Research on the Teaching Design of Maker Thinking for College Students Based on Design Thinking

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Abstract: Maker education is an important way to cultivate college students' innovative spirit and practical ability, and design thinking provides new concepts and methods for maker education. This article analyzes the advantages of teaching design for college students' maker thinking under the background of design thinking, dissects the problems existing in current teaching design, and proposes improvement measures from the aspects of constructing teaching content system, innovating teaching mode, optimizing practical teaching, and establishing multiple evaluation mechanisms, in order to provide reference for improving the quality of college students' maker thinking cultivation.
***Keywords*:** design thinking, maker education, college student, instructional design

1. Introduction

Maker education is an educational model aimed at cultivating students' innovative spirit and practical ability, which has become a new trend in education reform around the world. Chinese universities actively carry out maker education practices, striving to cultivate new generations with patriotism, international perspective, innovative thinking, and practical abilities. However, there are still problems in the current maker education for college students, such as insufficient understanding of concepts, unreasonable curriculum design, and weak practical links. The pertinence and effectiveness of maker thinking cultivation need to be strengthened.

The advantages of designing maker thinking teaching design for college students under the background of design thinking

1.1 Design thinking helps cultivate college students' innovative consciousness and ability

Design thinking is an innovative thinking model guided by problem-solving. Its core is to discover and define problems, apply multidisciplinary knowledge and methods, and generate innovative solutions through divergent and convergent thinking. Guiding students to use design thinking methods to analyze and solve problems can break through fixed thinking patterns, stimulate divergent thinking, and generate a continuous stream of novel and unique creativity. For example, in the teaching of the "Creative Design" course, teachers guide students to use design thinking methods to brainstorm, draw concept maps, and create low fidelity prototypes around the theme of "Smart Campus", inspiring students to break out of their comfort zone, break through conventional thinking, propose novel and unique design ideas, and cultivate and exercise their innovative consciousness and ability in design practice.

1.2 Design thinking can enhance the comprehensive quality of college students in solving complex problems

With the rapid development of the economy and society, the current era presents features such as globalization, informatization, and uncertainty, and people are facing increasingly complex and changing problems. Cultivating students' comprehensive ability to analyze and solve complex problems is an important goal of talent cultivation in universities. Design thinking emphasizes analyzing problems from multiple perspectives and levels, and comprehensively applying interdisciplinary knowledge to seek solutions. This helps students form multidimensional and systematic thinking, and enhance their ability to solve complex problems. For example, in the teaching of the "Intelligent Robots" course, teachers organize students to form interdisciplinary project teams, guide students to use design thinking processes, and carry out robot design around social issues such as elderly and disabled assistance. Team members need to have thorough discussions, clarify the needs of target users, and apply multidisciplinary knowledge such as mechanics, electronics, and computer science to design solutions, conduct trial production testing, and enhance their comprehensive ability to analyze and solve complex problems through collaborative research and development.

1.3 Design thinking provides new ideas and methods for teaching college students maker thinking

Traditional maker education emphasizes technical learning and product development, while neglecting the cultivation of creative thinking and value guidance. Introducing design thinking into maker education provides new concepts and paths for cultivating maker thinking among college students. Design thinking is centered around human needs, emphasizing value orientation and social responsibility. It guides students to always pay attention to real needs, think about the social value and user experience of works in the innovation process. This helps correct the problem of technology supremacy and neglect of humanistic care, and enables students to grow into innovative talents with patriotism and global vision. For example, in the "Design Thinking Workshop" course, teachers guide students to apply design thinking patterns and focus on social hot issues such as environmental pollution and poverty education to carry out innovative design. Students conduct in-depth investigations and interviews at the grassroots level, starting from human needs, brainstorming around topics such as "how to prevent and control haze" and "how to improve reading conditions for rural children", proposing solutions and creating product prototypes. Maker practice is closely integrated with social values, providing new ideas and tools for cultivating maker thinking.

2. The Current Status of Maker Thinking Teaching Design for College Students under the Background of Design Thinking

2.1 Lack of systematic design and overall planning in teaching entrepreneurial thinking to college students

At present, maker education in most universities is still in the exploratory stage, and maker courses are mainly elective courses, lacking the support of compulsory courses. The status of courses is not high, and the arrangement of class hours is insufficient. Maker education lacks top-level design and overall planning, lacks integration with professional education and innovation and entrepreneurship education, and is disconnected from in class and out of class teaching, resulting in insufficient initiative and sustainability of student participation. For example, a certain university's mechanical engineering major offers maker elective courses for junior students, but the connection with the required courses of the major is not sufficient, and students' learning enthusiasm is not high. The practical part of this course mainly focuses on participating in maker competitions, which is not closely related to daily teaching. After the competition, many works are shelved, and students' enthusiasm for innovation is difficult to sustain. The cultivation of maker thinking lacks systematic planning and is highly arbitrary, making it difficult to form a complete training system.

2.2 Insufficient integration of maker thinking teaching content and design thinking concepts for college students

Most maker courses in universities still focus on technical learning, with teaching content covering 3D printing, laser engraving, Arduino programming, etc., emphasizing the cultivation of hands-on skills, but not enough emphasis is placed on training creative thinking methods. Even though some courses involve innovative methods, they mostly stay at the introduction of common techniques such as TRIZ and SCAMPER, and are not closely integrated with the core concepts of design thinking. For example, a certain university has set up a maker space called "Baiguoyuan", equipped with various processing equipment, mainly teaching the development technology of biological networking applications, but neglecting to guide students to start from human needs and use design thinking processes to carry out innovative design, resulting in limited improvement of students' creative thinking abilities. This reflects that many teachers have insufficient understanding of the connotation and value of design thinking, equating it with general innovative techniques and ignoring its user centered and humanistic care characteristics. The deep integration of teaching content and design thinking needs to be strengthened.

2.3 The evaluation system for college students' maker thinking teaching needs further improvement

Traditional maker teaching evaluations tend to be result oriented, often based on the technical content and innovation level of the work, with teachers being the main evaluators and students lacking opportunities to participate. This singular evaluation method is difficult to comprehensively examine students' performance in maker practice, and cannot provide accurate feedback for students' sustainable development. For example, in a creative program competition for a school sports meet, the judges mainly focused on the technical difficulty and visual impact of the program, while neglecting to examine whether students had conducted character interviews, drawn storyboards, and whether the plan had undergone multiple iterations during the planning process, making it impossible to fully evaluate students' application of design thinking. The scientificity and diversity of maker teaching evaluation need to be further improved.

3. Strategies for Teaching Design of Maker Thinking for College Students under the Background of Design Thinking

3.1 Building a teaching content system for college students' maker thinking based on design thinking

Incorporate maker education into talent development programs, offer mandatory maker courses, and increase the proportion of class hours. At the same time, we should pay attention to the combination of maker education and disciplinary characteristics, encourage teachers to introduce professional frontiers and social needs into maker teaching, and develop maker practice projects with disciplinary characteristics. In various aspects such as setting teaching objectives, designing course content, organizing teaching activities, and providing feedback on teaching evaluations, we adhere to a demand-oriented approach, strengthen humanistic care, focus on guiding creative thinking methods, and construct a maker thinking training system that embodies the concept of design thinking. For example, in the course of "Smart Home Design", the teacher first guides students into the community, interviews different groups of people's living needs, and uses empathy maps and other methods to understand user pain points. On this basis, students brainstorm around issues such as "how to design convenient smart home systems for the elderly", propose multiple creative concepts, and gradually model, prototype, test, and improve to form the final design plan. The course content closely follows the design thinking process, allowing students to master innovative thinking methods in practical design, and systematically cultivate maker literacy.

3.2 Innovate the teaching mode of maker thinking for college students and integrate design thinking concepts

Traditional maker teaching often adopts the model of "teacher lectures+student practice", which limits the space for students to explore independently. To stimulate students' innovative potential, teachers should innovate teaching modes and fully reflect the characteristics of design thinking. Teachers carefully design challenging innovative projects, organize students to form interdisciplinary project teams, guide students to explore the social issues behind the projects, and use design thinking processes to carry out innovative practices. During the implementation of the project, teachers conduct thematic workshops at appropriate times to impart creative thinking techniques, while creating a democratic and trusting classroom atmosphere, encouraging students to speak freely and inspire each other. Teachers select classic design cases to guide students in exploring how designers can perceive user needs, define design problems, generate creative inspiration, and overcome technical bottlenecks. They lead students to experience the iterative optimization process of design thinking and enhance their ability to analyze and solve problems. For example, in the course of "Design Thinking and Innovation", a teacher selected a design case of "Xiaomi Bracelet" and demonstrated the process of designers using the design thinking process from the aspects of design background, user research, conceptual conception, prototype production, etc. Through case analysis, students can master the essentials of design thinking and apply them to independent innovation practice. Innovative teaching models provide solid support for cultivating students' maker thinking.

3.3 Optimize the practical teaching of college students' maker thinking and strengthen design thinking training

Maker education is essentially a practical education, and maker spaces are a key platform for cultivating students' maker literacy. However, currently most university maker spaces only focus on hardware infrastructure construction, with insufficient software service supply, resulting in insufficient depth and poor experience of student maker practice. To fully utilize the educational function of maker spaces, enterprise designers, maker experts, etc. should be hired as maker mentors to provide systematic guidance to students in project selection, scheme design, prototype trial production, and other aspects, and teach the essentials of design thinking. Establish an innovation guidance file, record students' design ideas and progress throughout the process, tailor teaching to students' needs, and provide precise assistance. Invite enterprises, social organizations, etc. to establish joint innovation bases, providing students with real design projects and application scenarios. Regularly hold maker salons, workshops, and other activities to promote cross-border exchanges and collisions between students, experts in various fields, and alumni, and broaden students' innovative horizons. For example, Tsinghua University has introduced design thinking into the "three innovation" teaching, established an innovation and entrepreneurship education platform that integrates creative cultivation, project incubation, and entrepreneurship acceleration, and hired enterprise mentors and alumni mentor groups to provide students with full guidance and resource support, greatly stimulating their enthusiasm for innovation and entrepreneurship. Students strengthen the essentials of design thinking in practical design, and their maker literacy is continuously enhanced.

3.4 Establish a diversified evaluation mechanism for college students' maker thinking teaching

Scientific teaching evaluation is an important link in ensuring the quality of maker education. Pay attention to students' performance in the design process, focus on their needs insight, problem definition, team collaboration, prototype testing, and other efforts, guide students to experience the iterative optimization process, rather than blindly pursuing the results of the work. Learning logs, interviews, project reports, and other forms can be used to record students' growth trajectories and provide timely feedback and guidance. Cultivate students' awareness and ability to evaluate the quality of works using design thinking elements, regularly organize experience sharing and peer evaluation, and achieve self-improvement through mutual appreciation and reflection. Establish a maker project portfolio, collect students' design works, reflection logs, etc. at different learning stages, and comprehensively examine students' growth. Inviting stakeholders such as business representatives and community residents to participate in the evaluation of student works, examining the social value and application potential of the works from multiple perspectives, inspiring students to pay attention to practical needs, and serving society with innovative achievements. For example, Beijing Forestry University offers a course on "Design Thinking" and adopts a comprehensive evaluation method that combines formative and summative evaluations. During the semester, teachers use classroom observations, questioning, brainstorming, and other methods to understand students' cognitive development; At the end of the semester, we will showcase our achievements, invite representatives from enterprises and audiences to participate in feedback, and guide students to conduct self-evaluation and peer evaluation, examining their ability to use design thinking to analyze and solve problems from multiple dimensions. The evaluation results not only focus on students' theoretical knowledge, but also emphasize their design thinking skills, while considering feedback from enterprises and user experience, comprehensively and objectively assessing students' innovation ability. The diversified evaluation mechanism leads students to continuously improve, and maker thinking has made significant progress.

4. Conclusion

Cultivating college students' maker thinking is an important part of innovation and entrepreneurship education in universities, which is of great significance for enhancing national innovation capabilities and accelerating the construction of an innovative country. Introducing design thinking into college student maker education, by constructing a curriculum system based on demand-oriented and humanistic care, innovating teaching organizational models, strengthening maker practice, and establishing a diversified evaluation mechanism, can effectively enhance students' innovation awareness and practical ability, and help cultivate innovative talents.

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Author Bio

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