

Research on the Design of Service System of Maker Education under the Concept of Service Design

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Abstract: *The article explores the use of service design concept to build a reasonable service system for Maker education from the current problems of unfair distribution of resources and uneven development of Maker education. Service design integrates multiple skills and methods in design, management, and process, aiming to provide comprehensive services to customers, and it is an interdisciplinary field of practice and research[1]. Service design uses process standardization and purposefulness to decompose service processes according to user needs and their own characteristics, which can better build service systems. In this paper, firstly, by analyzing the development and main models of Maker education, it is believed that the service system of Maker education is beneficial to the development of Maker education. Secondly, by analyzing several famous service design processes and the tools and methods of the processes, the service design processes and the possible methods and tools that are suitable for constructing the service system of Maker education are summarized. Finally, several advantages of building a service system for Maker education are analyzed, and it is concluded that building a reasonable service system for Maker education can provide certain ideas and exploration directions for the development of Maker education nowadays.*

Keywords: *service design; maker education; service system; platform construction*

1. Introduction

In recent years, many countries have paid more and more attention to the cultivation of innovative talents, as a result, innovative education models such as Maker education have been paid attention to. In China, starting from the 13th Five-Year Plan, the National Education Bureau emphasizes the enhancement of students' information literacy, innovation awareness and innovation ability, and encourages the exploration of new education models such as Maker education^[2]. The 14th Five-Year Plan proposes to focus on key areas of education, key links, vigorously promote education reform and innovation, promote education innovation in the information age, and achieve high-quality development of education^[3].

The obvious economic differences between urban and rural areas in China lead to obvious differences in education^[4], the obvious imbalance of educational resources has become one of the social problems today. Since the reform and opening up, the national economy has made great progress, and the service industry in the tertiary sector has become a key factor affecting industrial development. With the research and application of service industry, service design is gradually used to solve social problems and social conflicts, and in 2015, Gao Ying argued that the lack or imperfection of public service system, including education, is directly related to the overall lack of meticulous and standardized service design^[5]. In 2019, Xie Guanping believes that the construction of information technology equipment has been relatively perfect, but teachers and curriculum in some cities need to be strengthened^[6]. The infrastructure of Maker education relies on information technology and equipment, and the Maker education service system is conducive to reducing the differences in the geographical development of Maker education, which can provide a reference for better meeting the needs of national innovative talents cultivation.

2. Development and model of Maker education

2.1. The origin and development of Maker education

In 1968, Professor Simon Papert, the founder of Artificial Intelligence Lab and Media Lab in Massachusetts Institute of Technology (MIT), developed LOGO language, the world's first

programming language for students in primary and secondary schools, which stimulates children's interest and enthusiasm in learning by means of basic graphing language and commands that children can easily understand, so as to achieve the purpose of entertaining and teaching. Therefore, he is recognized as the "the father of Maker movement" by scholars. The Fab Lab was founded in 1998 by Professor Neil Gershenfeld at the Massachusetts Institute of Technology's Center for Bits and Atoms, and it gave students the materials, equipment and knowledge to turn their ideas into reality. Those who are brave enough to turn their ideas into reality are called "Makers". In 2005, Dale Dougherty and Mark Frauenfelder founded the magazine "Make". They believe that Makers are good at learning, brave to study and willing to share, and Makers' activities cultivate innovative talents to adapt to the future social development. Both Steve Jobs and Bill Gates are club members of the magazine *Make*. In 2006, the magazine *Make* held the first Maker Faire, and later Maker Faire was held all over the world. The magazine *Make* is also recognized as the core organizational force of maker movement and the source of maker theory. In 2009, Obama spoke of wanting young people to create and invent, and scholars and educators began to pay attention to the issue of Maker education for students. In 2013, the White House launched the "Maker Education Program" to explore the integration of maker education into K12 education. On June 18, 2014, when the White House held the Carnival of Makers, President Barack Obama said that "today's inventions can become tomorrow's Made in America", and designated June 18 as National Day of Making.

2.2. Main Models of Creativity Education

Maker education originated in the United States, and the commonly used international Maker education models are also from the United States, mainly including Fab Lab, Living Lab, Learning Labs, WeWork and other Maker education models. Until now (September 20, 2022), MIT Fab Lab has cooperated with 2009 maker Labs, becoming the most popular maker education mode at present.

In 1998, Professor Neal opened a course called How to Make Almost Anything. He believed that in the era of big data, teenagers should know the real world and discover the science around them. In this class, even if students don't have enough technical experience and scientific background, students can still create something they can imagine, which makes students incredibly excited. At the same time, the MIT Fab Lab runs a virtual Fab Academy, which provides an intensive Maker education course covering all ages, including teenagers. Students complete the course by imagining, designing and making prototypes. These courses may use equipment or techniques such as computer-aided design, computer-controlled cutting, electronics generation, and 3D printing.

MIT Fab Lab combines more than 2,000 Fab Labs and the Maker communities around the world to form a huge online and offline education service system for Makers: Maker resources and tutorials, student achievement sharing platform, and shared maker Lab, providing sustainable service system solutions for Makers. Some scholars believe that the sustainability of Fab Lab concept is an important reason for the rapid expansion of Fab Lab maker education model in the world^[7].

3. Theory, methods and tools of service design system for Maker education

3.1. Theory of service design system

At the end of the 20th century, developed countries in Europe and America began to shift from social economy to service economy, and experts and scholars began to research on service design. In the 1980s, Lynn Shostack published several papers about service design: *How to design a service*, *Designing services that deliver*, *Planning the service encounter*, *Service positioning through structural change*. Shostack introduced the concepts of "service design" and "service blueprint", and therefore he was also regarded as the founder of service design.

There is no clear concept of service design so far, but scholars have found that service design plays a crucial role in solving practical problems through research. In 2007, Xu Fei and other scholars summarized the definition of service in a broad sense: "Service is a concept that includes the goal of the service, the service provider, the service recipient, the specific content of the service, the resources consumed by the service, the standard that the service should achieve, the specific behavior of the service, and the service design. The service is an interactive process that includes the goal of the service, the service provider, the service receiver, the specific content of the service, the resources consumed by the service, the standards that the service should meet, the specific behavior of the service, and the scenario in which the service occurs. The organizations and resources involved in this process and their

mutual interaction relations constitute the service system"^[8]. In 2016, Mr. Jiajia Chen pointed out in his book *Service Design - Definition-Language-Tools* that the study of service design is to think and plan every aspect of the service process in an all-round way^[9]. In 2019, China released the "*Service Outsourcing Industry Key Development Areas Guidance Catalogue (2018 Edition)*", which states that "service design in service is user-centered, collaborative multi-stakeholder, through the integrated integration of personnel, environment, facilities, information and other elements of innovation, to achieve service delivery, process, and contact system innovation. It is a design activity to enhance the service experience, efficiency and value through systematic innovation of service delivery, process and contact points by collaborating with multiple stakeholders.

Thus, in service design, "service" is actually a complex system, which includes the service provider, the service recipient, and the complete process of beginning, development, completion and repetition of the cycle of system interaction between the two.

3.2. Methods and tools of service system design for Maker education

In this paper, by analyzing the methods and tools of four well-known service design processes commonly used, the possible reasonable service design processes of maker education service system are considered. The four service design processes are as follows: the service design processes provided by ServiceDesignTools.org, IDEO which is an American interdisciplinary design company, Live | Work in Britain which is the first company in the world that focuses on service design, and double diamond service design process summarized by British Design Council. According to the ideas provided by these four service design processes, the service design process of maker education service system is divided into the following four stages:

The first stage, the demand collation stage: Maker education is an educational concept based on information technology, in which Makers use existing technology and equipment to turn their ideas into reality through their own hands, so as to "learn by doing"^[10]. Nowadays the emergence of artificial intelligence injects new blood into Maker education, and also puts forward new requirements for the teacher reserve and space construction of Maker education^[11]. In this stage, the resource situation can be analyzed through field research such as case study and field survey; the teachers, students, schools and local policy support can be understood through user interview techniques such as expert interview, group interview and individual interview; and the accuracy of information and needs can be confirmed by integrating user needs and designers' ideas with designing games, question cards, role plays, role files and other tools.

The second stage, design conception stage: how to show the needs should be think about from the overall situation to the details, so as to define the activities and service links of each link in the service system of Maker education. The service system diagram can help designers to understand the service elements, structure and purpose of the whole service system in the service system of Maker education. The user journey map can help the designer to clarify the interaction of each element and feasibility analysis of each link; Service blueprints can help designers quantify logical and interactive relationships; Touch point tables and user profiles can also help designers identify key points of user experience in service scenarios.

The third stage, prototype and testing phase: The designer finds the problems in the system from the perspective of users using the service system of Maker education, and digs out the possible problem points in the actual situation. At this stage, scene design, hotspot map, experience prototype and other tools can be used to make the prototype of the service system of Maker education at a low cost and high speed.

The fourth stage, evaluation and feedback phase: The Maker education service system relies on the current rapidly developing information technology, so the system is also required to provide timely update and iteration services. The evaluation and feedback mechanism of the Maker education service system is established to collect user feedback in time to help designers update and improve the Maker education service system. This stage mainly considers tools such as global impact analysis, scenario construction, and role tracking to complete the redesign task.

4. Advantages of Maker education service system

Service Design Network (SDN) was established in 2004, which marked the entry of service design into the discipline of education. In 2014, some scholars pointed out that it should continuously improve

the educational process, services and related stakeholder relationships for service design to flourish in the field of education^[12]. The integrity of the service system of Maker education lies in the system design considering the overall service, and Professor He Ke Ren believes that the focus of service design lies in the overall service^[13]. Service systems are diverse, and Professor Gong Miaosen believes that China's emerging service industry and ecology based on emerging technology platforms have surpassed the advance^[14]. The service system of Maker education is on the basis of emerging technologies and uses the service design concept for the overall service design, so it has several advantages as follows.

It is conducive to the reasonable distribution of service elements in the service system of Maker education: the characteristics of Maker education are practice, innovation, collaboration, and sharing; the objects of Maker education include teachers, students, parents, schools, and society; the process of Maker education involves Maker education curriculum, home-school interaction, policy support, and hardware and software support for schools. Different combinations of different service elements constitute different service system design solutions. Therefore, designing a Maker education service system according to the four stages of the service system of Maker education design process summarized in this paper can provide a reasonable configuration of the service elements in the service system and ultimately improve the service quality.

Facilitate the design of suitable service system: Service design is a system design, and service design needs to consider the needs of stakeholders in the system from the whole perspective. The purpose of the "whole" perspective of service design is to take into account the interests of multiple parties, in order to achieve the maximum social value of the design^[15]. Considering the feasibility and quantification of details of the service system as a whole with a global perspective, and using service design methods and tools to study the whole service system, is conducive to better design of the service system for creative education, so as to promote the healthy and smooth development of creative education.

It is conducive to improving user satisfaction and loyalty of the service: a perfect service quality assessment service system can help designers fully understand the usage of the service system Maker education, so that they can make corresponding adjustments and modifications, which is ultimately conducive to improving user satisfaction and loyalty of the creative education service system.

5. Conclusion

The development of services along with the economy has prompted various industries to conduct research on service design, and services have gradually moved from simple product manufacturing to comprehensive service system design. The development of computers and information technology intervene in the service industry, and through the design of services, industrialized society turns to information development. The unreasonable distribution of resources (teachers, equipment and other resources) for Maker education at present leads to the unfair development of Maker education. Establishing a reasonable service system for Maker education is conducive to maximizing the existing resources for Maker education and reducing the differences in the development of Maker education in various regions. Besides, when constructing a Maker education service system, the reasonable distribution and interaction of the elements in the service system are fully considered and a reasonable service system is designed. Therefore, the service system of Maker education is feasible in guiding the implementation of Maker education, and provides some reference for the development of Maker education and related design research such as the establishment of the service system.

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