness of entrepreneurship and entrepreneurial skills. In the process of building the foundation of professional subjects for students, we can also help them construct an organic correlation of knowledge. Through a wide range of knowledge, they can learn to discriminate, think, select and orientate, so that they can enhance social adaptation, resource integration and integrated innovation ability, that is, the survival ability and development ability. This is the ultimate purpose of “educating people”. Therefore, the innovation and entrepreneurship education system based on the professional disciplines is an
inevitable choice for the development of innovation and entrepreneurship education in colleges and universities, because the system can improve the breadth and depth of the development and meet the needs of social development.

2. Construction of Innovation and Entrepreneurship System Based on Material Science

In recent years, School of Materials Science and Engineering, of Central South University, has carried out the innovation and entrepreneurship system reform, implementation and optimization of research with characteristic speciality and systematicness, and has explored the cultivation mode of material discipline innovation and entrepreneurship talents. We have established and improved the material discipline innovation and entrepreneurship curriculum system and ability training system; revised and updated the personnel training program; set up a reasonable amount of innovation and entrepreneurship courses and class hours, and actively organized a series of innovation and entrepreneurship practices for college students. The extracurricular credit, award evaluation, free-test recommendation or comprehensive selection of graduate students is actively identified by all kinds of innovation and entrepreneurship achievements of students. At the same time, we encourage the combination of production, study and research, and encourage the creation of academic companies and entrepreneurship combat companies, so the innovation and entrepreneurship education of colleges and universities will effectively fall into the production and practice, and effectively improve the innovation and entrepreneurship awareness and social practice of students whose major are material science and engineering. The related results “research and practice focused on the personality development of material innovation and entrepreneurship personnel training model” won the first prize of teaching achievement in Hunan Province, and “the foundation of a new model of college students’ entrepreneurship education” won the second prize of national teaching achievement.

2.1 Constructing the course system of innovation and entrepreneurship in material science

School of Material Science and Engineering in Central South University, adheres to the concept of running a school: “taking high moral values establishment and people cultivation as the foundation, taking the needs of the community as orientation, and taking students as the center”, and implements the policy of cultivating: “thick subject basis, wide professional field, strong practical application, perfect innovation ability”. Combining the advantages and characteristics of the College, and according to the international engineering education professional certification standards, we focus on training high-quality personnels with scientific research and engineering technological ability in the area of material science and engineering. The personnels should have good ideological quality and professional ethics and humanity literacy; master the basic theory of a solid and systematic professional knowledge and certain social, economic, legal, management and other knowledge; know the dynamics of the forefront of the discipline; have practical abilities, the capacity of obtaining knowledge by themselves, the capacity of innovation and entrepreneurship; and have strong organization and management ability, teamwork spirit and international perspective.

Figure 1 is the material subject innovation and entrepreneurship curriculum system. Around the material discipline curriculums, we set up material science innovation and entrepreneurship courses, interdisciplinary elective courses and the second classroom innovation and entrepreneurship seminars. We also reasonably arrange the class configuration, and these courses are basics of each other, complements of each other and promotions of each other, in order to play the role of the classroom more effectively, and lay a good theoretical foundation of innovation and entrepreneurship for students.
2.2 Carry out a series of practical activities of innovation and entrepreneurship with distinctive characteristics of material science

Material disciplines have a strong teaching staff, and a large number of national and provincial teaching and scientific research results with professional background. The students generally have solid professional knowledge. On this basis, organizing professional, characteristic and systematic innovation activities can combine with professional background better, and convey knowledge to wisdom better. This can make students’ innovation and entrepreneurship more objective, realistic and feasible. The field of material subject is wide, involving many industries. On the one hand, successful alumni of all walks of life provide students with real and fresh cases of innovation and entrepreneurship. On the other hand, we can hire outstanding alumni as entrepreneurship mentors, providing innovation and entrepreneurship guidance for students.

Scientific and technological practice is the main way to carry out innovation and entrepreneurship education. The campus should build and create a strong atmosphere of innovation and entrepreneurship culture and build a wide range of innovative education platforms. The series of activities such as “Going into Scientific Research”, “Material Student Forum”, “International Talents”, “Guidance of Material” and “Real Materials” have been continuously carried out. The “Going into Scientific Research” has been held for 17 times, focusing on the application of professional knowledge, scientific research and practical ability training of students. This activity includes innovative personnel training laboratory, metallographic sample making competition, innovative material design competition, innovation and entrepreneurship annual meeting and various competitions. The winners will get awards and extracurricular credits, and the instructors will get lesson-hour subsidizes and workloads. “Material Forum” series of activities focuses on inviting high-level experts, outstanding entrepreneurs at home and abroad, and outstanding students to come to the stage for reporting or exchange ideas, in order to expand students’ horizons, and enhance their ability of innovation and entrepreneurship. Through the influences of new materials, new visions and new ideas, we explore the potential innovation points of material discipline. Nearly 200 seminars were held in the past four years. The distinguished guests are from more than 30 countries, including the United States, Russia and Japan, benefiting more than 40,000 people directly. Through the above activities, in the near five years, more than 150 people in the School of Material Science and Engineering won national discipline competitions and innovation and entrepreneurship projects annual, winning the National “Challenge Cup” Grand Prize, Cross-Strait Students Innovation and Entrepreneurship Competition Grand Prize, “Internet +” Innovation and Entrepreneurship Competition Silver Prize, and a series of honors.

It is the ultimate goal of innovation and entrepreneurship education to establish an independent or
co-founder company to carry out entrepreneurial combats. “Turning knowledge into capital” and “turning wills to actions” are the effective standards for finalizing the effect of innovation and entrepreneurship education. On the one hand, through the combination of production, study and research, colleges and universities should be linked with alumni enterprises, academic companies, and students’ start-up companies. Then, all of them should make a positive contact and have cooperation with each other, so that the corporate culture, campus culture and entrepreneurial culture can have mutual penetration, mutual integration, and mutual complement, in order to help students have feasible creativity and results. All of them should be applied to the practice, thus achieving the seamless docking of knowledge, quality, and ability, so as to continuously enhance the ability of students’ innovation and entrepreneurship. On the other hand, the successes of the discipline entrepreneurial companies which are the main carriers of the students’ early integration of production, study, and research, can attract students to participate in scientific research and production activities, thus forming a flexible, open, synchronous capacity training platform of innovation capacity training. In addition, colleges and universities, enterprises, research institutes and government agencies can jointly develop incubation bases dedicated to students’ innovative and entrepreneurial practice. Start-up companies can select entrepreneurial projects which have development prospects by students under the guidance of teachers, such as the conversion of mature laboratory research results to the production practice. And we should clearly require that all companies in the entrepreneurial base should obey the “corporatization” operation. In the full incubation basis, we encourage and support those projects that have the ability to resist market risk, have capital and technology, and have relatively mature operation and management, to register as a company officially, promoting them to the market and encouraging them to do more, and finally achieving the value of innovation and entrepreneurship education in colleges and universities.

Conclusions

Deepening the reform of innovation and entrepreneurship education system is an urgent need for China to promote innovation-driven development strategy, speed up the economic upgrading and quality, and upgrade industrial development. It is an important measure to implement the comprehensive reform of higher education to promote better employment of college students [1]. College students’ innovation and entrepreneurship education is a kind of university education which is different from the traditional one whose main task is teaching knowledge. It is a new educational idea based on innovation, which has become a new trend of modern higher education reform. To promote innovation and entrepreneurship education reform, it is essential to strengthen the deep integration of innovation and entrepreneurship education with the background of professional disciplines. Through the establishment of the innovation and entrepreneurship educational system with the deep integration of material science, we will stimulate students’ interests in innovation and entrepreneurship, and improve the ability and quality of innovation and entrepreneurship in curriculum system design and practice organization. Through the establishment of the combination of production, study and research, and establishment of discipline companies and other entrepreneurial companies, the students’ practice of innovation and entrepreneurship will be carried out genuinely. With the rapid development of innovation and entrepreneurship education both at home and abroad, colleges and universities should deeply understand the importance of cultivating innovative and entrepreneurial talents, continuously promote the reform and development of innovation and entrepreneurship education in colleges and universities, and further cultivate comprehensive talents who have comprehensive high quality, and innovation and entrepreneurial ability, so as to provide intellectual support and talent assurance for building an innovative country.

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