Foundation Course Design Based on Double-Diamond Model Theory

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Abstract: In the context of the continuous development of digital and multimedia technologies, it has also reshaped the design industry's demand for design talents. As designers, they not only need to master solid design skills, but also need to form design concepts that are in line with the characteristics of the times, and have innovative design thinking and design methods in the current environment to cope with the new problems and challenges brought by the transformation of design. This study starts from the change of the basic design curriculum and explores the transformation of the educational approach of the design discipline, aiming to help undergraduate students transform their literacy and train them to form design thinking for the future development of the industry. Under the theoretical framework of design thinking and double-diamond model, observation and questionnaire methods are used to propose the BOPPPS design foundation course teaching model. The model consists of six links: introduction, objectives, pre-test, participation, post-test, and summary, and it accomplishes the goal of cultivating students' design thinking and design literacy for the future design industry by advancing the curriculum from figurative to abstract teaching content, from thinking to practice, and by establishing a three-dimensional integrated evaluation model.

1. Overview of the Design Foundation Program

1.1 History of Development

As a core component of design education, the most representative of the design foundation course in its development history is Bauhaus, the founder of the Bauhaus school at the beginning of the 20th century. Bauhaus emphasized the idea that design education should combine art and technology, which was widely influential at that time, and the students he trained did have a better integration of creativity and practical ability. With the advent of the 21st century and the rapid development of computer technology and the Internet, design foundation courses also need to continuously incorporate digital and multimedia elements to better realize the diversity and plurality of teaching content and forms [1].

Especially after the global new crown epidemic, the online education model has become an indispensable instrumentalization platform. It is significant for promoting the change of design foundation courses. From the effect point of view, teachers and students interact and communicate with each other through online platforms, which breaks the time and space limitations of traditional classrooms and improves the flexibility and efficiency of teaching. At the same time, online education also promotes and improves the diversification of the dissemination paths of teaching resources, as well as the extended sharing value, providing more possibilities for design education.

1.2 Analysis of Poblems

Of course, in the actual application process, it is also found that the design foundation course faces some problems and challenges in the development process. Firstly, the traditional design foundation course pays more attention to the skill training and neglects the cultivation of designers' thinking and methods. Secondly, the course content and teaching methods lack systematicity and consistency, which also leads to the difficulty for students to accurately and flexibly apply what they have learnt in real projects. Another is that the evaluation mode is single, which cannot

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effectively track and evaluate the process of progression, and the limitation of relying only on the work display and technical assessment cannot fully reflect the comprehensive quality of the students and the ability they have learnt.

Aiming at these problems, this study purposefully proposes a reform plan for the design foundation course based on the theory of double-diamond model. The double-diamond model emphasizes the four stages of exploration and definition, development and delivery in the design process, which can effectively guide students to train their thinking in the design process so as to form a multi-faceted and multi-dimensional model, which better cultivates students' systematic design thinking and methodology and lays a solid foundation. Through the BOPPPS teaching mode, the theory of double-diamond model is integrated into the design foundation course, which comprehensively improves students' design literacy and comprehensive ability [2].

2. Design Fundamentals Course Reform Program

2.1 Double-Diamond Model Theory

The Double-Diamond Model Theory was proposed by the UK Design Council to describe the four key stages in the design process: exploring the problem, defining the problem, developing the solution and delivering the solution. The model emphasizes extensive investigation and analysis at each stage to ensure that the design outcome is innovative and practical.

2.2 BOPPPS Teaching Model

The BOPPPS teaching model consists of six segments: Bridge-in, Objective, Pre-assessment, Participatory learning, Post-assessment and Summary. Through this model, teachers can systematically plan the teaching and learning process to ensure students' active participation and effective learning in each session.

2.3 Three-dimensional evaluation model

In order to comprehensively reflect the design literacy and comprehensive ability of professional students, this study proposes a "three-dimensional integrated" evaluation model. The model consists of the following dimensions: knowledge dimension, skill dimension and attitude dimension, and comprehensively measures students' learning outcomes and development potential through diversified evaluation methods, such as project works, classroom performance and self-assessment.

3. Theoretical Overview of the Double-Diamond Model

The Double-Diamond Model (DDM) was first proposed by the UK Design Council in 2005 to describe the basic framework of the four key stages in the design process. The model illustrates the dynamic evolution of design thinking through two "diamond-shaped" processes of expansion and convergence. The four phases are exploring the problem, defining the problem, developing the solution, and delivering the solution, and each phase has its own specific goals and methods to ensure the systematic and scientific nature of the design process [3].

The explore-problem phase serves as the starting point of the design process and aims to gather extensive information to understand the user needs and the problem context. In this phase, designers need to conduct extensive research, including user interviews, observations, questionnaires, and other methods, in order to fully understand all aspects of the problem. By collecting and analyzing information, the designer is able to examine the problem from multiple perspectives, laying the foundation for the subsequent definition phase.

In the define-poblem phase, the designers collate and analyse the information collected in the eplore phase to clarify the design goals and core issues. The key to this phase is to summarize and conclude the extensive research findings to form a clear problem definition and design requirements. By clarifying the problem, designers can focus on solving the most critical design challenges and avoid blindness and arbitrariness in the design process.

In the dvelop-solutions phase, design thinking is further deepened, and designers begin to

conceptualize and create solutions based on a clear problem. Designers explore a variety of possible solutions through brainstorming, conceptual design, prototyping and other methods, and conduct continuous testing and optimization. This process emphasizes creativity and experimentation and encourages designers to be bold and innovative.

The deliver-solution phase is the final stage of the design process, where the designers realize and implement the solution that has been repeatedly tested and optimized. During this phase, designers are required to produce the final design and conduct user testing and feedback collection. Through continuous adjustments and refinements, it is ensured that the final design results can meet user needs and design goals. This stage also includes the presentation and promotion of the design results to ensure the successful application and dissemination of the design solution [4].

In the design foundation course, the application of the double-diamond model can effectively enhance students' design thinking and comprehensive quality. By organically combining the four stages of exploration, definition, development and delivery, the course systematically guides students in the dispersion and convergence of design thinking, and cultivates their innovative and practical abilities. Specifically, the course can set up corresponding teaching contents and activities in each stage, such as research tasks for problem exploration, discussion sessions for problem definition, brainstorming and prototyping for solution development, and user testing and demonstration for solution delivery. Through these sessions, students can fully grasp the key stages of the design process and develop systematic design thinking and methods.

4 Framework for Foundation Program in Design

4.1 Learning Objectives

The learning objectives of the Foundation Program in Design Studies cover a wide range of areas and aim to enhance students' design skills and literacy in a holistic manner. The specific objectives are listed in Table 1 below:

Table 1 Learning Objectives

Learning Objectives	Concrete Content
Acquire basic design skills	Include drawing, modelling, use of digital tools, etc.
Foster design thinking	Understand and apply design thinking methods such as the Double-Diamond Model for systematic design
Enhance innovation capacity	Enhance students' creativity through creative training and practical projects
Understand design theory	Study design theory and history to develop a solid theoretical foundation
Develop teamwork skills	Develop students' co-operation and communication skills through team projects

4.2 Double-Diamond Teaching Arrangement

The teaching arrangement of the design foundation course based on the double-diamond model is shown in Table 2 below:

Table 2 Basic course teaching arrangement

Stage	Teaching content	Teaching methods	Timetable
Discover	User needs research, background research, problem analysis	Questionnaires, user interviews, observation methods	Weeks 1-3
Define	Information collation and analysis, clarifying design objectives, writing design briefs	Brainstorming, group discussions, application of analytical tools	Weeks 4-5
Develop	Creative Ideation, Concept Design, Prototyping	Brainstorming, sketching, prototyping	Weeks 6-9
Deliver	Final design implementation, user testing and feedback, presentation of design results	Production of final product, user testing, project presentation	Weeks 10-12

4.3 Three-Dimensional Integrated Teaching Assessment Model

In order to comprehensively assess students' learning outcomes, a three-dimensional integrated teaching assessment model is proposed, including knowledge dimension, skill dimension and attitude dimension Table 3:

Table 3 Three-Dimensional Integrated Teaching Assessment Model

Assessment dimensions	**Content of the assessment**	**Assessment methodology**
Knowledge dimension	Design theory mastery, design thinking application	Course tests, theory exams
Skill dimension	Drawing skills, modelling skills, skills in the use of digital tools	Project work, practical exams
Attitudinal dimension	Creative sense, teamwork skills, learning attitude	Group review, self-assessment, teacher evaluation

5. Validation of Efects

5.1 Validation Methods

The effectiveness of the design foundation course based on the double-diamond model was validated in this study by the following methods Table 4:

Table 4 Validation Methods

Validation Methods	Concrete Content
Student Feedback Questionnaire	At the end of the program, feedback questionnaires are distributed to students to collect their views and suggestions on the program content, teaching methods and evaluation methods.
Assessment of Teaching Effectiveness	Compare student performance and quality of work before and after the reforms by comparing students' design project scores and theory exam scores before and after the reforms.
Observations on Teaching and Learning	Teachers make observation records during the teaching and learning process to analyze students' performance and progress in various teaching and learning sessions. For example, records are kept of students' participation, creative performance and teamwork at different stages.
Off-campus accreditation	Industry experts are invited to assess the students' final designs and provide professional advice and suggestions for improvement. The criteria for expert assessment include creativity, practicality and technical level.

5.2 Validation Pocess and Results

In order to understand the actual effect of the curriculum reform in detail, the study designed a series of validation processes with a school as the target. During the course implementation, a student feedback questionnaire was conducted to collect students' opinions on the course content, teaching methods and evaluation methods. The results showed that most of the students were satisfied with the new course model and considered the course content to be more systematic and richer, and the teaching methods to be more varied and interactive. Table 5:

Table 5 Validation Pocess and Results

Assessment of projects	Pre-Reformation	Post-Reformation	Amplification
Average rating for design projects	72	85	18.06%
Average score on theoretical examinations	68	80	17.65%

From Table 5, the results of the assessment of the effectiveness of teaching and learning show that there is a significant improvement in the performance of the students in both the design project

and the theoretical examination. The specific data are as follows:

By two assessment items, one is that the average rating of the design project was 72 before the reform and increased to 85 after the reform, which is an increase of 18.06%.

The second is that the average score of the theory examination increased from 68 before the reform to 80 after the reform, which is an increase of 17.65%.

Observations from the teaching also showed that students' participation and motivation in all teaching sessions increased significantly. In the explore-problem and define-poblem phases, students were able to actively participate in the investigation, research and discussion sessions. In the develop-solution and deliver-solution phases, students were able to demonstrate strong creativity and practical skills.

In the off-campus evaluation session, industry experts evaluated the students' final design works. Through the evaluation, the experts agreed that the students' design works had significantly improved in terms of creativity, practicality and technical level, which fully reflected the effectiveness of the application of the double-diamond model in the design foundation course.

Through the verification of these methods, the design foundation course based on double-diamond model has effectively improved students' design thinking, innovation ability and comprehensive quality, laying a solid foundation for cultivating high-quality talents for the design industry in the future.

6. Conclusion

This study carries out a comprehensive reform of the design foundation course based on the theory of the double-diamond model, aiming to enhance students' design thinking and literacy to meet the needs of the future design industry. Through an in-depth discussion of the application of the double-diamond model in design education and the combination of the BOPPPS teaching model and the three-dimensional integrated teaching assessment model, a systematic and scientific teaching framework is proposed.

In the specific implementation process, the four stages of the double-diamond model (exploring the problem, defining the problem, developing the solution, and delivering the solution) provide clear guidance for course design, ensuring that students learn and practice systematically in each segment.The BOPPPS teaching model systematically plans the teaching process through six segments: introduction, objectives, pre-test, engagement, post-test, and summary, ensuring students' active participation and effective learning [5].

The three-dimensional teaching assessment model can comprehensively measure students' learning outcomes through multifaceted assessments in the knowledge dimension, skill dimension and attitude dimension. And the application of the assessment model is helpful for improving students' theoretical knowledge and skill level, and more importantly, tapping into the cultivation of their innovative consciousness, teamwork ability and learning attitude.

The effect of the curriculum reform was comprehensively verified through various methods such as student feedback questionnaires, teaching effectiveness assessment, teaching observation and external review. The results show that the design foundation course reform based on the double-diamond model significantly improves students' design thinking, innovation ability and comprehensive literacy, and achieves significant teaching effects. Specific data showed that the average rating of students in design projects increased by 18.06%, and the theoretical examination scores increased by 17.65%.

The design foundation course reform scheme based on the theory of double-diamond model proposed in this study provides a new idea and method for design education. In the future, with the development of the design industry and the advancement of educational technology, the curriculum framework needs to be optimized and improved to better cultivate high-quality design talents that meet the needs of the new era.

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