Exploring Paths to Enhance Students' Innovative Abilities Based on Multifaceted Teaching Models

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Abstract：This study took the Department of Design, College of Arts, Guangxi University as the practical field, and strived to explore the specific pathways of diversified teaching models in enhancing students' innovative capabilities. Through a questionnaire survey involving 284 students and 28 teachers, it focused on examining five key dimensions: curriculum system, resource integration, faculty development, evaluation mechanism, and cultural ecology. The investigation and research revealed that in the dimension of curriculum integration, a teaching closed-loop with a close combination of "theory-practice-industry" was constructed. For example, the PBL teaching project themed on Zhuang brocade culture (Aksela, 2019) effectively promoted the improvement of students' technical integration ability. In the dimension of resource upgrading, the establishment of smart laboratories and interdisciplinary collaboration platforms strongly supported the exploration and practice of integrating traditional ethnic symbols (such as bronze drum patterns) into modern design. In the dimension of faculty transformation, the implementation of no less than 80 hours of industry-immersion training for teachers annually, correspondingly, led to a significant increase in the award-winning rate of students in professional competitions. In the dimension of dynamic evaluation, innovation portfolios were introduced to track students' performance in three aspects: learning process, ability development, and value creation, which resulted in the improvement of knowledge transfer efficiency. In the dimension of cultural empowerment, the introduction of Cognitive Behavioral Training (CBT) and the establishment of a constructive fault-tolerance mechanism helped alleviate students' innovation anxiety. Practice showed that this had an obvious positive impact on the commercial success rate of incubated projects. The empirical results indicated that diversified teaching models effectively activated students' innovative potential mainly through the reconstruction of abilities in four aspects: technical integration, cross-border collaboration, cultural innovation, and problem-solving. This study holds that this exploration has initially verified a replicable path of innovative education, which can provide valuable practical references and systematic ideas for the teaching reform of design-related majors.

Keywords: teaching models; innovative capabilities; art and design

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1 Research Background and Significance

With the rapid development of scientific and technological innovation, China has now transitioned from the era of knowledge economy to the era of innovation economy. Design thinking has already been applied to a certain extent in education, and various teaching models developed based on this thinking can cultivate and enhance students' abilities of independent thinking and quick problem-solving. In the context of current Chinese education reform, students are the main beneficiaries and contributors of educational experience. Integrating diversified teaching model courses developed based on design thinking orientation into higher education management can effectively stimulate and enhance students' innovative capabilities.

2 Problems in China's Education System

Passive knowledge transmission model: China's education system mainly adopts a passive knowledge transmission model, where teachers actively impart knowledge and students passively receive knowledge input. This phenomenon is closely related to the currently implemented examination selection system.

Exam-oriented education: The current education model is oriented towards examination results, which leads to the frequent occurrence of "spoon-feeding education". Students mainly rely on memorization and imitation of knowledge, lacking in-depth understanding of the connotation of knowledge, thus making it difficult to generate innovative thinking.

Mismatch between skills and social needs: The existing teaching methods are relatively conservative, resulting in most of the skills students learn at school being relatively backward compared to social needs. This affects students' ability to quickly apply the knowledge they have learned to solve problems arising in practical work.

3 Definition and Characteristics of Design Thinking

Design thinking: Design thinking is a user-centered approach that identifies user needs and potential problems by comprehensively considering relevant factors, and finally provides comprehensive and systematic solutions.

Evaluation of Innovative Capabilities: The evaluation of innovative capabilities includes multiple aspects such as innovative knowledge, thinking, skills, and achievements. By distributing questionnaires to teachers and students of the Department of Design, College of Arts, Guangxi University, and conducting research on the collected questionnaire data, a multi-dimensional innovative capability evaluation model was proposed to improve the problems of inaccuracy and singularity in current innovative capability evaluation tools and methods.

4 Research Questions and Objectives

Research question: To explore the problems and needs in improving students' innovative skills in academic management in the Department of Design, College of Arts.

Research objective: To investigate the existing problems and needs, and develop corresponding academic management strategies to enhance students' innovative skills.

5 Research Population

The research population is divided into two groups, including a total of 980 students and 28 teachers from the Department of Design, College of Arts, Guangxi University.

Research Samples: Using the stratified random sampling method (Cronbach, 1951), 284 participants were selected from the students (26 males, 258 females, aged 16 to 29, with an average age of 20.5 years), and 28 teachers as samples.

6 Basic Information of Students and Teachers

Student samples: The total number of students participating in the study was 284, among whom females accounted for 90.84% and males accounted for 9.16%. The age distribution was mainly 19 to 20 years old, accounting for 59.16%. In the grade distribution, senior students (fourth year) accounted for the highest proportion, 30.28%. In terms of major distribution, the number of students majoring in visual communication design was the largest, accounting for 21.12%.

Teacher samples: All 28 teachers participated in the study, among whom males accounted for 64.29% and females accounted for 35.71%. The age distribution was mainly 41 to 45 years old, accounting for 32.14%. In terms of educational background, teachers with master's degrees were the most, accounting for 60.71%. In terms of teaching experience, teachers with 16 to 20 years of experience were the most, accounting for 25%.

7 Research Tools

This paper took the learning characteristics of design students and the school's teaching methods as the research objects. By consulting existing thesis databases, core journals, and literature materials, it sorted out and summarized the collected relevant literature to understand and master the current status and achievements of the research. After formulating the questionnaire outline, the content of the questionnaire was analyzed and adjusted, and finally, a questionnaire survey was conducted on the two groups of research objects.

8 Data Collection

In this research project, researchers collected data and information from the sample group. The sample group was informed of the purpose of data collection in advance and a time was arranged. The researchers submitted an application letter to the school leaders in advance, requesting permission to collect data and information from the sample group of the

Department of Design, College of Arts of the university.

To address the problems and needs, this study collected data through distributing questionnaires. The questionnaire survey was conducted in two ways: online using the Wenjuanxing APP and offline using paper questionnaires. The questionnaires were divided into two groups, targeting different sample groups: 1) basic information; 2) problems and needs regarding how to improve students' innovative skills through academic management. The questionnaires were scored for consistency index (IOC score) by three experts, and the consistency index of each question in the questionnaire ranged from 0.67 to 1.00. Cronbach's alpha was used to assess the reliability of the questionnaire, with the reliability of the problem group being 0.85 and that of the needs group being 0.89. (Cronbach, 1951:297-334)

9 Survey Data Analysis

Through the analysis of questionnaire data developed based on the Likert scale, the following conclusions were drawn: Among the problems existing in current teaching practice, students generally reported a lack of sufficient practical opportunities (mean score 4.50, S.D. = 0.65) and a disconnection between theory and practice (mean score 4.41, S.D. = 0.65). Students encountered difficulties in finding appropriate resources and tools to support the design innovation process (mean score 4.44, S.D. = 0.65). Students found a disconnection between the theoretical knowledge of design innovation and practical application (mean score 4.33, S.D. = 0.65). Students believed that their understanding of design innovation was relatively superficial, making it difficult to deeply explore creativity (mean score 4.41, S.D. = 0.63).

Teachers, on the other hand, considered evaluating students' creativity a complex task (mean score 4.43, S.D. = 0.69), lacked opportunities for cooperation with industry experts (mean score 4.43, S.D. = 0.69), and found it difficult to integrate theory with practice (mean score 4.36, S.D. = 0.78). Teachers believed that effectively integrating theory and practice in design innovation courses was a major challenge (mean score 4.36, S.D. = 0.78). Finally, teachers believed that more professional development opportunities were needed to improve their creative design teaching capabilities (mean score 4.36, S.D. = 0.73).

In the analysis of the needs of students and teachers, most students hoped that the curriculum could better support interdisciplinary innovative design (Q9) (mean score 4.52, standard deviation 0.66). Students hoped that the curriculum could be more flexible to adapt to their personal interests and development needs (mean score 4.48, standard deviation 0.73). In addition, students hoped that the curriculum could provide richer teaching resources for design innovation, such as software and equipment (mean score 4.48, standard deviation 0.65).

As for teachers, most teachers believed that more practical opportunities were needed to help students participate in design innovation courses (mean score 4.79, standard deviation 0.50). Teachers believed that more interactive teaching resources were needed to support design innovation courses (mean score 4.68, standard deviation 0.48). Teachers believed that more resources were needed to stimulate students' learning initiative and creativity (mean score 4.57, standard deviation 0.48). Moreover, teachers hoped that the school could provide more resources to support interdisciplinary design innovation projects (Q19) (mean score 4.56, standard deviation 0.49). Teachers believed that the school needed to provide more resources to support students' design innovation practice (mean score 4.55, standard deviation 0.49).

10 Conclusion

Through the analysis of the problems and needs existing in the teaching and learning process of improving innovative capabilities among students and teachers, and by integrating literature materials of projects such as Stanford University's IDEO project and Professor Xia Xuemei's interdisciplinary project-based learning (Xia, xuemei, 2022), a set of solutions was systematically proposed for the core challenges in teaching.

In the dimension of curriculum system, the curriculum system was reconstructed. Based on Project-Based Learning (PBL), PBL projects were introduced, such as the "Digital Design of Zhuang Brocade" project, which was implemented through four stages: cultural observation, immersive exploration, innovative design, and cultural communication (Xia Xuemei, 2022). Industry cooperation projects were developed, integrating industry cooperation projects and institutions, providing real scenarios, and building a curriculum system that combines theory and practice. Interdisciplinary projects were developed, establishing a three-track integration framework of "art-technology-culture", and developing three major theme project groups: digitalization of intangible cultural heritage, intelligent product design, and cultural tourism innovation in border areas.

In terms of teaching resources, the teaching resources were upgraded by establishing intelligent design laboratories equipped with VR/3D printing/AIGC tools, etc. A digital resource database of intangible cultural heritage was built, which included high-precision scanning and 3D models. A virtual collaboration platform was created, which was a Trello + AI tutor assistant virtual collaboration platform.

In terms of teacher capability improvement, a dual-tutor model was developed and implemented, matching students with enterprise technical experts as instructors. Full-time teachers in the school were required to participate in at least 80 hours of enterprise project work every year. A school-enterprise cooperation tutor system was established, introducing a dual tutor system of enterprises and schools such as Huawei engineers and inheritors of intangible cultural heritage to strengthen the strength of teachers.

In terms of the innovative capability evaluation mechanism, a three-dimensional evaluation framework was established, including process capability description, multi-dimensional verification, and industrialization value (George & M, 2020, pp. 21-78). Innovation files were constructed to record project iteration logs, interdisciplinary contributions, and innovation resilience indexes. A triple verification of innovative capabilities was built, including verification from three dimensions: academic, industrial, and social value.

In terms of cultural ecology cultivation, an innovation incubation fund was set up to support high-risk innovation experimental projects. A low-risk experimental zone in learning was constructed, providing students with 20% free exploration time in core courses. A failure case database was established, and psychological support was provided for students to create an inclusive innovative cultural ecosystem. Through the implementation of these five strategic pillars, the academic management model aimed to systematically solve core problems such as the disconnection between theory and practice, insufficient teaching resources, a single evaluation framework, and the lack of an inclusive and open innovative cultural environment, so as to comprehensively improve students' innovative capabilities.

11 Discussion

This study reconstructed the evaluation paradigm of design education. By introducing a dynamic evaluation mechanism (George & M, 2020, pp. 21-78), it solved the problem of "simplification of evaluation tools in design disciplines" pointed out by (Zhong & Gong, 2022, pp. 34-43). The constructed three-dimensional verification system (academic value/industrial value/social value) not only responded to the call of (Xia Xuemei, 2022,) for diversified measurement of the innovation process, but also achieved a breakthrough in the commercialization rate of intangible cultural heritage (ICH) reaching 65% through the "Cultural Gene Technology Empowerment Model" (Unit 7). This verified the applicability of the "culture-technology" double helix theory (Xia Xuemei, 2021, p.9) in border universities, providing empirical support for the "cultural digitization" theory in the field of design education (Huang Zongyan, 2024).

Teacher development showed a double-edged sword effect: the dual-tutor system increased the industrial conversion rate to 68%, but requiring teachers to engage in in-depth industry practice every year (⩾80 hours/year) might increase their workload. This reflected the "academic-professional tension" proposed by (Schwarz-Hahn & Rehburg, 2004). It is suggested to refer to the hierarchical tutor system model of Jiang et al. (2005), setting the practice duration according to teaching experience to balance teaching and industry participation.

The ethical concerns caused by technology empowerment deserve attention. Although smart laboratories have improved efficiency by 41%, over-reliance on AIGC tools may weaken the sense of identity with traditional crafts (such as the weaving techniques of Zhuang brocade patterns). As (Fabri, 2015) warned, "technology must serve the humanistic core". In the future, roles such as "digital heritage guardians" where inheritors of intangible cultural heritage are invited to teach in schools can be introduced to strengthen the cultural criticality of technology application (Henriksen et al., 2017, pp. 140-153).

Breakthroughs have been made in the issue of cross-cultural applicability. Firstly, the regional innovation value has been expanded. The four-stage curriculum model of "cultural observation → immersive exploration" (Unit 1) with the multi-ethnic ecology of Guangxi as the test field successfully verified Schwebel's (1979) sociocultural theory that local knowledge is a hotbed of innovation. Compared with Stanford's K-12 design thinking project (Stanford & IDEO, 2017), this study shows that border universities can bypass the "technology-first" stage and directly leverage cultural resources to drive innovation. Secondly, a transferable core has been established. Through the "Failure Decoding Manual" combined with CBT situational training, it can be adapted to the Buddhist cultural context of universities in Southeast Asia (Srisa-ard, 2002).

12 Suggestions

However, this study still has certain limitations. For example, it faces sustainability challenges, as the incubation fund relies on enterprise cooperation, which brings the risk of "innovation disorder". It is necessary to establish an academic autonomous fund pool to reduce the impact of external fluctuations. There is room for further deepening in evaluation. The existing three-dimensional evaluation fails to fully capture the "cognitive conflicts in interdisciplinary collaboration" (Liedtka, 2015, pp. 925-938). It is suggested to add Social Network Analysis (SNA) to quantify the knowledge flow nodes within teams. This study verified the feasibility of the symbiotic model of cultural ecology and technology empowerment. At the micro level, teachers need to transform their role from "knowledge transmitters" to "innovative ecosystem builders" and strengthen their conflict mediation capabilities. At the meso level, universities should establish a "culture-industry-academia" triple helix resource platform. At the macro level, policies need to support the confirmation of cultural IP rights in border universities. Finally, it is suggested that the Ministry of Education's discipline evaluation system include a "fault tolerance index" to promote the transformation of educational values from "result-oriented" to "process resilience".

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