

Enhancing Vocational Education in China: The Impact of Design Thinking on Curriculum Reform and Talent Development

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Abstract

China's vocational education strives to enhance its curriculum quality and optimize its structure to cultivate innovative talents. However, traditional approaches focus more on problem-solving than developing user-centered solutions, which may hinder innovation. This study explores the application of design thinking as the primary approach to improving the talent training model and curriculum structure in China's vocational education. Design thinking is considered to foster the development of innovative skills through a more solution-focused and user-centric approach. The study involved 46 participants at Shaoguan Technician College, Guangzhou Province, China. Participants participated in an experimental course designed to cultivate their design thinking abilities. The diary method was employed to track and record the learning process of the participants, allowing the researchers better to understand the impact of design thinking on their development. The findings show that the implementation of design thinking positively impacts the reform of the vocational education curriculum system. The new curriculum model based on design thinking significantly stimulated the participants' enthusiasm for learning. Moreover, participants improved their innovation, creativity, observation, and teamwork skills throughout the learning process. The vocational institutions in China adopt design thinking in their curricula. This is crucial for fostering talents adept at solving problems and innovating in response to real-world challenges.

Keywords: *Creative Ability, Design Thinking, Diary Method, Vocational Education*

A. Introduction

Design thinking is a systemic mode of thinking that is different from everyday logical thinking. Rikke Friis Dam and Teo Yu Siang (2022) believe that designers' work processes can help us systematically extract, teach, learn, and apply these human-centered techniques to solve problems creatively and innovatively—in our designs, in our businesses, in our countries, in our lives. Many universities think design thinking is an effective way to solve complex questions and cultivate students' ability to innovate and create. The emergence of design thinking comes from people facing some questions they can't solve with their common thinking way. Some try to find methods and break the traditional natural pattern, such as finding keywords from the topic and asking for help from other domain workers. We consider cross-domain thinking significant for them to cultivate talents and abilities.

This kind of thinking requires researchers to have a strong sense of logical thinking and imagination, which is lacking in vocational school teachers. The first term of design thinking is in the industrial world. With the development of the field, design thought has been introduced into many colleges. The design thinking structure was first developed in the 1950s when Fred

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Terman, Dean of the School of Engineering at Stanford University, modeled the teaching method from the Bauhaus Art School in Germany to encourage students to innovate businesses and bring income to the school. In order to realize this idea, he proposed the establishment of Stanford Industrial Park and Stanford Research and Development Park for the school. It was John Arnold who proposed the concept of design thinking in 1959. Later, in 1969, Stanford University launched the first design thinking course. After continuous development in the 1970s and 1980s, the design thinking course at Stanford University gradually became the most effective way for academicians to cultivate students' creativity and innovative thinking.

The application of design thinking is widely involved in several educational areas. Rikke Friis Dam and Teo Yu Siang (2022) believe that design thinking is not an exclusive property of designers—all great innovators in literature, art, music, science, engineering, and business have practiced it. Jeanne Liedtka (2018) writes about how the design thinking structure creates a natural flow from research to the outcome. “Immersion in the customer experience produces data, which is transformed into insights, which help teams agree on design criteria they use to brainstorm solutions” Liedtka (2018).

This study explores the application of design thinking as a systematic approach to enhancing innovation and creativity in educational settings, particularly vocational education. The research seeks to understand how design thinking can solve complex problems that cannot be addressed using traditional thought processes and how it encourages cross-disciplinary collaboration to cultivate more competent talents. The study highlights its potential to reshape how students are trained to think creatively and innovatively by investigating the historical development and widespread adoption of design thinking in higher education.

Design thinking offers a distinct mode of thinking that differs from everyday logical reasoning. Many universities, including Stanford, have found it an effective way to solve complex problems and nurture students' innovative abilities. This approach emphasizes a deep understanding of user experiences, transforming data into insights that guide creative solutions. In vocational education, however, teachers often lack the logical thinking and imagination required for such an approach, limiting students' potential for innovation. Given the rapid industrial advancements and the increasing complexity of real-world challenges, vocational education must adopt design thinking to better prepare students with technical skills and creative problem-solving abilities that will enable them to thrive in diverse fields.

B. Methods

1. Research Design

This study employs a qualitative design to investigate the application of design thinking in enhancing the vocational education curriculum in China. The study focuses on how design thinking can improve talent training models and curriculum structures, fostering student innovation and creativity (Brown, 2009). In contrast, a qualitative approach through diary entries provided more profound insights into participants' learning experiences and personal development (Dam & Siang, 2022).

2. Research Procedure

The study was conducted at Shaoguan Technician College, Guangzhou Province, involving 46 participants who took an experimental course to cultivate their design thinking abilities. The course was designed with a focus on user-centered problem-solving and solution development. The participants were introduced to the fundamental principles of design thinking, including empathy, ideation, and prototyping (Liedtka, 2018). Throughout the course, students engaged in various hands-on activities and group work to enhance their creative and innovative thinking.

Their progress was monitored through observational techniques and self-reported data using a diary method (Dam & Siang, 2022).

3. Data Collection Techniques

Data were collected using a combination of the diary method and observational techniques. Each participant was required to maintain a daily diary documenting their learning experiences, reflections, and challenges related to design thinking. Researchers conducted periodic observations to assess participants' engagement, collaboration, and creativity during the course activities (Liedtka, 2018). Pre- and post-course surveys were also administered to quantitatively measure changes in innovation, creativity, and teamwork abilities (Dam & Siang, 2022).

4. Data Analysis Techniques

The qualitative data from participants' diaries were analyzed using thematic analysis to identify recurring themes related to the impact of design thinking on their learning process (Braun & Clarke, 2006). These themes included motivation, creativity, problem-solving, and teamwork. For quantitative analysis, the pre- and post-course survey results were analyzed using paired-sample t-tests to determine any statistically significant improvements in innovation, creativity, observation, and teamwork abilities (Field, 2013). This combination of qualitative and quantitative data provided a comprehensive understanding of the impact of design thinking on vocational education.

C. Findings and Discussion

1. Considering Design: Divergent Thinking to Logical Thinking

We can understand the content of design thinking in four primary forms: divergent thinking, convergent thinking, inspire thinking, and logical thinking. We will briefly show and introduce these four critical thinking:

a. Divergent thinking

This type of thinking is often used in creative research as a measure of creative potential (Reiter et al., 2019). It is also known as radiation thinking. It refers to the thinking pattern of a state of trying in many directions when someone is trying to solve a problem. In many research studies, brainstorming is the primary method of cultivating divergence. In a team's design project, people always use this method to associate with the relevant words. Various psychologists believe that divergent thinking is the critical step in cultivating creative thinking, and it is also one of the main signs to judge whether a person has creative ability.

Positively, divergent thinking can help people improve their imagination and enhance their analytical. In reality, the primary function of divergent thinking is to provide a solution and enhance as much material as possible for later selection. Differentiation gives designers and researchers more freedom to analyze various fields than other thinking patterns. They should understand the topic quickly to adapt and digest new ideas and connect the interrelated content. The divergence of thinking is more reflected in the speed and number of the initial problems.

b. Convergent thinking

This is based on divergent thinking to select the most appropriate research topic from many schemes. Philippe et al. (2022) think that most research has focused on divergent thinking, leaving aside convergent thinking. Phillip et al. consider that convergent thinking can also increase creative ability. Designers should search for a suitable and unique plan

based on known conditions and research problems. To be specific, convergent thinking is to sort out, analyze, and select the schemes derived from divergent thinking and select the most possible, economical, and valuable sketch scheme from them. In the next step, designers will use this experimental scheme to make models. Eventually, in improving the scheme, designers can also integrate some contents of other schemes into it. However, it should be made clear that the scheme obtained by convergent thinking is not necessarily the final scheme. As such, designers should know the main concepts, methods, and other contents designed, or they may be re-overturned or even negated.

c. Inspired thinking

Inspired thinking is usually regarded as a random and uncertain thinking mode because of this uncertainty. That is why it will not become the basis for judging whether a person has design thinking. However, if the researcher is suddenly inspired in the middle of his work, his achievements will be even more exciting and successful. The emergence of inspired thinking is hidden in all thinking processes. Researchers must go through many thinking connections and practical attempts during this period. After experiencing this long-term thinking mode, researchers will suddenly get a special thinking mode under the stimulation of some things or external factors, such as changes in their living environment. Therefore, the randomness of inspired thinking is more about its frequency and time uncertainty. It is not a thinking mode that can be explained by detailed systematic logic but a thinking mode produced by the relative unity of logic and non-logic.

Basic features of inspired thinking: i). The emergence of inspirational thinking is random and accidental. ii). Inspired thinking can occur in anyone and is not limited by status. iii). There is little relationship between the generation of inspirational thinking and economic cost. Inspiration itself is valuable, but its value also has a certain randomness. iv). Inspiration thinking is transient and unstable. When researchers do not take the initiative to grasp inspiration, it will be lost quickly. v). Human inspiration often has a lot to do with their emotional changes.

d. Logical thinking:

Logical thinking is an advanced thinking form of design thinking. It connects and organizes all the contents of thinking together. Whether it is divergent, convergent, or inspired thinking, it exists just like a system form of framework in the brain, which does not exist in real life. Swestyani et al. (2023) believe brains can remember information in different forms, images, symbols, sounds, and senses. The information is connected and needs imagination and association to construct new meaningful images by logical thinking.

Logical thinking is always used to organize these different concepts and different forms of frameworks together to form a relatively complete structural model, which is the central role of logical thinking. Usually, logical thinking has two modes: empirical and theoretical. Experiential logic thinking is based on practical activities and takes its original experience as the basis of judgment. For example, farmers know what crops to produce at what time, and experienced people can tell whether it will rain by looking at changes in the clouds in the sky. Theoretical logical thinking is more based on the conclusions obtained using scientific experiments, concepts, laws, and judgment. Mathematicians, scientists, and theorists usually use this model.

2. Current Situation Of Design In Vocational Education In Most China's Colleges

Pan Gong Kai and Pan Qing (2018) write about how Chinese design education happened in imperial and private workshops and ateliers, and most learning took place through a master-apprentice system. This education model would not change until the nineteenth century, when China's general education system was greatly challenged, and all aspects of society entered the modern era. The establishment of the curriculum model for China's vocational education is constantly changing according to the development and transformation of China's economic market. China's economic development has gradually changed from high-speed to medium-high development. This is why many enterprises have begun changing the recruitment method for the needed staff. Now, many companies want to employ innovative and all-round talents. Therefore, the curriculum system of vocational education is facing a significant transformation.

Nowadays, the curriculum mode of Chinese vocational schools is mainly based on past professional theoretical courses and computer practice courses. These two are different in class patterns, but they are not too different in their basic models. For example, whether it is a professional theory or a computer practice course, the dominance of the class is always caught by teachers. This process is just like teachers are knowledge output machines and students are passive recipients. The professional theoretical courses are as follows: First, the teacher prepares the course contents in PowerPoint. Then, they will make it possible for the students to understand the knowledge they have output. The class model of computer practice courses is as follows: teachers are still learning the knowledge of preparation in the form of PowerPoint and teaching cases, and then the teacher will put the knowledge and the steps into the computer lab. Students need to remember every step of the teacher in the classroom and copy these steps. Until they've copied the steps over and over again.

Although this classroom model can help students continuously consolidate their technical ability, it also causes many problems.

- a) Vocational schools pay too much attention to the demand for talent at the technical level and neglect the development of thinking. The Chinese vocational education mode is mainly based on skill teaching and personnel training in practical teaching and software teaching to provide professional talents for society. However, due to the excessive emphasis on the technical level of students and the neglect of the cultivation of students' thinking, many students in secondary vocational schools now rely on teachers to a greater degree. It is challenging to analyze the subject content through independent thinking.
- b) Vocational schools do not have a clear understanding of the future employment prospects of their students. From the perspective of employment analysis, the technical training mode of secondary vocational colleges can quickly obtain employment opportunities after graduation. To some extent, they have certain advantages. With the increasing work intensity in the later period, they constantly need to learn new technologies through self-learning ability. These vocational school students can carry out form, structure, and concept innovation on the basic model through innovation and creation, which will allow them to adapt to the changing market. However, most students in secondary vocational schools do not have these abilities. So, students gradually lose their original advantages two to three years after graduation and will finally be eliminated.
- c) The theoretical knowledge of vocational schools does not match the knowledge reserve and comprehensive quality of students. The teaching mode of secondary vocational colleges is closely related to that of higher vocational colleges and comprehensive

colleges. So, most vocational colleges directly refer to college knowledge textbooks when formulating textbooks and reference materials. Compared with undergraduate students, students in secondary vocational schools have a significant gap in their art foundation, learning ability, understanding ability, and teaching background. Therefore, it is not easy to understand textbooks designed for undergraduate students.

3. The Positive Influence of Design Thinking On Curriculum System

Upgrading and optimization of talent training objectives

Nowadays, most vocational education training modes in China aim to cultivate professional and technical talent. Design thinking is one of the best ways to cultivate innovative talents. Take art and design-related majors as an example. In the past, the curriculum was mainly to cultivate students' professional and technical abilities; teachers also hope students have primary uses and methods of design software. Finally, they will be able to use it skillfully. That is why vocational schools have spent too much time teaching students technical abilities. When the vocational education curriculum integrates design thinking, each stage will reflect the cultivated thinking mode. It can improve students' independent learning, innovation and creation, understanding, communication, and problem-solving abilities. This will help teachers be more explicit about their teaching goals and realize the upgrading and optimization of talent training objectives through thinking guidance.

Teaching optimization and curriculum model improvement

The most fundamental thing for design thinking to guide teaching innovation is that teachers should use design thinking to re-examine the knowledge and content system of the curriculum. Trying to sort out a curriculum structure framework that students of secondary vocational schools can accept according to the primary curriculum structure system. The core of the course is to clarify the ability of professional knowledge to give students. From the perspective of teaching, teachers with design thinking can accurately understand the emotional state of the students in each learning stage and set reasonable teaching tasks according to the characteristics of each student. According to the model orientation of design thinking, teachers who have design thinking can find a course pattern that is easier to understand for the students of vocational colleges. This model helps teachers clarify teaching purposes and allows teachers to consolidate their knowledge systems and form a rigorous and reasonable knowledge system. Ensure the orderly integration between the two.

The basic model of talent training in vocational schools under the guidance of innovative design thinking

Combining with the objectives of talent training and the content of teaching structure system optimization, this research puts forward the basic model of talent training in secondary vocational schools under the guidance of design thinking. The model is based on the innovative curriculum education thinking system with design thinking guidance as the premise.

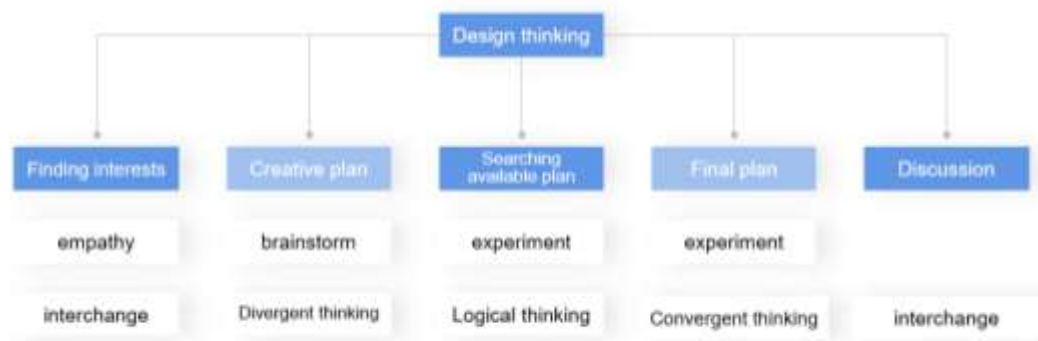


Figure 1. Design thinking model of this experimental study
(designed by Gao He Tian, 2023)

The first step is to help teachers establish good relationships with students. The teacher actively understands students' interests, hobbies, teaching background, and other factors. Teachers can use this information to build a good relationship with students. Vocational college students are about 18-22 years old. At this stage, they are in a rebellious period. It is easy to have rebellious psychology on some content that they are not interested in. In order to ensure the smooth progress of the experimental course, teachers need to have enough empathy to understand the emotional changes of students and adjust the course contents in time according to the obtained information. After determining students' interests and other factors, the second step is cultivating students' divergent thinking. The teacher classifies the students according to each student's personality characteristics based on their interests and hobbies and sorts the students with similar interests and personality characteristics into a group. After the group was organized, the teacher began to assign tasks to every group. Teachers encourage students to make as many schemes as possible in this step. No matter how crazy schemes are, they can be listed and tried. In this stage, students mainly use the brainstorming method to connect the keywords of the tasks.

The third step focuses on developing students' logical thinking. It sorts out some reasonable and feasible schemes based on the second step, which requires students to try every feasible scheme. Teachers can also help students by asking questions and adjusting their curriculum process during this time. In the process, students should try to find a more complete and likely plan and finish that will become the final model. Of course, students must deny some unreasonable plans, which also requires courage to say no. The fourth step focuses on developing students' convergent thinking. This content is based on the second and third steps. The first step is extracting the usable elements of the paper obtained in the second part together. Students should judge whether these elements are suitable for integration into the final scheme and whether they can optimize it. The fifth step is the group discussion process. This step lets students understand the knowledge and ability they have gained in this study and, through evaluating others, understand their shortcomings and make the future more suitable for their growth direction.

4. Experimenting with Diary Research to Understand Students' Design Thinking

This experimental course uses the diary method as the primary research method to explore the influence of design thinking on the reform of vocational education curricula in China. The research objects selected in this study are students from vocational colleges in

Shaoguan City, Guangdong Province, in China. They are between 15 and 18 years old, with 27 boys and 19 girls. In order to reduce the interference, participants were selected for this study whose education level, knowledge storage, and learning ability were roughly the same. The teaching content of the whole experimental course is mainly the content of art design. During this experiment, the researcher will select several students to record their status changes at each stage using the diary method. The duration of this study was roughly divided into 7 weeks and was divided into three stages.

The first stage is to define students' interests. This phase will take a week. At this stage, researchers need to know the specific aspects of students' interests. For this reason, we used questionnaires and face-to-face interviews to talk with them. Some participants chose the same interest, and there would be an intersection, such as playing games, sports, listening to music, etc. We did a quiz before the experiment to get a general idea of the students' personalities. In the form of pictures, students are asked to draw a set of expressions that accurately express their inner thoughts. Below are the pictures drawn by three students.



Figure 2. Five expressions are drawn by student A (2023)

The expression drawn by student A may refer to some expressions on the Internet or social software. Overall, it is difficult to show her actual psychological activities, and it is more difficult to obtain the teacher's approval to complete the task. In the personality assessment, I defined classmate A as introverted with a certain herd mentality.



Figure 3. Five expressions are drawn by student B (2023)

Student B's expression is made in comics, although she also has a specific reference and shows her favorite content. We think that student B has a particular ability to express himself, share his interests with others, and get the approval of others after sharing them.



Figure 4. Five expressions are drawn by student C (2023)

In the first two groups of works, the expressions drawn by student C are very different. Both the mouth opening degree and the eyes are exaggerated to some extent. Although the details are not in place, the expressions are more vivid. In the evaluation of student C, we think he has a strong performance ability, a lively, cheerful personality, and may have some empathy.

The second stage is the creative proposal development stage, which is shared for 5 weeks. This step is designed specifically for the group and to improve one or more of the students' divergent and convergent thinking abilities. Before starting, we will take students' interests as the premise and try to divide students with the same interests into the same group, forming seven groups in total. Among them, we selected five participants in different groups to keep diaries of their learning status. According to the characteristics of each group, we will choose their favorite theme for them to develop the plan. At this stage, many group members began to engage in active discussions after experiencing initial confusion. The following are the diary entries of some students during the second stage. At this stage, students will have a variety of emotions, and these emotions will lead them to improve their abilities. The following is Student W's diary contents:

21/3 2023 AM:10.00

The teacher gave me the theme of daily life. I want to draw a scene about playing mobile phones at night. I mainly showed the draft to my friend. A friend said I could make the game elements bigger than other decorations. I thought that was a good idea and added many sheep to the background. Secondly, I was inspired to put the plug into the mobile phone behind the figure to give people the feeling that the phone controls the figure. I am happy with this kind of inspired thinking.

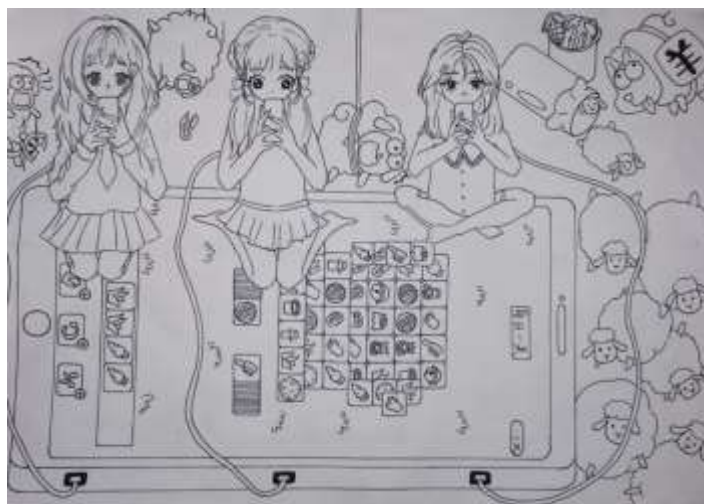


Figure 5. My Diary Life (drawing by student F, 2023)

06/4 2023 AM:14.39

I think I can do my subsequent work better this time. I will draw a picture of my friend's workplace in this plan. He told me that working there was just like being in a movie. I think it would be exciting if I could draw his work scenes. I decide to do this topic. However, when I was creating, I found that the characters in the picture were not very prominent. I knew I wanted this when I saw some movie posters with characters that went straight out of the box.



Figure 6. Helping my friend work at the coffee shop (drawing by student F)

The next group of works consists of character designs created by student W, where she combines her favorite elements with content from her diary. This approach allows her to create a unique and personalized character image that reflects her artistic preferences and personal experiences. By incorporating diary entries, she adds emotional depth and meaning to her designs, transforming them into more than just visual creations but also expressions of her inner world. This method demonstrates how personal experiences can enrich the creative process, making the characters visually appealing and emotionally resonant.



Figure 7. Character design (drawing by student W)

17/4 2023 AM:14.39

The final figure assigned by the teacher this time is character creation. I thought that since it was character creation, I should first choose the character image I liked. Firstly, I thought of the kindly missing image in the animation characters I had seen before, so the character's initial temperament was created. However, I want to make a particular difference from most anime characters so I need to add some special elements. I added

a fox mask as a decoration. Secondly, when designing a dress, I think it is more suitable for her to make a dress. I also added decorative elements to the dress, such as love, stars, etc. Make the whole character more lovable.

From the results of this experimental course, we find that design thinking can improve students' abilities in many exciting ways. The diary helps accentuate a more personal expression, which allows for a deeper understanding of their approach toward specific problems (Liedtka, 2018). For the subjects of this experiment, design thinking is revealed as an enlightened teaching method that activates students' imagination, creativity, and self-discovery. These enhanced abilities boost students' self-confidence and improve their innovation, awareness, and teamwork skills (Brown, 2009). The students selected for this course, aged between 15 and 18, are at a crucial stage of human development, where any improvement in these skills can significantly impact their future growth (Dam & Siang, 2022). Researchers observed these effects, such as with student A, who initially struggled to extract keywords from design projects but could apply design thinking principles by the third stage to propose new design schemes effectively. This progression, from being unsure to smoothly identifying key elements, demonstrates the positive impact of design thinking on students (Cross, 2011).

However, some challenges were encountered during this experimental course. The first issue arose during the team formation process, where some students grouped based on interpersonal relationships rather than competencies, resulting in teams with poor leadership and direction. This dynamic hindered their ability to complete tasks in later stages (Hattie, 2012). Additionally, students with mental health conditions, such as depression or autism, struggled to share ideas and cope with failure. When their plans were rejected, they often experienced intense emotional reactions, eventually losing the ability to think clearly and continue with the design experiment (Warren, 2020).

D. Conclusion

The study concludes that design thinking significantly impacts the cultivation of innovative talents in China's vocational education system. As a structured thinking mode, it enhances creativity, problem-solving, and collaboration skills, transforming teaching and learning processes. By shifting away from traditional education models, design thinking enables students to think critically and imaginatively, encouraging them to tackle real-world problems with fresh perspectives. Moreover, the approach promotes empathy and teamwork among students while providing teachers opportunities to improve their instructional methods and adapt to evolving student needs. Overall, this research underscores the value of integrating design thinking into vocational education to better prepare students for the demands of modern industries and contribute to China's economic development.

The study recommends that vocational institutions in China incorporate design thinking into their curricula to nurture creativity, innovation, and collaborative skills among students. Continuous professional development for teachers is essential to effectively implement this approach, ensuring they can adapt to new teaching methodologies and respond to students' evolving questions. Design thinking-based courses should also remain flexible, allowing for iterative updates to meet industry needs and student development. Policymakers are encouraged to support the widespread application of this methodology in vocational education to help cultivate a future workforce capable of driving innovation. Further research should focus on the long-term effects of design thinking on graduates' career success and contributions to industrial innovation.

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