

Research on the value of invisible knowledge in "2 + 1" innovative design education of new engineering

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Abstract. Tacit knowledge is an important part of knowledge pedigree. "2 + 1" design innovative education is the latest talent training mode and design innovative education concept. According to the concept and characteristics of tacit knowledge, this paper attempts to explore the impact of tacit knowledge on "2 + 1" design innovative education, focusing on how to give full play to the value of tacit knowledge through studio cases.

1 Introduction

According to whether knowledge can be clearly expressed and effectively transferred, Michael Polanyi, a British scholar, divides knowledge into two categories: explicit and implicit. What is expressed in written words, charts and mathematical formulas is called explicit knowledge; what is not expressed is another kind of knowledge that people have in doing something, which is called tacit knowledge [1]. "Recessive" means implicit, ineffable, implicit, imperceptible or not revealed. Tacit knowledge is highly individualized, difficult to formalize, and difficult to share with others. It often exists in the form of personal experience, impression, perception, and is difficult to express clearly in the form of words, language, images, etc.

2 Analyze the value of tacit knowledge in design education under the mode of "2 + 1"

Since modern times, the study of design has been based on the framework of western logical thinking, and it has been influenced by business. If we expand the tentacles of thinking and look at the original design category from a broader perspective, there will be some different cognition. The inspiration of design comes from daily life, and creativity is everywhere. According to Gregory Bateson's understanding of living ecology, the smallest innovation unit is not a single organic organism, nor a species, but must exist in the form of combination of species and environment. The win-win strategic concept creates conditions for the two aspects of the association [2]. Based on the background of the times, we can interpret Gregory Bateson's life ecology as a global communication dimension of innovation situation, which includes technology, service, culture, ecology, place and

other factors. At the same time, we should also consider the role and value of human tacit knowledge in innovative education.

Design education needs to cultivate the designer's concrete and symbolic cognitive development process, the ability to solve practical problems, and the skills of nonverbal thinking and communication. The teaching of design discipline is different from and independent of natural science and human science in research object, application method, value system and solution method. It is the third kind of science in the human world, focusing on the integration, reconstruction and innovation of human knowledge and experience [3]. The curriculum system of design needs to train students' skills in planning, creation and production through the three education standards of theory, skills and integration, so as to help students realize self-awareness in the learning process and build a professional knowledge system of drawing inferences from one example to another. "2 + 1" design innovative education is the talent training mode and an education concept proposed by the author in the 2018-2019 Anhui quality engineering project. It mainly refers to a series of teaching reforms based on classroom reform and exploration, including "studio" skill development, which includes leading and guiding the student team to participate in the competition, plus "product design project enterprise training", which will be directly absorbed by the enterprise after graduation, so as to reduce the gap between the school major and the actual operation of the factory, so that the students under this training mode can Directly connect with the enterprise [4].

2.1 Tacit knowledge is the basis of "2 + 1" design innovative education

In "2 + 1" design education teaching, the courses taught by teachers belong to teachers' personal skills, which are

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closely related to teachers' personal learning experience, design experience, personal perception, etc., mainly in the form of tacit knowledge. Teachers' design thinking, design concepts and design values are based on the accumulation of long-term experience, and have a strong sense of subjectivity. In the design professional curriculum, teachers' design style, personal cultivation, academic research experience, intuition, hunch, concept and so on play a key role in curriculum guidance, and have a subtle impact on students' creative style. In the course of designing classroom reform, teachers' design experience, cultural background, creative style, thinking mode, vision, cultural background and other tacit knowledge are particularly important. Because of the difference of students' acceptance of tacit knowledge, the practical works of students are quite different after the same theory class is taught. Some students can better receive the unspeakable knowledge, thus generating insight and obtaining design inspiration. Therefore, design education is not only the transformation process from explicit knowledge to tacit knowledge, but also the socialization process of tacit knowledge.

2.2 Tacit knowledge is the key of "2 + 1" design innovative education

Teachers' tacit knowledge refers to the teaching methods, teaching and scientific research skills, education mechanisms, concepts, emotions and wisdom, which are deeply embedded in the teachers, contained in the teachers' minds, and displayed in the educational and teaching work scenes, as well as the special interpersonal relationship knowledge around the educational and teaching work. It is an important foundation of teachers' knowledge [5].

Compared with other majors, design majors have greater particularity, which is reflected in teachers' greater flexibility in curriculum setting and content. (1) Under the unified syllabus, teachers can make decisions according to their own understanding of design connotation, extension and theory. They can arrange courses; (2) in the same course, teachers can arrange different subjects, use different teaching methods to take

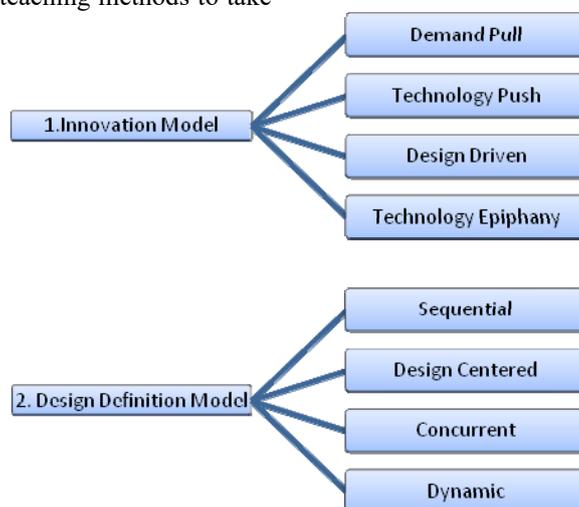
different courses; (3) in the same course, the same teacher, in different periods, according to his own perception, will also make decisions different arrangements. Therefore, teachers' grasp of the curriculum and the effect of imparting knowledge depend on their tacit knowledge about teaching content and teaching methods.

2.3 Tacit knowledge is the core of "2+1" design innovative education

The edge of design discipline, the diversity of design and the relationship with other related fields require students to have the ability of comprehensive thinking, relearning and teamwork. With the continuous development of society, higher requirements are put forward for design talents. Modern design education should cultivate a large number of new design talents with reasonable structure, strong ability and high quality. For students majoring in design, they should not only master the basic theoretical knowledge of design, be familiar with the historical process of art design development, but also have the comprehensive thinking ability, high social responsibility and design innovation ability. The characteristics of tacit knowledge, such as intuition, imagination, research skills, cooperation ability and culture, are the core contents of forming and cultivating these abilities and qualities.

3 Design innovation under "2 + 1" mode

According to the previous studies under "2 + 1" mode of strategic school, design innovation under the "2 + 1" mode can be divided into four schools, namely, planning school, learn school, imagination school and cognitive school. In order to better understand the transformation from macro decision-making to micro decision-making, the author identified four driving factors of new product development through literature review. (Figure 1) includes innovation model, design definition model, project management approach and collaborative model.



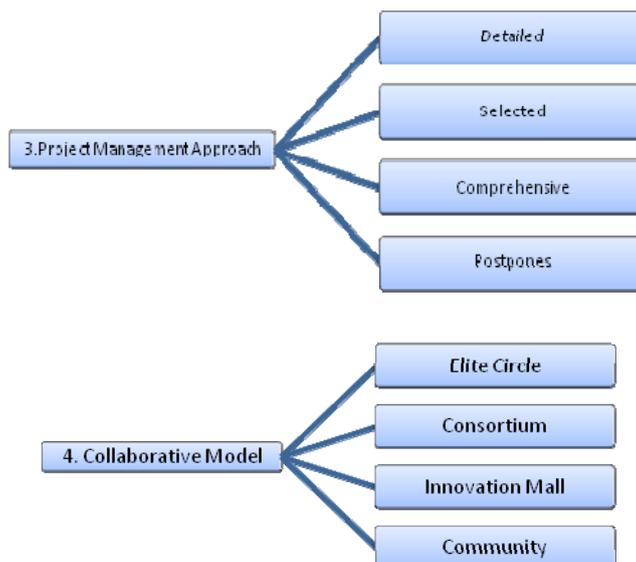


Figure 1. Four driving factors of new product development.

4 Analysis of tacit knowledge sharing in design education under "2 + 1" mode

In real society, knowledge sharing is often limited to some extent due to organizational structure, evaluation standards, systems, values and other reasons, while tacit knowledge sharing is more difficult due to the reasons of difficult description, communication, high personalization and so on. As the main unit of teaching and scientific research, design professional studio is a research and teaching team with a certain subject direction, better professional vision and execution, a combination of research, teaching and practice, with the characteristics of fewer members and flexible operation. Team members work together for the same idea and research direction. In the process of completing the project, it can enhance the information exchange and cooperation between teachers, and effectively realize the dissemination, integration, sharing and innovation of tacit knowledge, which is an effective platform to achieve tacit knowledge sharing.

4.1 Analysis of teachers' tacit knowledge sharing in the studio

The staffing of the studio should reflect the combination of the old, the middle and the young. In the process of teacher training, the old teachers' words and deeds can help the new teachers to realize the positive transformation of social roles and promote their rapid growth. The long-term accumulated teaching experience and teaching methods of the old teachers can help the younger teachers to understand the tacit knowledge of teaching methods as soon as possible, while the new ideas and new ways of thinking of the young teachers can inject vitality into the thinking of the old teachers. Reasonable personnel allocation establishes a channel for

the transmission of tacit knowledge and accelerates the sharing and transmission of tacit knowledge.

Teachers' tacit knowledge is acquired after a long time of accumulation, a lot of energy and hard work. Due to the lack of credit and the risk of personal knowledge stolen, knowledge subjects tend to intentionally or unintentionally hide personal tacit knowledge, limiting the spread and sharing of tacit knowledge. The operation of the traditional individual incentive mechanism can only aggravate the individual's tacit knowledge monopoly. Therefore, increasing organizational performance evaluation and changing individual incentive into organizational incentive can encourage teachers' knowledge sharing to achieve greater organizational performance.

In the office space design of the studio, the arrangement of organized activities and other aspects, establish a platform for teachers to exchange and share. Experiments show that a good communication platform can deepen teachers' feelings and sense of belonging, which is more conducive to the development and sharing of tacit knowledge. The studio can also carry out academic lectures, academic practice, and scientific research team seminars, as well as organize and participate in external exchanges and other activities, so that studio members can get more knowledge sharing from the interaction of various activities.

In addition, because tacit knowledge is based on a single subject in the final analysis, the studio should encourage teachers to learn through various ways to expand, extend and reconstruct their own tacit knowledge system, and finally generate new tacit knowledge.

4.2 Analysis of tacit knowledge sharing between teachers and students

First of all, the design of the studio mode means that it is different from the traditional classroom teaching, using a new teaching method and means.

The traditional overall arrangement based on the class is transformed into a flexible teaching operation mechanism based on the studio and the common research direction. Each studio has a clear research direction and style characteristics. According to their own characteristics and interests, students enter the studio through two-way selection. This kind of studio with the characteristics of integration, openness and interaction are conducive to the collision of ideas between students and students, between students and teachers, and speeds up the flow and transfer of tacit knowledge. In the studio mode, teachers and students carry out practical activities to complete a design project together. Teachers and students are relatively fixed, have sufficient time for communication, and have a deep understanding of each other. Teachers and students get along with each other day and night, teaching by words and deeds, can not only fully mobilize the students' enthusiasm and initiative in learning, but also be conducive to the spread of teachers' tacit knowledge, which is especially crucial to the cultivation of design quality. In the setting of studio courses, we should reflect the tacit knowledge structure as much as possible, expand the knowledge, background and ability foundation of students, shape the overall quality of students, and build a reasonable knowledge and ability structure. The history and culture education of human society, the knowledge of humanities and social sciences, the moral education, the education of social viability, the cultivation of psychological quality and other courses should become the important content of teaching. By combining the western excellent experience with the profound traditional cultural accumulation in China, the content of Chinese traditional culture can be permeated into the modern design teaching, and the design style with Chinese characteristics can be cultivated.

Tacit knowledge is always closely related to specific situations and exists depending on specific situations. It is the overall grasp of specific tasks and situations. Therefore, it emphasizes the role and status of situational practice in the process of knowledge generation. In the studio, the teacher guides the students to carry out special topic, project research and skill development with the team as the unit, guides the student team to participate in the design competition and the learning process becomes a practical activity that a person participates in the creation. Through project practice, case study and other practical topics, students can understand and master the design principle and connotation, cultivate the ability and method of finding, analyzing and solving problems, and in the process of completing the project practice, imperceptibly cultivate the tacit understanding of the team, improve the comprehensive artistic quality, and finally transform into their own tacit knowledge.

According to the needs of the course, the studio can hire well-known experts and professors at home and

abroad to hold lectures from time to time to enhance students' professional awareness. By using modern network technology and constructing information exchange platform, we can further expand the time and space of learning, exchange and interaction between teachers and students, change single guidance into multiple exchanges, and improve the efficiency of tacit knowledge transformation and sharing.

5 Conclusion

Because of its implicit characteristics, tacit knowledge in design education is easy to be ignored. The "2 + 1" model provides a practical platform for the research and design of explicit tacit knowledge. Paying attention to the mining of tacit knowledge in design education, researching and discussing the definition, characteristics and other related categories of tacit knowledge is the top priority of current design education.

In the training mode of product design professionals, we should consider whether the courses offered can meet the needs of the society, and whether the knowledge learned can be better applied to the work in the future. What is more important is whether the theory and practice learned in the classroom can better and faster solve the problems encountered in the work. Promote the research progress as a whole and accelerate the presentation of practical teaching results.

Under the support of internet technology, the creative design of "2 + 1" model has begun to transform into an economical industrial design service [6]. According to the factory's requirements, the "2 + 1" model team [7] was established, and the ideas and effectiveness of the innovative design, students were verified through the modules of creative factory and sharing station [8].

In recent years, with the change of talent demand in the product design and manufacturing industry, the product design specialty and professional group continue to increase the intensity of curriculum reform, and re-plan the curriculum system based on the post demand of industrial enterprises. Connect with regional industries, reform professional setting, and optimize product design. It is necessary to form a long-term mechanism of school enterprise cooperation that "school enterprise integration, production and education simultaneously" under the new engineering concept of "2 + 1" talent innovation and training mode. Recently, educational institutions have joined forces with a number of companies and enterprises to jointly run schools, actively explore the long-term mechanism of school enterprise cooperation of "school enterprise integration, simultaneous development of production and education" in close cooperation with the government, industry, enterprises and schools, jointly build a professional group of product design, cooperate in education, employment and development. Under the overall planning of the school enterprise, we should integrate the school enterprise teaching resources and try to establish a "practical teaching base of product design". Relying on various member units, we will carry out diversified and in-depth cooperation.

Taking the ability training required by local enterprises as the main line, building high-quality core courses, and cultivating application-oriented talents of product design as the building cornerstone; application-oriented talents mode and ability training construction ideas are as follows: according to the requirements of professional posts, working out curriculum standards together with enterprise experts; compiling school-based teaching materials suitable for teaching in production training base.

Acknowledgments

Funded projects: Quality engineering teaching research project in Anhui Province (No. 2019jyxm0471).

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