Research on Situation and Countermeasure of Students’ Makerspace Constructed by College in China

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Abstract: The implementation of Maker education in Colleges and universities is carried by Makerspace, based on the idea of innovation, practice and sharing. Its purpose is to culture students’ capacity for innovation, practice, Entrepreneurship and employment. The paper introduces some domestic representative Makerspace, summarizes the significance of constructing Makerspace in college, and put forward several rational Suggestions.

Introduction

With the proposal of “Mass entrepreneurship and innovation”, entrepreneurial group in China is changing from “small minority” to “public”. A new type of entrepreneurial carrier called “Makerspace” is rising rapidly. On March 11, 2015, the state council issued a document named Guidance on developing maker space to promote innovation and entrepreneurship in the public, which required to accelerate the construction of the maker space, summarize how to promote new incubator model such as Makerspace, entrepreneurial coffee, innovation works and so on, reduce the threshold of innovation and entrepreneurship to encourage technicians and college students. Recently, the concept of “Makerspace” has spread rapidly, which attracts attention of enterprises, entrepreneurs and the public. Many domestic colleges and universities have begun to construct Makerspace to expand the new space for teachers and students, cultivate students’ practice and innovation ability and stimulate young students to seek jobs or start their own business.

The Connotation and Characteristic of Makerspace

“Maker” is a kind of people who doesn’t regard profit as a target, but turn idea into reality by his own interests and hobbies [1]. Makerspace is a community platform with the core concept of users’ innovation which provided to maker to communicate creative and innovative ideas, combine online and offline products and bond innovation with making friends. It is a typical performance of 2.0 mode innovation in the field of design and manufacture. According to the statistics of global Makerspace of wiki’s web site, there are 1899 Makerspaces all over the world until May 2015, including 53 domestic Makerspaces which have been formally operated. Radiation area of them covers North China, the Yangtze River Delta, the Pearl River Delta, central and western regions and Northeast of China. Certainly, new Makerspace around the world is still emerging.

In the early stage, Makerspace is generally formed by a group of people with similar interests. With development of its scale, some Makerspaces maintain the positioning of fans gathering places or common work sites, and the others undertake the functions of skills training faced to community-oriented or the host city by providing the sites, tools, equipment and coordinating various resources to support the project development of creative team in order to incubate products[2]. Its typical characteristics are as follows (1) Having a creative physically space place (2) Having a social type of learning groups; (3) Flexible forms of organization; (4) A highly open way to obtain resources of innovative elements[3].
Classic Case of Domestic Makerspaces

The differences of industrial structure and cultural atmosphere in China make the features of Makerspace various. On the aspect of development pattern, the domestic Makerspace has formed three main levels: Firstly, the mega-urban Makerspaces like Beijing, Shanghai, Shenzhen, etc.; Secondly, the Makerspaces in central cities which based on good technology; Thirdly, the Makerspaces which relying on universities and research parks. We will introduce several classic cases of Makerspace selected from cities and colleges in this paper.

Urban Makerspace

Beijing

As Internet Network Information Centre in China, Beijing has assembled a large number of software engineers and venture capital investment, which makes it convenient for the transformation and industrialization of Makerspace’s production. At present, Beijing has emerged some service organizations of Makerspace such as Beijing Makerspace Alliance and a multitude of entity Makerspaces, for example, “Beijing Makerspace”, “Beijing IC Coffee” and so on. “Beijing Makerspace” founded in 2011, it is an important part of the global network of maker, as well as the largest Makerspace in Asia. In Beijing, there are more than 300 members of Maker and the number of people affected is over 100 thousand. It also has more than 1,000 square meters of the activity space and the most complete processing facilities and equipment. “Beijing Makerspace” has established its own featured brand in three aspects of setting up a platform for collision of creative ideas, insisting on cross-border collaboration to promote creative products, cooperating with top enterprises and providing financing support.

Shanghai

Shanghai is an internationalized metropolis, which has a lot of active Makers. The Makerspace covers the field of intelligent robots, ecological farms, smart home and so on. Located in Changle Road, Xuhui District, “Xin Chejian” is the largest Makerspace in Shanghai, as well as the first one in China. Its mission is to support, create and promote physical computing, open source hardware and Internet of things. The long-term goal is to spread the word about Makerspace all over China and promote culture of Maker. Thereafter, Makerspaces like “Moguyun Makerspace”, “IC Coffee”, “Mayi Makerspace” and “AC117” have been established one by one. In addition, nearly 40 innovation service organizations jointly set up the Shanghai Makerspace Alliance. On March 29, 2015, the Shanghai government issued “Action Plan on Pujiang Entrepreneurship”, which means to make Shanghai become the best practices city of global Maker in 2020.

Shenzhen

With the profound industrial base, open and inclusive city atmosphere and complete industrial chain of Maker, Shenzhen is regarded as the Heaven of Maker. On June 17, 2015, the Shenzhen government issued Three-year Action Plan on Development of Maker. It intends to use 3 years to build Shenzhen into an international center of Maker. At present, Shenzhen has gathered some typical Makerspaces such as “Chaihuo Makerspace”, “TechSpace”, “Shenzhen DIY Community” and so on. Founded in 2010, “Chaihuo Makerspace” is the first Makerspace in Shenzhen, which has attracted more than 10,000 people to participate in activities in the establishment of 4 years. Its creative products are involved in Internet of Things, Green Energy and many other subjects. When Premier Li Keqiang visited “Chaihuo Makerspace” on January 4, 2015, he praised them for fully meeting market demand and infinite creativity. At the same time, he mentioned that this kind of vitality and creativity will be the eternal power of Chinese economic growth in the future.

Xi’an

Since 2015, Xi’an entrepreneurial innovation has been increasingly active and entrepreneurial groups continue to expand. The Xi’an government issued Three-year Action Program on Accelerating the Development of Science and Technology Enterprises (2014-2016) in order to
encourage innovation and promote entrepreneurship. On September 14, 2015, Science and Technology Department of Shaanxi made Plan of Constructing Makerspaces’ Incubation Bases, it creates a series of venture coffee and Makerspaces. The first batch of 24 municipal Makerspace has been established until November 27, 2015, including “Xi’an Makerspace” which is located in the east gate of Xi’an University of Technology. Founded in the end of September 2015, Xi’an Makerspace covers an area of 230 square meters and consists of conference area, production area, 3D printing area and mechanical processing equipment area. The main function of it is to provide working platform for technology communications, as well as produce creative products. Compared to the large urban Makerspace, its scale and function and other aspects need to be further enhanced.

**Makerspace in Campus**

**Hangzhou Onion Capsules**

“Hangzhou Onion Capsules” founded in 2011, it is the fourth Makerspace after “Beijing Makerspace”, “XinCheJian” and “ChaiHuo Makerspace”, it is also the first domestic Makerspace created by college students. It was co-founded by the students who come from School of Intermedia Art, and gradually developed into a publishing platform of production while keeping an open, creative and friendly environment. Compared with other Makerspaces, it pays more attention to Interactive art, sound art and so on. In a word, the artistry of it is more prominent.

**Maker space in Tsinghua**

“Tsinghua Makerspace” was established in September 2013, which is located in Tsinghua University with 9 floors in total. It is currently the largest university Makerspace around the world, covering almost 16500 square meters. The Makerspace is designed to create innovative research and advanced manufacturing workshop as forerunner, based on engineering training area and regard open Maker studio and interdisciplinary laboratory as guide. It is aimed to form a comprehensive originality & innovation & entrepreneurship training base for education and engineering. At the end of 2014, “Tsinghua Makerspace” set up with the hope of gathering other universities who possess Makerspaces to make resources sharing come true and hold large-scale activities. So far, more than 10 colleges and universities have joined in Maker Alliance in the campus.

**Makerspace in Xi’an University of Technology**

According to the author’s survey, there are two Makerspaces in Xi’an University of Technology. One is Zero Maker Team, whose studio is located in engineering training center in campus. It was established by 7 students, who respectively come from Academy of Art and Design, College of Computer Science, Machinery Institute and College of Science, Including six directions such as civil engineering, metal, non-metal, machinery, electronics and product development. It has developed into a comprehensive Maker Team until now, and was admitted by Xi’an Science and Technology Bureau. Another is CoD Alliance founded by Entrepreneurial Association, who is responsible for guiding entrepreneurial team, organize entrepreneurial activities in the campus and help development of the students’ entrepreneurial team. It has become a branch of Shaanxi College Students’ Entrepreneurship Association of Xi’an University of Technology which directed by Shaanxi Provincial Civil Affairs Department, and the incubator base of Shaanxi’s Makerspace which belongs to the subordinate body of Shaanxi Science and Technology Resource Centre.

**The Significance of Constructing Makerspace in Colleges and Universities**

**Promote the Development of Relevant Subjects**

Colleges and universities have four functions, which is spreading knowledge, cultivating talents, scientific research and serving the society. So, there is unique advantage to create Makerspace. All of the college students, teachers, alumnus and other related social persons can share their creation in Makerspace and collaborate to design new product models. Based on these, the development of Makerspace can perfect the theoretical research system like informatics, pedagogy, management
science and so on. For example, the emergence of Library Makerspace establishes the foundation of librarianship’s theoretical reformation and development, promotes the education of library science and realizes a positive interaction between practice and theory.

**Enhance the Depth and Breadth of Scientific Research Innovation in Colleges and Universities**

Faced groups with different experiences, major, and academic background, Makerspace has the ability to break departmental division, promote interdisciplinary communication between teachers and students, and provide a new way to combine teaching, research with production by exchanging and cooperating to be a comprehensive and multidisciplinary project. At the same time, some colleges and universities can take the initiative to cooperate with enterprises to develop projects jointly and provide internship opportunities with the assistance of Maker Team. It can not only promote students’ skills learning and teamwork spirit, but also increase their knowledge in order to support the experiment and verification for scientific research.

**Improve the Innovative Capability of College Students**

As an opening and sharing communication platform, Makerspace enables students to share their knowledge and work together and provide a new type of learning and production environment to create new things. It is combined cross-disciplinary integration with the development of economic society effectively by interdisciplinary training for students and satisfying the needs of enterprises. The construction of Makerspace can further enrich the campus culture of innovation and create a good atmosphere for innovation and entrepreneurship. It also plays a positive role in promoting talent cultivation and improving the innovative ability of college students.

**Stimulate College Students to Be Self-employed**

Starting a business is one of the important measures to ease the employment pressure of college graduates. That is to say, entrepreneurship means driving employment. However, lack of college students’ hands-on ability and social experience makes it easy to fail. As an incubation platform for students who desire to innovate and do their own business, Makerspace is able to help students to grasp the market direction, establish and acquire projects, set up teams and effectively shorten the distance between idea and reality with the purpose of stimulating college students to be self-employed. In addition, it can realize the entrepreneurial exercise in advance.

**Measures to Establish a Makerspace in Colleges and Universities**

**Emphasis on Creating Makerspace from a Strategic Height, and Promote the Cultural Construction of Maker**

On May 5, 2015, Party of Ministry of Education pointed out that we should strength the construction of Makerspace, make full use of University Science Park, Demonstrating Center of Engineering Practice and other recourses, and extend the number of college students to establish Makerspace on the conference named “Study and Implement Spirit of Prime Minister Li Keqiang’s Important Reply to Tsinghua Students”. In the new situation, colleges and universities should pay high attention to the construction of Makerspace, and bring it into the institutional construction and top-level design, as well as increase the intensity of corresponding policies support. Guided by the cultural concept of Maker, they should provide the special physical space for interest groups to innovate and practice, and organize the training of Maker Team by holding Maker Salon, Maker Competition, Maker Marathon in order to create a cultural atmosphere of Maker.

**Build a Right Mode of Organization and Operation with its own Characteristics and Resources**

The development and operation modes of Makerspace are different due to difference in professional directions and resources in colleges and universities. According to their own situation and development tendency of interest groups, colleges and universities should select the appropriate
mode of the operation. Makerspace can be built by a single department or related departments in the campus. Combined with local science and technology departments and governments, universities can establish a larger one. For example, Associated with local science and technology departments and governments, combined with the construction of students’ innovation and entrepreneurship team, the Makerspace in Central China Normal University built a school district of 2400 square meters. At the same time, creating online and offline platforms is convenient for Makers to communicate. We can make full use of the existing online platforms, such as discussion groups about the campus media, we chat, etc. Certainly, offline space is even more important.

**Strengthen the Financial Guidance and Development the Makerspace**

Fund is a key issue during the construction of Makerspace in colleges and universities. It is necessary to require a heavy outlay to equip common tools such as 3D printers, network devices and literature resources related to the innovative projects. The development of established Makerspaces in colleges and universities are limited to the lack of space for innovative activities, sustainable funds and other issues. It is a good way to imitate foreign cases of Makerspace to raise fund through budgetary expenditures, extra budgetary expenditure and others from institutions and individuals. Colleges and universities with adequate funds can support more funds or special funds in the budget. Lack of funds, the others should control the scale of Makerspace and implement gradually [4]. It is a good choice to jointly build and manage Makerspaces or win financial support by Makers’ products and social cooperation, so as to reduce the financial pressure.

**Strengthen Human Resources of Makerspace and Improve Security Services**

Most Makerspaces in colleges and universities are still in the early stages of development in organizing, training, assisting, incubating and managing. They are responsible for completing relevant policy system, operating mechanism and management plan to protect the construction and development of Makerspace. In terms of personnel, they can attract teachers, students or anyone interested in it, and absorb alumni, outsiders or experts. To establish the relevant systems and management standards, the managerial personnel must have a high comprehensive quality. For example, Combined with library and related departments, Students Affair Department of Central China Normal University brought 60 Maker groups organized by self-organized student organizations and student union into Makerspace with the assistance of MA, PhD and experts. Its goal is to provide support in terms of policy, space, funds and other operational service assurance and to make entrepreneurial teams better.

**Establish the Evaluation Index System for Sustainable Development**

On the basis of the constant development and expansion of Makerspace, colleges and universities should establish a set of effective evaluation index system. We can test the effect of Makerspace by questionnaires, satisfaction survey or interview. And the evaluation system can be used to test the aspects of investment and financing channels, mode selection and production and talent management, as well as assess operating costs and earnings of scientific and technological output in later stages. It should be established to promote the operation and the sustainable development of Makerspace.

**Conclusion**

The emergence of Makerspace has led to “the new normal” of the public to participate in innovation. College students is a group with engineering professional knowledge, active thinking and strong practical ability, they are supposed to be practitioners of Makerspace. In the process of constructing colleges and universities’ Makerspace, it needs relevant policy support, the platform provided by campus and the participation of social enterprises. At the same time, college students should give full play to creativity in the tide of “Mass entrepreneurship and innovation”, and work together with the youth innovation talent and team, so that make the innovation of the college students’ Makerspace to new heights.
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