Advances in Social Science, Education and Humanities Research, volume 493
International Conference on Education Studies: Experience and Innovation (ICESEI 2020)

Research on the Teaching Model of Innovation and Entrepreneurship Education From the Perspective of Design Thinking

Zijian Zhang[1,*] Jiakun Liu[1]

[1]Shandong Youth University of Political Science, Ji'nan, Shandong, China
[*]*Corresponding author. Email: 86974796@qq.com*

ABSTRACT

How to effectively carry out innovation and entrepreneurship education is one of the major tasks of education and teaching of China's higher institutes in the context of innovation and reform. In this regard, this article introduces the concept of design thinking to clarify its guiding significance for innovation and entrepreneurship education. Based on the design thinking framework and design thinking method, a teaching model integrating design thinking with the innovation and entrepreneurship education is constructed. It is found that applying the most popular problem-solving theory and method of "design thinking" of foreign countries to the study on the teaching model of innovation and entrepreneurship education can open the method of using whole-brain thinking to cultivate an open and optimistic attitude for college students and teach them how to use the tools and methods of innovative thinking of college students, also can improve the level of college students' innovation and entrepreneurship and speed up the implementation of innovation and entrepreneurship of colleges and universities.

Keywords: *innovation and entrepreneurship education, design thinking, teaching model*

I. INTRODUCTION

Innovation and entrepreneurship education is a new type of education concepts that guide and help college students to establish innovation consciousness, form innovation thinking, cultivate entrepreneurship spirit, master entrepreneurship knowledge and improve innovation and entrepreneurship ability through multiple channels such as school, government, enterprise and society. It aims to cultivate high-quality talents with innovation and entrepreneurship consciousness, ability, thinking model and personality charm in line with the development of the times. With the emergence, development and application of high and new technology, it is also a kind of education modes that adapt to the development of the era of knowledge economy [1]. In 2015, the general office of the State Council issued the opinions of the general office of the State Council on deepening the reform of innovation and entrepreneurship education in colleges and universities, which pointed out that deepening the reform of innovation and entrepreneurship education in colleges and universities is an urgent need for the country to implement the innovation-driven development strategy and promote the upgrading of economic quality and efficiency, and is also an important measure to promote the comprehensive reform of higher education and improve high-quality entrepreneurship and employment of college graduates [2]. So far, many colleges and universities have made actions in implementing the reform of innovation and entrepreneurship education. Many universities have set up a series of innovation and entrepreneurship education courses, and some even set up independent entrepreneurship colleges. It can be seen that the cultivation of innovative and entrepreneurial talents has become the consensus of whole society. However, how to cultivate is still in constant thinking and practice.

Design thinking is a new concept and method of innovation and entrepreneurship education emerging in the 21st century [3]. It is called "the necessary creative thinking power in the age of right brain" [4]. In book "A whole new mind", Daniel H. Pink, a futurist, believes that expressing the sense of design is one of the necessary skills in the era of concept [5]. Design thinking has become an indispensable course for European and American students to master the skills of 21st century. In China, the concept of design thinking is slowly spreading and accepted [6], and its educational value is far from being recognized and found. The author believes that the introduction of design thinking and the design of humanized education system in innovation and entrepreneurship education is conducive

to the cultivation of students' innovation and entrepreneurship ability to the maximum extent.

II. DESIGN THINKING

Design thinking is a human-centered innovation mode, which is extracted from designer's tools and methods, and integrates human needs, technical possibilities and business sustainability. It is a standard thinking model that designers should have when thinking about design issues. It is required to start from the specific needs of customers, run through systematic divergent thinking and integrated thinking, find and use feasible technology to carry out relevant product design, and then transform it into real customer value and market opportunities through the corresponding business model [7], [8]. Many people misunderstand that it should be the professional skills of designers, not the common sense that everyone needs to learn. This view is rooted in people's narrow understanding of design. Herbert Simon, the winner of the Nobel Prize in economics, is the first one to break this narrow understanding. In his opinion, engineers are not the only professional designers. Everyone who tries to change the status quo and cater to his own wishes is doing design [9]. Design thinking focuses on thinking instead of design. It advocates that everyone should focus on the possibility of innovation, take the result as the guide, have divergent thinking, face the future with a free and positive attitude, and then realize innovation.

Design thinking is a thinking model that synthesizes integrative thinking and opposable mind. In other words, there are many different, even opposite views in the brain at the same time. It is emphasized that with the preliminary investigation of the actual needs of customers, the collection and integration of information, a batch of high-quality solutions can be obtained as much as possible. After the comprehensive consideration of the actual operability and the possibility of technical realization, the ability to obtain "better" solution with the advantages of all parties will be promoted. This is different from the traditional solution of "taking one and abandoning one" or "taking one and abandoning more". The traditional method of thinking pursues the "best" solution, while the design thinking integrates the advantages of each solution and pursues the "better" solution [10].

Design thinking includes three aspects: cognitive method based on abductive reasoning, creative attitude that breaks the existing restrictions, and interpersonal relationship criterion based on empathy [11], [12].

In the aspect of cognition, design thinking regards abductive reasoning as the main cognitive method, that is, starting from the result and deducing the cause of the accident, which is a reverse thinking mode.

In terms of attitude, design thinking refuses to be "mediocre" or "single", dares to break the stereotypes and traditional attitudes, pays attention to both the validity and reliability of the solution, so as to create a new solution "subverting tradition".

In terms of interpersonal relationship, design thinking advocates empathy, which refers to the awareness, grasp and understanding of others' emotions in a position, and is mainly reflected in emotional self-control, transposition thinking, listening ability, expression of respect and other aspects related to emotional intelligence [13]. In the process of training design thinking, it is necessary to communicate with customers, classmates, teachers, business partners, etc. Empathy is of great significance to truly understand customer needs and deal with various interpersonal relationships.

III. THE COMBINATION OF DESIGN THINKING AND INNOVATION AND ENTREPRENEURSHIP EDUCATION

The School of Design of Stanford University divides the design thinking process into five stages: empathy, defining, ideating, and constructing prototype and test. This methodology also becomes a general five-step methodology in the methodology of design thinking [14].

Empathy is the core stage of the whole design thinking framework, as well as the basis for defining and solving problems. It refers to observing, thinking and investigating problems from the standpoint of stakeholders through transposition thinking, so as to truly understand what kind of group your users are and what their real physical and emotional needs are. Therefore, design thinking model is added to the innovation and entrepreneurship education to teach students to think in a new way. From the perspective of stakeholders, entrepreneurs who have "empathy", can understand the needs of society and customers, and can propose creative solutions can be cultivated. This is not only a test for students to deal with the relationship between teachers and students, classmates, colleagues, etc., but also of great significance for the treatment of all aspects of interpersonal relations and the cultivation of design thinking in the future.

In the definition stage, it is necessary to make the synthesis of collected information. Through a series of ingenious thinking processing of the seemingly mixed and disordered information fragments, it will excavate the real final needs, and then clearly define the problems to be solved. For the innovation and entrepreneurship education, this stage is also a comprehensive stage of knowledge application and implementation. According to the user needs obtained in the empathy stage, the internal and external

environment faced by the project implementation can be analyzed. Through the information sorting in the previous stage, the user needs, value propositions and behavior information are summarized as comprehensively as possible without analysis and evaluation. SWOT matrix, PEST matrix, business model canvas, analysis of competitor product and model, user portrait, Canvas drawing, task path analysis and other methods will be used to make the interaction within the team, and the reconstruction of the problem can be constantly promoted. In other words, in the application process chart of Stanford design thinking, it constantly returns from the second stage to the first stage. This kind of circular backtracking can better tap the value of the project, find the entry point of the target user, make clear the positioning of the project or the solution, and seek more perfect implementation strategy. Starting from their own knowledge structure advantages, team members will seek the intersection of different knowledge and problems, which is more conducive to the innovation of the project and the improvement of team communication efficiency. Absorbing individual target users into this stage can also lay a foundation for further digging into user needs, forming a vertical project development path, and stimulating the generation of user specific needs.

In the ideating stage, team members express their own opinions and inspire each other. They don't need to consider which idea is the best, can propose as many ideas as possible, and have a large number of alternative schemes. Therefore, this link is very concerned about "finding the possibility". When the innovation and entrepreneurship education enters this stage, brainstorming method must be taken as the main method to stimulate inspiration and eliminate interference. Team members work together under the drive of common goals, think about the elements already possessed by the project from the perspective of the field, and make the innovation based on the ideas of others. According to the problems defined in the previous stage, as well as the new problems found in the implementation of the brainstorming, factors are summed up, the mind mapping is used to sort out the design ideas of the project, and the innovation vitality and creative thinking of team members are stimulated by constantly increasing limiting factors and possible misunderstandings.

In the prototype-building stage, the designer initially creates the product prototype that meets the user's needs. Product prototype emphasizes core functionality in a crude way, and the most important value of building a prototype is to have the questions in mind answered and the solutions to the problems corrected. In the process of innovation and entrepreneurship education, the environment for implementing the project is simulated by taking local materials, including the simulation of product process and the simulation of specific project operation environment. The construction is based on the user data collected in the empathy and definition stage and the preliminary scheme formed in the assumption stage. Through the construction of "prototype" (Fig. 1), the target group is organized to have an immersive role-playing experience. Through the use of story scenarios or the explanation of the functions of physical products, it will get more emotion and feedback with the help of virtual use scenarios. In this stage, the whole scheme can be divided into different modules for more detailed and targeted implementation.

In the test and feedback stage, the design thinking method emphasizes the iterative improvement of the prototype. By collecting the real feedback from users, it is required to make the improvement again and again until the designed products meet the needs of users. However, the test can help people get closer to the right direction. For the innovation and entrepreneurship education, the test stage can also be regarded as the market-oriented exercise stage of the project participated by multiple subjects. Only relying on the professional knowledge of the project team members and the user's intuitive experience, it is impossible to fully reflect the substantive defects of the product or program. At this stage, technical testing methods and experts in the industry or field should be included in the testing team together. For example, through eye tracker, gesture recognition equipment and other modern technical equipment and means, it is convenient to judge the opinions of the target group that are not expressed in the use or evaluation process, and then convert potential interaction into cognitive and expressible interaction. Through A / B test, usability test, feasibility consultation, user feedback and other links, experts in the industry or in the field can make intuitive judgment on the market prospect and even put forward suggestions for problem reconstruction according to the test results and the development trend of products or formats [15].

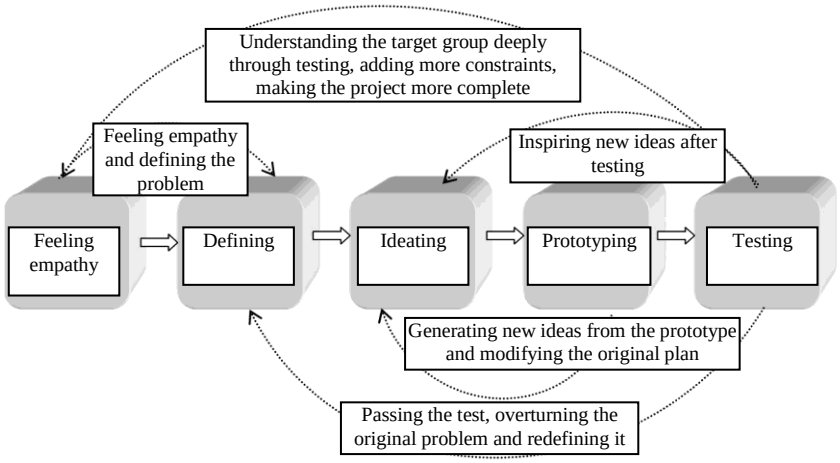

Fig. 1. Application process of design thinking of School of Design of Stanford University.

Through the above analysis, it is not difficult to see that design thinking and innovation and entrepreneurship education are actually similar, which can be summarized as the following three aspects:

A. Common ideas

Viewing from the process chart of the application of design thinking and the analysis on the content of each stage, design thinking is a bridge connecting the actual needs and design results. The purpose of innovation and entrepreneurship education is to meet the needs of specific target groups or put forward practical solutions to certain social problems by using the entrepreneurial results or innovative ideas. Therefore, in the process of innovation and entrepreneurship education, it is necessary to select practical projects and cultivate talents based on the accuracy and pertinence of results.

B. Common thinking mode

Design thinking uses the logic way of abductive reasoning, and takes the solution as the guide. It starts with the result and the goal to be achieved, seeks for better goal, and strives to produce as many refreshing and high-quality programs as possible. Different from the traditional logical thinking and deductive inductive thinking, abductive reasoning is a kind of converse thinking. It advocates the free and open thinking concept, without criticism. At the same time, it only requires to produce as many ideas as possible, and then get "better" ideas through screening. It is more like the liberation of thinking, so innovative ideas emerge in endlessly. In order to survive in the complex and changeable environment, it is necessary to start a business with innovative nature. And innovation is needed in decision-making, marketing strategy, product concept, design and packaging, etc. In order to train (potential) entrepreneurs in entrepreneurship education, the cultivation of students' innovation ability is indispensable. Applying design thinking to entrepreneurship education and the cultivation of students' design thinking are of great help to improve students' abductive reasoning ability and innovation skills.

C. They have jointly stressed interdisciplinary cooperation

The "brainstorming" advocated by the design thinking method effectively avoids the limitations of professional thinking, and gathers members from different fields to express their own opinions without risk, inspires each other, and produce as many high-quality ideas and schemes as possible. It is a process of cooperation among different professionals in various fields. In the innovation and entrepreneurship education, the interdisciplinary cooperation ability is also very important. Innovation and entrepreneurship behavior and activities can't be carried out without the division of labor and cooperation of people in different disciplines and fields. Using the concept of design thinking, students in different professional fields will be reorganized, and the cooperation ability of learners will be effectively enhanced.

It can be seen that the background and development path of design thinking, including the educational concept and guidance, all emphasize the innovation and results, and the reform of methods, which are highly consistent with the core of innovation and entrepreneurship education. And its many novel working methods have great space and value in the application of innovation and entrepreneurship education.

IV. INTEGRATING DESIGN THINKING INTO INNOVATION AND ENTREPRENEURSHIP EDUCATION

As for the application of design thinking in education, Herbert Simon, the Nobel Prize winner in

economics, advocated that business education should be connected with design as early as in the book "Artificial Science" published in 1969. In 2014, Glen et al. [16] of Boise State University proposed for the first time that design thinking can not only be highly consistent with the existing business (economic management) field, but also be applied to other curriculum fields, so as to promote the optimization and upgrading of existing curriculum education, and cultivate more graduates with innovative ideas and entrepreneurial ability. Based on the above research, according to the activity flow framework of design thinking, combined with the characteristics of innovation and entrepreneurship education, and by grasping its core significance, the implementation model of innovation and entrepreneurship education based on design thinking framework can be explored. The essence of design thinking is different from the retrospective logic of analytical thinking. It can effectively achieve the balance between analytical thinking and intuitive thinking, achieve the coordination and integration between the two thinking modes, so as to improve the innovative thinking ability of the main body, and cultivate more creative composite talents with the ability to create customer value. Innovation and entrepreneurship education in China is facing many problems. The introduction of design thinking in innovation and entrepreneurship education can inject new vitality into innovation and entrepreneurship education. Also, it can use design thinking to design the current innovation and entrepreneurship education curriculum and increase the practical operability.

A. Innovation and entrepreneurship teaching activities based on design thinking

With the guidance of design thinking, it is convenient to cultivate learner's innovation ability, ability of communication and cooperation, ability to solve practical problems innovatively, as well as the innovative consciousness and indomitable entrepreneurial will. According to the proposed "five-step" design thinking framework, combined with the core essence of innovation and entrepreneurship education, the scheme of innovation and entrepreneurship teaching activity based on design thinking is proposed.. From three dimensions of activities, tools and achievements, the design is based on five stages: empathy research, definition problem, brainstorming, prototyping and test feedback. The innovation and entrepreneurship teaching program based on design thinking is mainly based on the problems or needs in the real situation. On the basis of immersive research, the learners pull out the key problems to be solved accurately through empathy and other ways. Probing into these problems, it is possible to obtain the knowledge and skills needed in the process of solving the problems.

Next, brainstorming and other ways are used to create solutions (product design scheme); prototypes are made through group division of labor, efficient collaboration and other ways; finally, the "people-oriented" concept is followed, and feedback from users is constantly collected through testing to find out problems and make iterative improvement. It should be noted that there is not a single linear relationship among stages, but a cyclical and spiral rise.

B. Innovation and entrepreneurship teaching model based on design thinking

Based on the systematic research of design thinking framework and the scheme design of innovation and entrepreneurship activity, the author puts forward the innovation and entrepreneurship teaching model based on design thinking through practice. Taking the design thinking framework as the main line of the course, it runs through the teaching of whole innovation and entrepreneurship education course. The innovation and entrepreneurship activities based on design thinking include the following aspects. In the phase of empathy research, in order to achieve the real needs of the research, learners get interview records, user feedback, user characteristics, problem lists and other results through immersion, formal interviews, informal interviews, structured interviews and unstructured interviews. In the stage of defining questions, in order to grasp the core questions, learners get the summary results of questions by interviewing with stakeholders, holding seminars, defining core questions and other activities. In the brainstorming stage, in order to put forward and sort out ideas and schemes, learners can get mind mapping, priority map, close relationship map and solutions through activities such as probe in practical problems, risk-free communication, brainstorming, etc. In the prototyping stage, learners can carry out group cooperation, select the best scheme and visualize the scheme and prototype. In the test feedback stage, learners put forward improvement suggestions through testing, observation, evaluation, discussion and other ways, and carry out iterative improvement. Under the guidance of the design thinking framework, learners can think about and solve problems like designers, which is closer to the core of innovation and entrepreneurship education. After emphasizing the leading role of design thinking framework, the teaching model also emphasizes the introduction of design thinking method. For example, in the stage of mind mapping, it is required to introduce the SCAMPER method to systematically inspire new ideas from seven aspects. SCAMPER design thinking method is composed of seven aspects, and each capital letter represents a direction.

- Substitu- ted, i.e. what can be replaced;
- Combined, i.e. what can be combined;

- Adapt, i.e. can it adapt to adjustment;
- Modify, i.e. can it change some characteristics such as voice, form, color, etc.;
- Put to other uses, i.e. what other uses are there;
- Eliminate, i.e. can be removed, refined or simplified;
- Rearrange, i.e. can the elements of the product be reorganized.

According to the research, SCAMPER design thinking method can effectively improve the thinking of learners, broaden the breadth and depth of learners' thinking, effectively improve the quality of brainstorming group, and promote learners' divergent thinking and innovative thinking ability. At the same time, the teaching model encourages heterogeneous groups to achieve interdisciplinary cooperation.

V. CONCLUSION

The 21st century is a century of innovation-driven development. Countries all over the world are looking for ways to cultivate innovative talents to meet the increasingly stringent requirements of the future society. College students are the most potential human capital for development. Vigorously promoting college students' innovation and entrepreneurship is one of the important ways to make efficient use of human resources and promote employment, which can improve the overall quality of college students, promote the all-round development of college students, and enhance the national comprehensive strength and international competitiveness. As an innovative problem-solving methodology separated from design, design thinking has been attached great importance by the practical, theoretical and educational circles [17].

At present, the so-called problems "five emphases and five neglect" commonly exist in college education, i.e. "emphasis on theory and neglecting practice, emphasis on knowledge and neglecting ability, emphasis on unified requirements and neglecting personality development, emphasis on intellectual factors and neglecting non-intellectual factors, emphasis on training of basic knowledge and skills and neglecting training of innovative thinking ability". These problems can be well solved and made up in the design of thinking courses. In the process of completing the project challenges by the student team, the intuitive thinking in observation can be cultivated, the ability of thinking divergence in brainstorming can be trained, and the practical ability in prototyping can be improved. The students complete reflection in the test process, and form the systematic innovation ability based on design thinking, which is of great benefit to the students' future development. There are many similarities between design thinking and innovation and entrepreneurship education in colleges and universities. The application of its theoretical system and working methods in innovation and entrepreneurship education is of great vitality. It has broad development prospects and application space to tap its application value to promote the development of entrepreneurship education.

There are still some shortcomings and deficiencies in this paper, such as the specific impact of innovation and entrepreneurship education under the design thinking concept on students' satisfaction and educational output needs more practical tests. The following questions are worthy of follow-up study by follow-up scholars, such as whether the education model will be affected by culture, the entrepreneurship education effect in cultural environment, the exploration of applying design thinking in innovation and entrepreneurship education, comparative studies on whether design thinking is also applicable to other education environments, such as training education, vocational education, etc.

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