Results and Strategies of Maker Education in China's Basic Education

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Abstract. Maker Education is a hot topic in education. The elementary and secondary schools of china are increasingly focusing on Maker education, from the government to primary and secondary schools and teachers, all actively exploring the maker education localized in China. This paper presents a Maker Education development path of China. China's Maker Education includes four periods, incubation period (before 2009), germination period (2009-2012), exploration period (2013-2014), development period (after 2015), Associating problems encountered in China's Maker Education, three viewpoints concerning developing specific and measurable Maker educational goals, playing an active role in guiding the policy and Strengthen the teachers' training and fostering are pointed out.

Introduction

The Maker Movement is a community of hobbyists, tinkerers, engineers, hackers, and artists who creatively design and build projects for both playful and useful ends. There is growing interest among educators in bringing making into K-12 education to enhance opportunities to engage in the practices of engineering, specifically, and STEM more broadly.[1]

Innovation education in China in the new era is increasingly emphasizing the practical teaching reform. The cultivation of students' innovative ability should be highlighted in this reform. In China, Maker education is seen as an important model for innovation education. China's Maker Education includes four periods, incubation period (before 2009), germination period (2009-2012), exploration period (2013-2014), development period (after 2015)[2]. Chinese maker education develops rapidly from both horizontal and vertical dimensions.

On the horizontal dimension, organizations have stepped up guidance and support. Maker Education has attracted in school and out of school. Research institutions deepen relevant theories and practice research. Many businesses make substantial investments in research and development of teaching equipment in Maker Education.

On the vertical dimension, more and more teachers know the Maker Education's concept and develop activities of the teaching in practice. Objective is to explore the construction of the Maker curriculum system.

The Development Periods of Maker Education in China

China's Maker Education includes four periods, incubation periods (before 2009), germination period (2009-2012), exploration period (2013-2014), development period (after 2015). (1) Incubation period(before 2009). In the early 1980s, the "zhongguancun electronics street" has become a "China making" historical miniature in the digital age. The elementary and secondary schools in china have always attached importance to the cultivation of students' ability to learn in innovation. China's middle schools' science laboratory teaching, the information and technology curriculum of elementary and secondary schools, the general technological teaching in high schools and the curriculum of labor in elementary and secondary schools, They provide support for teacher reserve, basic teaching
facilities and curriculum design for the development of China's Maker education. Beyond that, institutions such as Science Museum and Youth Palace have been critical both in terms of technology teachers and Makerspaces. (2) Germination period (2009-2012). In 2010, the radio magazine introduced the "MAKE" magazine, that opened a new window for "maker education" teachers. In that same year, the first makerspace for mainland China was born Shanghai; its name was "New workshop".[3] Since then, the maker culture has gradually formed in China. Maker Education has attached more and more attention in recent education reforms of teachers in the fields of science, information technology, and general technology. In 2012, Beijing Jingshan school holds the "Interactive technology and the future of the program teaching" seminar in which explored the Arduino, Scratch, etc used in Maker Education that is the beginning of Chinese maker education. (3) Exploration period (2013-2014). The teachers of elementary and secondary schools promoted the maker education through education practice, and then after-school education, university and maker enterprises began to pay attention to the education. The teacher who focuses on the development of the maker curriculum is constantly emerging, in the person of Xie zuo, Wu junjie, etc. University launched the maker education theoretical study. For example, Li yifei, a professor at Beijing Normal University, studies the design principles of the maker's curriculum. Zheng yilin and Li lu, a professor at Northeast Normal University, conducted a comparative research on Maker education. In addition, the open source hardware and robot such as Drobot, Microduino, 3D One, Seeed, and YuleWan are created to provide equipment support for the maker education practice. (4) Development period (after 2015). In June 2016, Education Informatization 13th Five-Year Plan issued by China's Ministry of Education has set new goals and targets for the Maker Education in China's elementary and secondary schools.[4] According to the proposal on the 13th Five-Year Plan, teachers should explore the effective approaches to carrying out the Maker Education and more Makerspaces set up. Shenzhen, Zhengzhou and Shandong province have successively promoted a series of Maker educational policies; these policies have the important leading and regular functions in educational developments of elementary and secondary schools. At the same time, the elementary and secondary schools formed a union and shared resources and infrastructure. For instance, "Qingdao elementary and secondary schools maker education alliance" was founded in May 2015 by Qingdao No. 9 Middle School and Qingdao electronic school, 20 schools in Qingdao and so on.[5] In January 2016, "Chongqing youth maker education alliance" was established in Chongqing No. 29 Middle School, which with 30 members.[6] In addition, more new results were made in the theory and practice of maker education. For example,"2016 primary and secondary schools and education resources research report"[7], through analyzing maker education of a wider global trend and investigating the maker education resources, the elementary and middle-school teachers can support awareness to maker education.

The Problem of China's Maker Education

In China Maker education is faced with a new environment, lots of difficulties will be encountered. (1) Teachers don't know about the essence of Maker movement for education. The goal of Maker education is to cultivate students' subject knowledge, innovation and manufacturing, self-cognition, cooperation, effective communication, responsibility and exploration ability. At the same time, the learning process based on creation is not only an interdisciplinary learning process, but education is one of the effective ways to make up the deficiency of education in traditional sub-disciplines.[8] (2) The maker's curriculum resources are inadequate. First, The teaching materials and teaching experience causes the teacher to be quite low deficient in the Maker education and Maker projects aspect scientific research ability.

Second, the education environment in the United States, the United Kingdom and other countries, as well as the setting of elementary and secondary schools subjects and the course, time arrangements and so on, are different from that of China. The maker textbooks of the United States and other countries cannot be used directly and need to be localized. Thirdly, the existing network learning
resources, which are more suitable for the study of adult makers, are not suitable for elementary and secondary school teachers directly for classroom teaching. (3) In China Maker teachers' professional quality is uneven. The teacher is the base of the Maker education. Teachers need to have practical skills and interdisciplinary knowledge integration ability. Educational resources are distributed in unbalance in China. Powerful teachers gather in the first-tier cities of Shanghai, Beijing, and Guangzhou and coastal cities in the east. At present, there are many temporary substitute teachers in the mid-western regions of China. Many of them lack systematic training and have low attainments in knowledge. These teachers are unable to carry out the maker curriculum. (4) Maker education equipment lacks effective supervision. It is necessary to pay attention to the safety problems in makerspaces such as electricity, ventilation and fire prevention. However, the corresponding construction standards for the construction of Chinese makerspaces security are missing, and the regulations on the safe use of the makerspaces are not standardized, and there are security risks in many primary and middle schools.

The Suggestion to Promote China's Maker Education Development

We need use society and government to publicize the Maker education. In the first place, the display policy guidance function promotes the Maker education development. Local governments have increased funding for education to promote the maker's teaching environment. The guarantee mechanism for the development of maker teachers is still to be perfected. In the second place, give full play to the advantages of education institutions and industry organizations, such as China education equipment industry association and China education society. We will build an education ecosystem, contributing to the construction of teacher training, maker curriculum, Maker faire, resource platform, standard formulation, education supervision and so on. Finally, strengthen teacher training, making locality to play an important role to sunk costs to develop Maker educational technology training for middle and primary school teachers. Meanwhile, we should leverage on higher normal universities resources to training the backup maker teachers.

Conclusion

Maker education as an important form of training students’ creativity, has been taken seriously by the China’s education. This paper, by review of the Maker education development in the china, analyzes the four developmental periods and seeing problems existing in the maker education, to find suitable path for the present situation of Chinese education.

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[6] Information on http://www.cqrb.cn/content/2016-01/21/content_47772.htm
