

# Exploration and Practice of Cultivating Multidimensional Design Innovation Ability

-- Taking "Product Development and Design" Course as an Example

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**Abstract:** This paper relies on the background of the "National Medium and Long-Term Science and Technology Development Program (2006-2020)" and "National Medium- and Long-term Education Reform and Development Program (2010-2020)" issued by the State Council. The document emphasizes the importance and urgency of cultivating innovative talents. This article takes the "Product Development and Design" course as a carrier to explore the multi-dimensional and jointly driven innovative talent training methods such as goal orientation, school-enterprise collaboration, science and education integration, and competition platform. Through: ① Build a three-tier progressive curriculum project system to help students internalize the theory and lay the foundation for practice. ② Create a school-enterprise mutual-feeding joint training method, supported by enterprise projects, and form classroom and project mutual-feeding. ③ Set up the second classroom of scientific and technological innovation, with the precise drive of the four-in-one team + project + platform (competition platform) + innovation (Internet +, rural revitalization, etc.), to build a five-level integration of teaching, production, competition, research, and theoretical practice for improvement way. ④ Construct a process-based, output-oriented, quantifiable and controllable, multi-channel feedback capability achievement evaluation standard. Multi-dimensional innovative ways to explore the training mode of applied innovative talents. It is hoped that it can solve the problem of connecting the innovation ability of students and the innovation level required by enterprises.

**Keywords:** Multi-dimensional innovation, Innovation method, Product development, Design innovation ability.

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## 1. Introduction

### 1.1. Purpose and significance

On February 9, 2006, the State Council issued the "National Medium- and Long-Term Science and Technology Development Plan (2006-2020)", pointing out that the goal of building an innovative country should be taken as the goal, and the foundation for building an innovative country is to cultivate innovative talents. On February 28, 2010, the "National Medium and Long-Term Educational Reform and Development Plan (2010-2020)" (draft for public consultation) released again emphasized the importance and urgency of cultivating innovative talents. With the advent of the era of informatization and dataization in the 21st century, innovation has almost become the theme of the times. The key to deepening educational reform, innovating educational methods, cultivating innovative talents, and promoting social transformation is to implement creative teaching. How to implement creative teaching scientifically and effectively is a never-ending topic.

Therefore, with the course of "Product Development and Design" as the carrier, we will explore innovative talent training methods driven by goal orientation, school-enterprise collaboration, integration of science and education, and competition platforms. ① Build a three-tier progressive course project system to help students internalize theory and lay a foundation for practice. ② Create a school-enterprise mutual-feeding joint training method, supported by corporate projects, and form a mutual feeding of classrooms and projects. ③ Set up the second classroom of scientific and

technological innovation. With the precise drive of the four-in-one team + project + platform (competition platform) + innovation (Internet +, rural revitalization, etc.) way. ④ Construct process-based, output-oriented, quantitative and controllable, multi-feedback capability achievement evaluation standards. Multi-dimensional innovative methods to explore the training mode of applied innovative talents.

### 1.2. Current status of domestic research

It is of great practical significance to implement the national development strategy of "mass entrepreneurship and innovation" and implement the multi-dimensional innovation training model of innovation and entrepreneurship education, applied talent training, collaborative education, and comprehensive reform of product design. In the current transition period of economic supply reform, the integration of innovation education and professional education is particularly important for product design majors, which has become an important path to cultivate product design applied talents. However, the traditional product design teaching embodies a single training mode, and the trained professionals are gradually unable to meet the ever-increasing needs of the product design and manufacturing industry.

creative teaching goes through the initial stage, the stage of systematic research in the teaching field, and the stage of multi-disciplinary and multi-perspective research. The research on creative teaching in our country is mainly carried out from the concept definition, teaching strategy, curriculum design, teachers' creative psychology, curriculum development, teaching mode and so on.

There are common problems in the field of educational

research, such as staying at the stage of theoretical research such as concept definition. As well as problems such as weak theoretical research and single research perspective, scholars still need to continue to pay attention to and solve them. In view of the above problems, in the future research, we should pay attention to the following aspects: strengthen the study of native language and pay attention to interdisciplinary, and pay attention to the theoretical research and teaching practice of creative teaching from multiple methods, multiple dimensions, and continuous long-term.

This article integrates the needs of regional industries, and aims at the difficulty of recruiting workers for enterprises. The "Product Development and Design" course and Yonglang Group launched an industry-university-research project to jointly build a school-enterprise cooperation course. Combined with the actual needs of regional enterprises: the main product of this enterprise is non-standard customized amusement facilities. Since the core of non-standard customization lies in originality, a large number of designers are required to invest in innovative designs; on the other hand, the enterprise recruits suitable innovative Awareness and competence are the major recruitment issues facing the designer city today. Carry out in-depth project cooperation with the product art design major to jointly build relevant courses, hoping to cultivate a group of reserve talents suitable for this industry.

## 2. Key Issues to Be Solved

(1) Under the new situation, how to build innovative talents training mode and teaching system and other bottleneck issues.

(2) It is difficult to adapt to the new needs of the industry in terms of current product design talent training

(3) Students' internal drive for theory is weak, and it is necessary to diversify and improve the transformation methods and methods from theory to practice.

(4) The general rating results are too subjective, and it is difficult for students to get positive feedback psychologically.

(5) Students' professional study is out of touch with their lives, the evaluation of achievements is not timely and objective, and teachers cannot motivate students in a timely and effective manner.

## 3. Research Content and Objectives

### 3.1. Research content

This article takes the "Product Development and Design" course as a carrier to explore the multi-dimensional and jointly driven innovative talent training methods such as goal orientation, school-enterprise collaboration, science and education integration, and competition platform. Dimension 1. Build a progressive curriculum project system to help students internalize theory and lay a foundation for practice. Dimension 2. Create a school-enterprise mutual-feeding joint training method, and enterprise projects as support, forming mutual feeding between classrooms and projects. Dimension 3. Set up the second classroom for scientific and technological innovation. With the precise drive of the four-in-one team + project + platform (competition platform) + innovation (Internet +, rural revitalization, etc.), a five-level integration of teaching, production, competition, research and use is built to improve the way of theory and practice. Dimension 4. Construct multi-channel feedback capability achievement evaluation standards, which are process-based, output-

oriented, and quantifiable and controllable. Through integration, multi-dimensional innovation methods to explore the training mode of applied innovative talents.

### 3.2. Research objectives

(1) A progressive curriculum project system has been established. Guided by problems and projects, construct "Curriculum Basic Training Projects (Basic Form Training: Level 3 Projects)", "Comprehensive Application Projects (Project Simulation: Level 2 Projects)", "Innovative Research and Development Projects (Innovation Competition: Level 1 Projects)".

(2) Create a school-enterprise mutual feeding joint training method. Construct a practical course teaching system consisting of "five links" (theoretical basic experiment, theoretical comprehensive experiment, classroom simulation project implementation, after-school practice training, and innovation competition) with school-enterprise co-education and deep integration.

(3) Set up the second classroom of scientific and technological innovation. With the help of the four-in-one precise drive of team + project + platform (domestic and foreign competition platforms) + innovation (Internet +, rural revitalization, etc.), the method of improving theory and practice is improved.

(4) Construct a process-based, output-oriented, quantitatively controllable, and multi-channel feedback capability achievement evaluation standard. Make course performance evaluation more objective.

(5) Construct a platform for the transformation of achievements with deep integration of the three parties. Improve the possibility for the excellent projects of future student teams to land.

## 4. Construction Implementation Plan

### 4.1. Construct progressive project course content

Construct a progressive project teaching system combining teaching, scientific research and production. With the goal of improving students' comprehensive design literacy and innovation and entrepreneurship ability, the requirements of regional industries for graduates have been comprehensively analyzed, and a capability matrix combining theoretical knowledge learning and comprehensive literacy has been carefully designed. Aiming at the curriculum teaching, deepen the teaching reform with innovation ability as the core, and turn the "knowledge classroom" into "ability classroom". Reconstruct the teaching content and mode of the "Product Development and Design" course, explore and construct the "Course Basic Training Project" (basic form training: third-level project), "Comprehensive application project (project simulation: second-level project)", "innovative research and development project (innovation competition: first-level project)" three-tier progressive course project system combining teaching, marketing and scientific research.

In order to achieve the goal of product design education innovation ability, the reform of course teaching methods and means introduces advanced teaching methods that are guided by problems and projects, and focus on conception, design, realization, and operation modes, and carry out problem-based learning and project-based learning. , case-based learning and other research-based learning methods, so that the topic and project exploration run through the entire

teaching process.

## 4.2. Create a school-enterprise joint training method

Guided by product design concept and practice, build a school-enterprise co-education and deep integration consisting of "five links" (theoretical basis teaching, theoretical comprehensive experiment, classroom simulation project implementation, after-school practice training, innovation competition) The whole process, multiple forms, and layered implementation of the practical course teaching system form a way of in-depth interaction and integration of school-enterprise joint training and enterprise practice.

Relying on the needs of regional industries and aiming at the difficulty of enterprise recruitment, this course cooperates with Yonglang Group Co., Ltd. , and the two tutors jointly cultivate reserve talents for enterprise needs . Based on the enterprise's demand for the theoretical reserve of talents, the enterprise tutor will intervene , and the teachers in the school will cooperate with the teaching to carry out theoretical basic teaching, classroom simulation project implementation and teaching evaluation. To ensure students' mastery of skills and knowledge. Based on the skills needs of

enterprises for talents, enterprise projects are involved to carry out after-school practical training and innovative design competitions to cultivate students' hands-on ability, communication ability, team awareness, scientific research style and innovative spirit. Finally, corporate mentors intervene in the evaluation system , participate in the evaluation of students and courses in a timely manner, sum up experience, and form mutual feeding between courses and companies.

an important way to enhance students' ability to solve complex product design problems . According to the ability needs of industries and enterprises for talents, the content of the course is structured: designing teaching tasks--ability decomposition (knowledge points and skill points)--designing reasonable teaching projects ( enterprise projects ). In order to improve the ability of students' project management and implementation, the training project management process table is designed. Through the diversified project experience in the classroom and outside the subject, students can exercise their abilities in project process management, progress management and project index grasping. These experiences ultimately improve the quality of design talent training and continuously deliver top-notch design talents to enterprises and society.

**Table 1.** School- enterprise joint training enterprise project intervention teaching

serial number	teaching task	Capability decomposition		Enterprise project intervention	teaching method
		knowledge points	Skill points		
1	Theoretical basis teaching	Module 1: Knowledge of product development and design Module Two: Sensory Training	Product innovation and inspiration performance	Inspiration extraction task in the early stage of product design project	Lecture method, case analysis method, task-driven method
2	Theoretical Comprehensive Experiment	Module 3: Origami Form Practice Module 4: Comprehensive Exercises of Spatial Form	According to the results of the product definition method , the information is transformed into design points	On the basis of functional components, the construction task of the three-dimensional shape of the product	Case analysis method, task-driven method
3	Implementation of classroom simulation projects	Module 5: Product Computer Modelling Performance Module 6: Combining form with product design	Demonstrate reasonable product structure, size, function and craftsmanship	For example, the single design project of standardized amusement facilities; the single design project of standardized comprehensive amusement facilities;	Case study method, task-driven method
4	After-school practical training	Show the appearance, functional components and structural components of the product; the techniques of product performance;	Application of product design method and innovative design method in enterprise project	For example, the single design project of non-standard amusement facilities; the single design project of non-standard comprehensive amusement facilities	task-driven approach
5	innovation competition	Product concept expression techniques; product poster production techniques; competition process;	Application of product design method and innovative design method in design competition	Related industry product design projects based on real-time design competitions	task-driven approach

## 4.3. Set up the second classroom of scientific and technological innovation, and actual combat competitions will improve the transformation of theory into practice

① Based on the cultivation of innovative applied talents,

the design of curriculum content inside and outside the classroom is optimized. Different from the previous classroom teaching and the second classroom. As an independent individual research method, the curriculum optimizes the design and teaching of the first classroom and the second classroom, and takes the "theory first classroom"

as the theoretical basis for the smooth implementation of the "innovative second classroom", so that "innovative The activities of the "Second Classroom" are purposeful, in-depth and guaranteed; at the same time, the flexibility of the "Innovative Second Classroom" in terms of time and space is fully utilized, so that students can obtain a variety of channels for comprehensive understanding and application of classroom knowledge, and contribute to the "Second

Classroom". It is possible to realize the teaching methods such as "task-driven" and "inquiry-based" in the first classroom teaching. In the arrangement of the "Innovation Second Classroom" activities, the knowledge, practice and innovation are emphasized, so as to further realize the overall curriculum goal of innovative and creative design of cultivating innovative and applied talents.

**Table 2.** Ability Achievement Evaluation Criteria Evaluation Criteria

serial number	scoring points	Score	Grading	
1	Product innovation and inspiration performance	30	Reflect the pain points of users; the work is novel	
2	concept of design	20	According to the results of the product definition method , the information is transformed into design points	
3	specific design	20	Demonstrate reasonable product structure, size, function and process	
4	Product Poster Production	main image design	10	The overall effect of the product and the performance of the product temperament, highlighting the main features of the product
		source of creativity	10	Pay attention to the source of product inspiration; highlight the innovation of the product
		product display	5	Multi-angle display skills of products
		Product details	5	Different parts or different combinations; standard views and dimensions; description of structural principles
		Use scene performance	5	Express the suitable usage scenarios of the illustrated product
		product creative expression	5	Express the concept feeling conveyed by the product; express the key basic information of the product

② Relying on the extracurricular competition platforms of colleges, schools, provinces, domestic and foreign, provide different levels of competition platforms, cultivate and demonstrate the innovation and entrepreneurship ability and teamwork ability of college students; guide and stimulate students' interest in science and technology and exploration spirit, and cultivate students' comprehensive The ability to apply engineering knowledge and creative thinking to solve practical problems. Construct a grade-based, cross-professional, all-round and three-dimensional innovation competition system including "domestic general subject competition", "international authoritative design competition" and "innovation and entrepreneurship design competition", forming a complete innovative teaching system inside and outside the classroom. This is a competition-oriented course designed to deepen students' understanding of the fundamental theory and applications behind practical design.

#### 4.4. Build a process-based, output-oriented, quantitatively controllable, and multi-channel feedback capability achievement evaluation standard

Construct a process-based, hierarchical and graded teaching evaluation standard that comprehensively assesses students' knowledge, ability, and quality, and form an output-oriented, quantitatively controllable, and multi-channel feedback accurate evaluation system for ability achievement. Focusing on improving students' comprehensive engineering literacy and innovation and entrepreneurship ability, based on the assessment indicators of various links such as enterprise requirements and ability refinement indicators, and the ability achievement evaluation criteria of multi-channel feedback.

Multiple assessments are carried out with students, teachers, and enterprises as the main body to effectively improve students' comprehensive abilities. The following tables are the

evaluation criteria of student course outcomes based on teacher opinions and corporate standards.

## 5. Conclusion

Explore the training mode of applied innovative talents through multi-dimensional innovation methods : construct the training mode and teaching system of innovative talents ; diversify the way and method of transforming theory into practice ; give students objective feedback in time ; on the other hand, make students' Professional study is integrated with life and work. Trying to solve the problem of connecting the innovation ability of students and the level of innovation needed by enterprises.

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