

Research on the Training Mechanism of “Maker” Talents

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Abstract:

As new era talents promoting “mass entrepreneurship and innovation”, “maker” has the characteristics of taking creativity as the core, practice as the foundation, “maker space” as the carrier, and the network as the basis. The emergence of “maker” is due to the emergence of open-source electronic prototype platforms represented by “Arduino” and the rapid development and promotion of 3D printing technology. As a product of the new era of science and technology, “maker” has the typical characteristics of taking creativity as the core, practice as the foundation, “maker space” as the carrier, and the network as the basis. Combining with the growth law of “maker” talents, the article proposes to optimize the talent training structure and establish a layered training mechanism; promote the integrated development of production, education and research, establish a collaborative education mechanism; break the resource bottleneck, and improve the talent training guarantee mechanism.

Key words: maker; talent training; mechanism

I. The Connotation and Characteristics of “Maker”

1. The Connotation of “Maker”

The word “maker” comes from the English word “Maker”, which means the person who makes something. In a broad sense, “maker” refers to a special group of people who can turn individual creativity and ideas into reality and are willing to share. In a narrow sense, “maker” refers to the application-oriented talents who can make use of open-source hardware and software to realize the creativity^[1]. American scholar Chris Anderson emphasized that “maker” behavior is derived from one’s own hobbies rather than profit-driven behavior. This behavior can transform ideas with certain technical challenges into realization^[2]. To sum up, we can see that “maker” is a kind of application-oriented talents who are keen on innovation, stick to their own interests and hobbies, and can use open-source hardware and software to turn various ideas into reality. They are not profit oriented and are willing to share.

2. The Characteristics of “Maker”

Creativity is the core. “Maker” is keen on innovation. Endless creativity and continuous inspiration are the basis of their creation and the core element of innovation. Driven by Innovation 2.0, the diversified development of the market, the increasing penetration of technology and the continuous release of policy dividends have provided fertile ground for the development of makers, and also provided a realistic platform for the realization of their creativity.

Practice is the foundation. The Internet has given birth to the era of “maker”, and “maker” has created a new situation of “mass entrepreneurship and innovation”. As the new force of mass entrepreneurship and innovation in the new era, “maker” not only has infinite creativity and inspiration, but also has strong practical ability. They have the courage to imagine and practice, are good at integrating existing resources, overcoming difficulties, putting ideas into practice, and turning ideas into products. They are real actors, not “daydreamers”.

“Maker space” is the carrier. “Maker space” is a low-cost, convenient, all element and open new entrepreneurial platform constructed through market-oriented mechanism, professional services and capitalization channels to meet the needs of innovation and entrepreneurship in the network era, which has the characteristics of openness, practicality, creativity and sharing^[3]. As an incubator of “maker”, “maker space” contains huge innovative energy. It not only provides a platform for maker to learn, communicate and create, but also provides an effective carrier for makers to realize their creativity.

Network is the basis. The rapidly changing network technology has changed the traditional technological innovation model. Technological innovation in the Internet age is undergoing profound changes. Firstly, the participants of innovation are not only professional and technical personnel, but also the general public. Secondly, the path of technological innovation changes from a single dimension to multidimensional interaction. Finally, “online crowd funding” has changed the traditional way of fund raising.

II. The Emergence of “Maker” and Its Historical Background

1. The Origin of “Maker”

In 1998, Professor Gershenfeld of the Massachusetts Institute of Technology in the United States opened a course called “How to Make Almost Anything”. It is surprising that students who have no technical experience in the class have created many impressive products. Inspired by this, researchers at the Massachusetts Institute of Technology established the first Fab Lab (Fabrication Laboratory). Fab Lab is a platform for rapid prototyping. Users can create, design and manufacture products in their imagination through electronic tools such as hardware equipment, materials and open source software provided by the platform. The establishment of Fab Lab platform laid a foundation for the emergence of “maker”.

In 2006, *Nature*, an international top academic journal, made a special report on the efforts and attempts of MIT researchers around the Fab Lab concept in the world. This report caused great repercussions in European society at that time, and also made people have a new understanding of invention and creation: Invention and creation not only occur in universities or research institutions with expensive experimental equipment, but also will not only belong to a few professional researchers, and have the opportunity to be completed by anyone anywhere^[4]. The idea that everyone can be an inventor and a creator has rapidly promoted the development of the “maker” group.

In 2012, the release of *Maker: The New Industrial Revolution* has had a profound impact on the development of “maker”. The author Anderson pointed out that “maker movement” is a booster for the digital world to subvert the real world, and also a new wave with epoch-making significance. The world will realize the creation of all people, and will also set off a new round of industrial revolution. He predicted that the future will be a “maker era”, which will lead the technology industry into a new direction, that is, the era of individual creation^[5]. In 2013, the publication of *Beyond the Obvious: Killer Questions that Spark Game-Changing Innovation* further promoted the upsurge of “maker movement”. Mckenney’s “killer questions” and “FIRE 4 steps” opened a door for the success of maker^[6]. It can be said that the two classics opened the theoretical door of “maker” research, making “maker” rise from individual phenomenon to theoretical research, which laid a solid theoretical foundation for the rapid development of the maker movement and the spread of globalization.

2. The Background of the Rise of “Maker”

With the rapid development of the Internet, the emergence of open-source electronic prototype platform represented by Arduino and the rapid development and promotion of 3D printing technology have greatly reduced the threshold for engaging in creative work, increased market demand, and accelerated the gathering of potential employees, which has greatly promoted the growth of the “fourth industry”. The rise of the “fourth industry” characterized by user experience provides fertile soil for the development of “maker” and accelerates the globalization of “maker”.

Open-source hardware and software means that developers provide software source code, circuit schematic diagram, bill of materials, design drawings and other contents originally protected by intellectual property law for users to copy, learn and develop for free. By providing an open source license agreement, people other than developers can also modify, combine, and produce designs of others according to their own needs^[7]. For developers, open source can help their design be adopted by more users, and constantly be modified and improved, thus accelerating the development and maturity of products. For users, open source reduces the development cost of products and projects, shortens the development time, and improves the efficiency, so that mass innovation becomes possible.

3D printing is a technology that uses bondable materials, such as powdered metal or plastic, to construct objects by printing layer by layer on the basis of digital model files. This technology appeared in the mid-1990s, but it is extremely rare in production life because of its high price. The emergence of open source hardware Arduino and the continuous improvement of open source technology have greatly reduced the production cost of 3D printers, making 3D printing technology gradually come into people's life. This has brought a technological revolution to the material shaping technology. The time period of industrial mould making has been shortened from several months to several days or even hours, and the production cost has been reduced from tens of thousands of yuan to tens or even several yuan. It can be said that the emergence of open source electronic prototype platforms and the promotion of 3D printing technology have accelerated the globalization of the "maker" group.

III. Construction of "Maker" Talent Training Mechanism

1. Optimize the Structure of Talent Training and Establish a Layered Training Mechanism

(1) Cultivation of "Maker" Talents in Elementary Education

The cultivation of "maker" talents is a continuous process. It is a gradual process from the enlightenment of innovation consciousness to the formation of innovation and entrepreneurship ability system. In the field of elementary education, it is essential to break the traditional score-oriented education model, strengthen the cultivation of innovation awareness and literacy, and then tap the potential of innovation and activate innovation genes. In fact, the purpose of elementary education is to enable students to develop their potential, creativity and critical spirit. As the education of cultivating all-round talents, "maker" education should pay attention to experience education in the field of elementary education, and integrate learning motivation, learning situation, cooperation and communication, team spirit and respect for failure into the process of curriculum learning. It should continuously improve students' self-awareness, self-efficacy and team-awareness by carrying out rich creative activities, so as to achieve the development of all-round abilities such as interpersonal communication, team cooperation, problem analysis and problem solving^[7].

(2) Cultivation of “Maker” Talents in Higher Education

The “maker” talents who enter the field of higher education are a group of college students with certain knowledge system and learning ability. They have their own understanding of innovation and entrepreneurship, and even some college students start their own innovation and entrepreneurship process as soon as they enter the campus. As an advanced stage of talent training, higher education is also an important stage for “maker” talents to realize their life dreams. Therefore, the cultivation of “maker” talents in the field of higher education should be guided by the learning concept of “use for learning”, and constantly strengthen “project-based teaching”. “Project-based teaching” here refers to the teaching activities carried out by teachers and students through the joint implementation of a well-designed teaching project. “Use for learning” emphasizes “learn because of use”, which is a learning philosophy of “starting with the end”.

(3) Cultivation of “Maker” Talents in Social Education

The “maker” group entering the society is not only the builders of emerging cities, but also the promoters of regional industrial transformation and upgrading. To accelerate the cultivation of “maker” talents in the field of social education requires the following three points. First, we should promote the construction of “maker space” and build a batch of “maker space” with the characteristics of low cost, convenience, all elements and openness. At the same time, we should bring into play the policy integration and synergy effect, and realize the combination of innovation and entrepreneurship, online and offline, incubation and investment, so as to provide good workspace, learning space, social space and resource sharing space for entrepreneurs. Secondly, we should promote the development of “maker” service industry, set up “maker” service platform, provide financing, product promotion, industrial design and other business services for “maker”. Finally, create a cultural atmosphere for innovation and entrepreneurship, and establish a number of entrepreneurial models through media propaganda and public opinion guidance, making entrepreneurship a common practice.

2. Promote the Integration of Production, Education and Research, and Establish a Collaborative Education Mechanism

(1) External Coordination Mechanism

The external coordination of “maker” talent training is a kind of cross organizational strategic coordination, which is a dynamic and open collaborative education system formed by the interaction among the subsystems of local governments, schools, industries and enterprises. The cultivation of “maker” talents is a long-term process, and the key is to establish a relatively stable and sustainable collaborative education system. First of all, establish and improve the multi-party collaborative management mechanism. At the decision-making level, the main leaders of the government, schools and enterprises in different industries should take the lead to coordinate multiple subjects and solve the contradictions and conflicts in cooperation. At the operational level,

working groups should be set up to take charge of the specific problems in the cooperation. Secondly, it is necessary to establish a dynamic mechanism of mutual benefit to guarantee the interest demands of multiple subjects, including external interest driving mechanism and internal interest demand mechanism, so as to promote the benign interaction and sustainable development of multiple subjects. Thirdly, reasonable and effective division of labor should be carried out around the core tasks of applied talent training. Colleges and universities should make full use of their rich educational resources and talent advantages to provide high-quality services for local social and economic transformation, industrial structure upgrading, enterprise technology innovation and product research and development. The government should give full play to its functional advantages of policy formulation, overall planning and coordination, and encourage and support enterprises to participate in the training of talents in schools. As an intermediary organization, the industry should make full use of its information advantages, strengthen the relationship between universities and enterprises, and effectively alleviate the structural contradiction between talent demand and talent supply. As the terminal of achievement transformation and product manufacturing, enterprises, especially high-tech enterprises, should make full use of their technological advantages and actively participate in the talent cultivation process of schools to provide help for students' practice and teachers' enterprise research.

(2) Internal Coordination Mechanism

The collision between “maker movement” and education has produced a new education mode - “maker” education. As a lever to promote the innovation and development of colleges and universities, “maker” education provides a powerful “handle” for promoting innovation and entrepreneurship education and cultivating students' innovative spirit and ability. First of all, build a collaborative mechanism in and out of class. Schools should always adhere to the combination of professional theory learning and practical training, the combination of the first class and the second class, and strive to build an effective interface platform between professional knowledge system and “maker space”. Secondly, build a cross-disciplinary and cross-professional training mechanism. Colleges and universities should break the traditional single subject teaching mode, and set up interdisciplinary majors according to students' needs, so as to enrich students' disciplinary background. Finally, build a multi-department linkage mechanism within the school. Collaborative innovation is a process of system optimization and collaborative innovation for each innovation subject. Colleges and universities should use the “maker space” as a hub to connect the channels between various departments in the University, and extend the “maker space” to the training base of college students, the research base of tutors, the innovation projects of the Youth League Committee, the entrepreneurship park of the students' office, etc., so as to effectively improve the effect of linkage education among various departments in the University.

3. Break the Bottleneck of Resources, and Establish and Improve the Guarantee Mechanism

(1) Cultivate “Maker” Culture

The vigorous development of “maker movement” gave birth to the development of maker culture. Maker culture is a kind of young culture that fosters the “mass innovation” ecology, promotes the two-way transformation of knowledge and wealth, and “wakes up” technology. It has the basic characteristics of innovation, practicality, openness and sharing^[10]. As the forerunner based on the practice of minority groups, maker culture is embodied as a kind of cultural “soft power”, which has important practical significance to lead the development of “maker” talents. Therefore, we should nurture maker culture based on the “maker space”. The “maker” groups in the region can be effectively gathered together to form a nursery garden for the growth of “maker” culture through the “maker space”. Besides, the system should be improved to ensure the healthy development of “maker” culture. The strengthening of system construction and the construction of scientific system can provide necessary guarantee for the development of “maker” culture. On the one hand, it is necessary to establish a top-down incentive mechanism and evaluation mechanism for the “maker” culture, and integrate the “maker” culture into the construction of mainstream culture. On the other hand, by organizing various forms of “maker” activities from the bottom up, the development of maker culture is continuously enriched and promoted.

(2) Optimize the External Environment of Innovation and Entrepreneurship

A good external environment is not only the source of vitality to stimulate innovation, but also an important guarantee to promote the sustainable development of entrepreneurship. Building a batch of low-cost, convenient, all-factor, and open new entrepreneurial service platforms through market-oriented mechanisms, professional services and capitalization is an important measure to optimize the environment for innovation and entrepreneurship and strengthen service levels. On the one hand, through intense policies, a benign policy ecosystem can be created for regional social development, and the effect of high-level talent gathering can be accelerated. On the other hand, building a service platform can guide and promote the healthy development of “maker space”, and provide platforms and opportunities for all kinds of scientific and technological cooperation. Only when the entrepreneurial and innovation activities of the talents are encouraged, can the entrepreneurial and innovation be brought into play, the innovation achievements be recognized, and the entrepreneurial desire be realized, finally forming a good situation in which the entrepreneurial and innovative talents are honored in politics, benefited in economy and respected in society.

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