ISSN: 2710-0170

Exploration and Practice of Cultivating Multidimensional Design Innovation Ability

-- Taking Product Development and Design Course as an Example

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Abstract

With the development of society and the improvement of people's living standards, consumers ' demand for cultural and creative products shows a trend of diversification and individualization, and people are becoming more and more picky about the aesthetics of cultural and creative products. Cultural and creative products should not only carry the use function and aesthetic function of the product, but also contain rich connotations of culture and art. Due to the lack of systematic theoretical and practical support, most product designers design a product based on their own experience and inspiration. Such a product is difficult to accurately and efficiently meet consumers' consumption needs . How to let design students use innovative methods to learn design is an important part of educational cultural and creative design methods. Based on the method of innovative design, it analyzes the excellent work , and strives to provide a certain basis and reference for the design education of cultural and creative products .

Keywords

Excellent Teaching Case; Product Design; Perspective of Innovative Thinking; Blocks Design.

1. Case Introduction

1.1. Conduct In-depth Research and Complete Basic Tasks

In the early stage of the design, detailed analysis and research were carried out on the existing products in the market and the problems that occurred during the use process. Starting from the problems, with the basic purpose of solving the problems that occurred during the user's use, the cultural and creative product modeling design, functional components and In terms of structure, an original design has been carried out on the product.

1.2. Innovative Solutions to Solve Original Problems

In the design process of this design scheme, in addition to extracting the features of the corridor bridge, other functions were also integrated to increase the interest of the product. The design point is to make the building blocks of the wooden arch bridge have the function of a model-calculating module to meet the needs of users for toys to play with. Using product design technology, the structure of the wooden arch bridge is simplified and the logic of product use is smoother. In terms of color matching, the use environment is also considered accordingly, so that the product can better meet the public's aesthetics.

2. Case Application

Application of case in professional course of product art design.

This case highly integrates industry application knowledge and students' professional knowledge, and realizes the seamless connection of multiple design links. Students are required

ISSN: 2710-0170

to master the core capabilities of each stage of product development, and use original methods to solve design problems to solve the design of each stage question.

The core courses of the major of product art design are precisely equipped with the practice of comprehensive design, such as "3D Design Software", "Puzzle Product Design", and "Cultural and Creative Product Design Project". For example, in the case of the "3D Design Software" course, the modeling steps can only be reversed based on the final results, and there is a lack of modeling demonstrations from beginning to end. In this graduation design case, the model is complex and the modeling prototypes of each stage are retained, which is just conducive to making up for the staged teaching cases in the Rhino course.

In addition, this case has been refined and decomposed, deeply analyzed, thought expanded, and effect compared in the comprehensive project design links such as "Puzzle Product Design" and "Cultural and Creative Product Design Project", especially in the design of cultural and creative products. Thinking about culture and productization, these have an important reference and guiding role in product development projects.

3. Achievement Display

3.1. Product Renderings

Rendering software is used to make renderings, which are mainly used to express the appearance structure, material color and surface treatment effect of the product. You can see the large shape and part of the detailed structure of the product. The materials are all made of abs plastic, and the colored parts are painted.

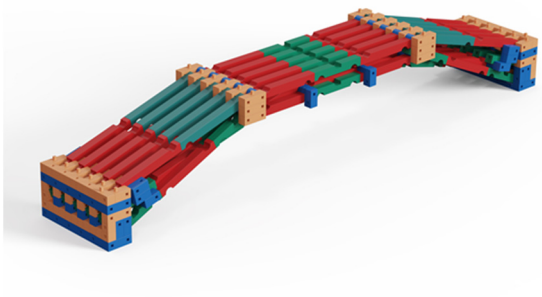

Fig 1. Effect drawing of "Yunyan" toy

3.2. 3D Model File

Use Rhino 3D modeling software to complete the drawing of production process documents, and the documents can be directly connected to the processing and production department for product production. Figure 1 is the display effect of the drawing file of this product in Rhino.

3.3. Mock-up

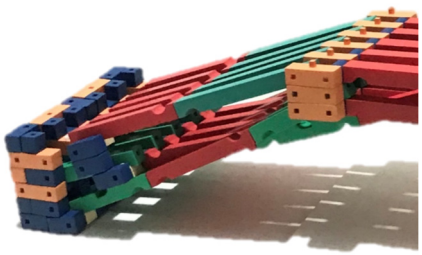

Fig 2. Is the physical rendering (details)

ISSN: 2710-0170

The physical model is made through 3D printing and CNC finishing. The physical model can intuitively display the details, surface treatment process and touch of each part of the product.

4. Case Description

4.1. The Problem Solved by the Work

existing toy products are not integrated in the processing of modules and overall shapes. The traditional design method of cultural and creative products only continues the appearance of the material itself, and it is mostly made into ornaments for viewing.

In the design process of this design scheme, in addition to improving the deficiencies of the original cultural and creative products, a new concept of weaving wooden arch bridge building blocks was proposed, and other functions were integrated to increase the interest of the product.

In today's society, parents pay more and more attention to their children's education, and pay attention to cultivating their children's comprehensive quality since childhood, and building blocks are the best choice for every parent. In addition, the intangible cultural heritage is declining in recent years, among which the Chinese wooden arch bridge construction skills are included in the UNESCO "List of Intangible Cultural Heritage in Need of Urgent Protection". Therefore, the intangible cultural heritage wooden arch bridge is integrated into building blocks to create a brand-new architectural building block.

In the design process of this design scheme, in addition to simplifying the structure of the original covered bridge, a new concept of a modular wooden arch bridge toy is proposed, and other functions are also integrated, which can be assembled into a variety of arch bridges The shape is to increase the interest of the product.

4.2. Work Function

This product creates a toy building block that stimulates creativity and spatial thinking. Repeated research on the style and structure of the model, hoping to better store the main elements of intangible cultural heritage on the premise of ensuring the development of children's interest. Therefore, after searching a large amount of literature knowledge, we choose to retain the main color tone established by the corridor bridge, and the mechanical structure of its mutual pressure and friction will also be the main creation method. Design method or design idea This product breaks the traditional way of building blocks through vision, traditional technology and rigorous physical design concept. A modular system demonstrates the possibility of unique and multifunctional construction and assembly, and improves children's carefulness of things and the establishment of meticulous logic by building blocks, and promotes communication and collaboration between parents and children.

4.3. Design Idea and Working Principle

In the research stage, firstly through the network investigation, understand the historical background, development process and construction principle of the wooden arch bridge. Then through the network and product research in nearby shopping malls, we collect information on various cultural and creative products on the market, and compare their appearance, functions, advantages and disadvantages. And understand people's demand for cultural and creative products and some requirements and suggestions for the product itself. Finally, summarize from these products, find your own design inspiration and some problems that should be avoided.

In the stages of shape design and mechanism design, several schemes have been made. In order to make the building block structure more reasonable and simple, many attempts and deliberations have been made on the module itself and the way of building. There are 5 modules

ISSN: 2710-0170

in the first plan, and the style of the assembled arch bridge is single. So, in the second plan, 4 kinds of modules were added, and finally, the building block styles were diversified.

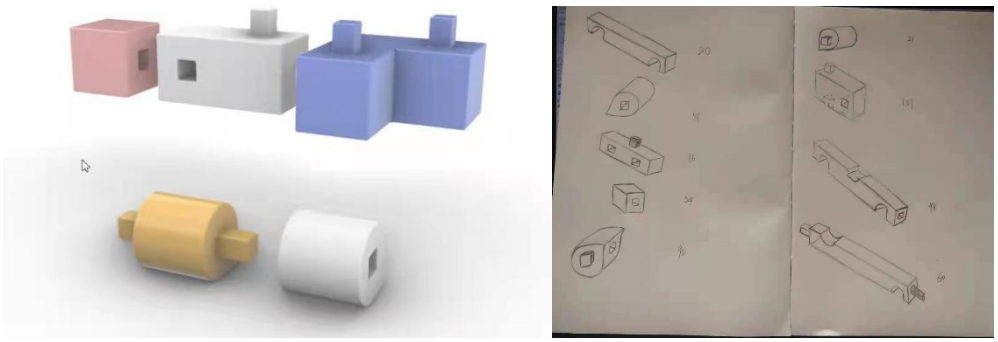

Fig 3. Shows the deliberation process of the modules in the scheme

In the structural design stage, considering the feasibility of the modular mortise and tenon joints of the building blocks, the various structural coefficients of the product were fine-tuned. In the physical verification stage, problems were found and solved. Make the product more convenient.

In the stage of functional deliberation, repeated deliberations were made on the module style to streamline the functions: 9 kinds of modules were selected, and various bridge styles can be flattened; the number of modules was limited; the structure of the common wooden arch bridge was anatomically reconstructed, and the mechanical principle is verified to ensure the implementability of the function.

In the stage of color matching design, it is considered that the architectural styles of the covered bridges are different and varied. The color matching of the product is selected from the ancient Chinese traditional architectural color system. The calm retro color adds layers to the color and material.

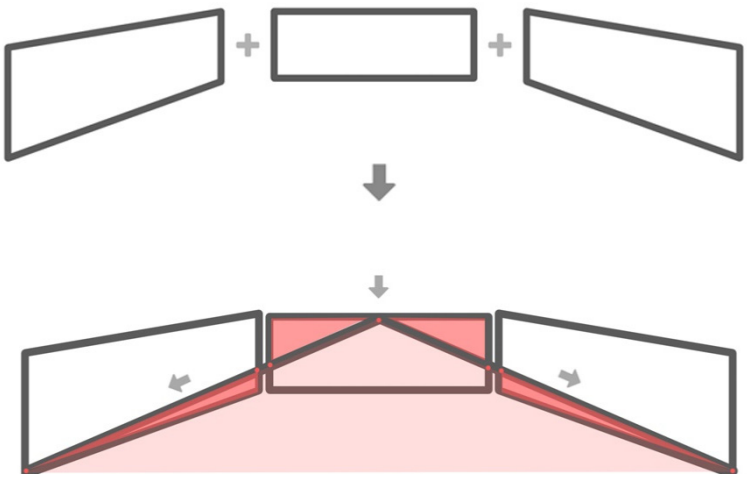

Fig 4. Schematic diagram of the building block structure of the corridor bridge

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5. Teaching Implementation

5.1. Teaching Objectives

The overall goal of this graduation comprehensive practice teaching is to cultivate students' ability to solve problems with original thinking, encourage students to observe life and experience culture, so as to find innovative materials, and guide students to self-discovery and self- display ability in design.

The ability goal is to enable students to have: the ability to modify and adjust projects; the ability to serialize design schemes; the ability to make product models; and the ability to display and release products.

Knowledge objectives enable students to master: knowledge about project design process; knowledge about serialization of product design; knowledge about product display and release.

At the same time, this graduation practice also sets quality goals, establishes students' correct professional awareness with "intentional service in design" as the core, cultivates students ' good team awareness, is good at thinking from the perspective of others, and learns to discover, Analyze and solve problems, cultivate good professionalism and mentality.

5.2. Teaching Focus

The teaching implementation process is mainly divided into three stages: early stage, middle stage and late stage. The early stage is the market research stage, which is mainly guided by teachers. Mainly conduct mainstream brand market research and product structure analysis. In the mid-term stage, for the proposal and verification of the design plan, I have to keep in close contact with the students every week, mainly discussing the modification and improvement of the student model. In the absence of face-to-face interviews, actively carry out online real-time communication, and keep abreast of the progress of the 3D model and prototype model at each stage. In the later stage, because the model plan has been determined, teachers will give priority to guidance, focusing on the production of physical models, the design of graduation exhibition boards, and the writing of graduation thesis, focusing on supervising the final presentation of products.

5.3. Teaching Arrangement

Table 1. Teaching schedule

Start and end time	Main points of stage tasks
December 20xx _	Design Concept
January 20xx _	market research, product research
During the Spring Festival	Complete the preliminary research PPT
February 21 , 20xx	Determine the topic
February 22~March 5	Project opening report, preliminary product sketch drawing
From March 5th to March 31st	3D model creation and modification
From April 1st to April 15th	Physical model making, graduation exhibition board making
April 19	Product graduation design exhibition, corporate exchange
April 28	Prepare to complete graduation thesis and prepare for graduation defense at all times
From May 1st to May 10th	Demonstration video production

ISSN: 2710-0170

According to the school's graduation design practical teaching arrangement and students' needs, a specific time will be set around the teaching process of product design (researchers, topics, topic opening, design conception and expression, physical production, document writing, graduation defense, achievement exhibition, etc.) Schedule.

5.4. Teaching Task List

This graduation comprehensive practice has gone through multiple design links, and this teaching case summarizes it into three stages. It mainly includes: the preliminary research stage of industry products, the modeling design stage, the production and display stage of product physical model. The specific content of each stage is shown in the table below.

Table 2. Contents of teaching tasks

S/N	work tasks		Course content	Skill Points
1	Product preliminary research	Task1: Industry product market research	Summary of characteristics of cultural and creative products at home and abroad	Understand the design characteristics of cultural and creative products
		Task2: Survey of bridge buildings	Covered bridge historical background Structural Analysis of Woven Timber Arch Bridge	Understand the structural principles of arch bridges made of braided wood
		Task3: Industry product user research	From the category of building blocks, users use psychological and behavioral characteristics	Understand the problems and solutions that users will encounter during use
2	Modeling and structure design of building blocks of braided wood arch bridge	Task1: Design task formulation and sketch representation	According to the preliminary research, analyze the market demand, and formulate the design task book	Synthesize the data of the previous research to find design breakthroughs
		Task2: 3D modeling and model modification	Determine the proportion of each part of the model in the design scheme	Master the main ideas, methods, and conventional proportions of modeling
		Task3: Model rendering and effect drawing production	Selection of materials for each part of the model and adjustment of rendering effects	Master the key points and main skills of 3D model rendering
3	Product physical model making and display	Task1: Model Structure Analysis	Analyze the internal structure of the actual model and think about the method of making the first board	Master the physical model division method
		Task2: Appearance model making	Fabrication and installation of each component of the physical model	Master the main steps of model making and how to assemble the parts of the model
		Task3: Design and manufacture of model exhibition boards	Graduation design exhibition board design and graduation booth layout	Master the display board performance of the design plan, understand the graduation booth layout and exhibit display skills

ISSN: 2710-0170

6. Teaching Implementation

6.1. Case Summary

The topic selection for this graduation started from the perception and problems discovered in daily life and culture, combined with the students' own professional ability and characteristics, made sufficient research preparations for the current market situation and the product itself, solved practical problems, and completed the design of a series of products. In the whole process, the author has worked and worked hard in the whole process from the early stage of design to the proposal of the concept, as well as the final scheme and model making. In the early stage of design, a lot of research and problem summarization were done, and then starting from the problem, a lot of conceptual solutions were proposed, and finally the outstanding problems of existing products in the market were solved through original design solutions. And put forward the design concept of building block cultural and creative products. In terms of the performance of the design scheme, a lot of attempts have been made in terms of product module design, product shape design, and color and material matching, and finally the existing mature scheme is obtained. Judging from the final design plan, it has solved the problems in the construction process of the existing products raised at the initial stage of the design. The plan includes original design, innovative points, and consideration of the user's use process, structure and production. craft. On the other hand, products can embody the connotation of cultural archetypes. Students have comprehensively applied the professional knowledge they have learned, mastered the tasks and requirements of each stage of product design, and greatly improved their professional ability, laying a solid foundation for future design jobs or further studies and confidence. From the perspective of product design, this work can be regarded as an excellent and mature product design case.

6.2. Reflection on Teaching

In the topic selection of this graduation project, there are a lot of structural problems that need to be solved, but the students of this major do not have a deep understanding of structural knowledge, and their sense of size is weak. Therefore, in the graduation design practice, it takes a lot of time to study the content of the design, and even a lot of reworks on the size problem. Therefore, in the future courses and graduation design teaching, it is necessary to increase the accumulation of non-professional knowledge learning and practical experience, and at the same time, it is necessary to cooperate across disciplines and disciplines.

In addition, in terms of the progress of the graduation project, students are relatively passive in the active communication of the graduation project. It will cause a design lag for a certain period of time, and the problem cannot be found in time. Teachers and students need to communicate more to ensure that the graduation design work can progress smoothly according to the proposed timetable. At the same time, the instructor needs to clarify the work tasks of the students at each stage, and explain them to the students in advance, and urge the students to complete them on time.

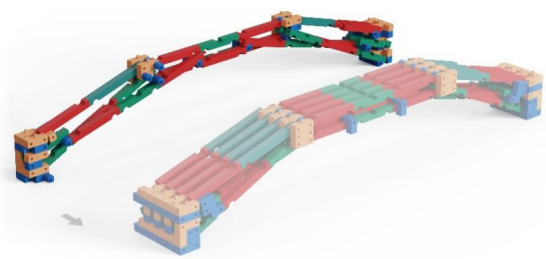

Fig 5. Schematic diagram of the construction steps of the corridor bridge building blocks

ISSN: 2710-0170

Acknowledgments

The "Fourteenth Five Year Plan" teaching construction and teaching reform research project of Wenzhou Polytechnic. The project number: WZYZD202204.

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