



CAD Method and Model in Teaching of Creative Design for Jewelry

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Abstract. Traditional blackboard writing cannot vividly demonstrate the content taught, and students cannot deeply and concretely understand the actual architectural design and construction process. CAD jewelry innovation design teaching has the characteristics of vivid and concrete teaching, convenient teacher-student interaction, and flexible teaching time. The network-based CAD jewelry innovation design teaching platform system designed in this paper is composed of teacher terminal, student terminal, manager terminal and platform system server. Teachers can upload materials, answer questions online, and ask questions online through the teacher terminal; students can ask questions, publish articles, and online homework through the student terminal; administrators can publish announcements, user management, and courseware management through the management terminal. We digitally process jewelry craft teaching materials such as text, pictures, 3D models, animation, audio and video, and then integrate all kinds of materials into a CAD innovative design teaching system that integrates sound, graphics, animation, video, and interaction. We realize the non-linear interactive operation of the courseware. The researched CAD innovative design teaching system is like a virtual digital jewelry craft dictionary, enabling students to complete a virtual craft journey to understand the main craft equipment and processes of jewelry before entering the real craft laboratory work. We establish a preliminary craft theory system and perceptual simulation understanding of the operation of process equipment. Exploring the practical functions and various practical possibilities of the CAD innovative design teaching system from the perspective of digital technology application can provide new ideas and strategies for the theoretical research and application exploration of multimedia teaching.

Keywords: Digital Model of Jewelry Craft; Innovative Design Teaching; CAD Method; Micro-Task-Driven Teaching Method

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1 INTRODUCTION

From the emergence of jewelry to its development to today, with the changes in history, the materials, crafts, styles and expressions of jewelry are also constantly changing. At the beginning of its birth, jewelry is both a tool and a decorative function, and can even be used to avoid evil and pray for blessings [1]. With the improvement of human civilization, jewelry can express and present more and more meanings, such as class, decoration, wealth, etc. All are included in jewelry. However, today when everyone pursues individualization and catches up with fashion trends, jewelry is also responsible for expressing emotions, emotions, and self-exploration. The diversity of functions also makes jewelry production and expression more and more diversified, but at the same time it also causes troubles for jewelry designers and jewelry majors [2]. In the Internet age of information explosion, you filter and extract effective and feasible information to your design. It has become a problem, and the error of information will cause difficulties in the overall promotion. Therefore, the production of a reasonable and orderly work production law is very necessary and feasible [3].

Jewel CAD is developed by Hong Kong Jewelry Computer Technology Co., Ltd. It is a set of 3D aided design software specially developed for the jewelry industry. Due to its high degree of specialization, strong modeling and editing capabilities, realistic rendering, and the ability to output standard seamless STL and SLC data, it has been widely adopted in the industry, especially in Hong Kong and Asia [4]. But its shortcoming is that the modeling function needs to be further expanded and optimized. JCAD3 Pro is a jewelry three-dimensional design software developed by a Japanese company. Its modeling thinking is basically the same as that of Jewel CAD, and it has more complete functions. It has a better effect in ribbon modeling, but the disadvantage is that the modeling function is not powerful enough and the rendering effect is not realistic enough, and there are not many users. Foreign independent designers have a high level of artistic accomplishment. The designer's design works have clear themes and rich and diverse styles. The materials of their works also choose new materials to express the different styles brought by the materials. Lee and Cha [5] believe that Western jewelry designers communicate frequently, and designers have a variety of ways to communicate. Frequent jewelry exhibitions and lectures ensure that designers can promote their latest works as quickly as possible. At the same time, many foreign manufacturers of new materials are also willing to cooperate with independent designers to explore and promote materials. Goel et al. [6] pointed out that independent jewelry designers have more opportunities to be exposed to the latest high-tech materials for jewelry design creation. Zeng et al. [7] pointed out that European art colleges and universities have set up the subject of jewelry design earlier. In jewelry design courses, they combine active design thinking with excellent craftsmanship and inherit traditional art and culture. The development is getting better and better. In terms of teaching, more emphasis is placed on the combination of European traditional culture and modern advanced technology, as well as the expression skills of creative thinking. In recent years, a group of young people who are willing to accept new things are called mainstream consumer groups. They are no longer satisfied with the value function of jewelry. Whether or not jewelry has a stored value function is no longer their only requirement for jewelry. The design form, fashionable design concept, innovative materials and the aesthetic embodiment of personality have become the fanciest part of the consumer group. Nowadays, although my country's jewelry design has great development opportunities than before, it still has a huge gap with the advanced and mature jewelry design industry in the West. Mauro et al. [8] believe that the contradiction between the huge demand of the jewelry industry and the current design level of the jewelry design industry cannot meet the needs of consumers. Jewelry products have a single style, either purely antique or purely realistic. Such a design style no longer meets the diversified requirements of design in today's society, and cannot meet consumer demand. Kielarova [9] believe that the lack of design caused by blind antiques will bring jewelry design into an irreversible design blind spot. This kind of work formed solely by the splicing of messy ancient elements will not be able to bring modern aesthetic works of art. As a result, the works are

nondescript and lack of surprises. And purely realistic jewelry design works have also become a more extensive subject in my country's jewelry design products. Research by Gulati et al. [10] has shown that purely objective descriptions have wiped out the original important subjective designer factors in jewelry design, and lacked the sense of form and the refinement of beauty. Such development will not only lead to the improvement of the aesthetics of jewelry design, but also limit the consumer groups' appreciation of the beauty of jewelry design.

This paper analyzes and designs the mechanism of the platform, and demands the research methods and theories of the platform, the environment and development tools of the platform development. Furthermore, the technical route and scheme of the platform were designed, and the three modules and their response modes were designed respectively. The design stage of jewelry craft CAD innovation design teaching is the key link of courseware development and the concrete presentation of design concepts. This part mainly includes courseware design ideas, courseware audio-visual effect design, and courseware interactive function design. The design thinking part is the overall framework design of the courseware design principles, structure and function; the courseware audio-visual effect design and the courseware interactive function design part are the specific means of expression under the overall framework design thinking. We explain the specific design separately through interface design, navigation design, color design, text design, picture design, sound design, video design, animation design, and interaction design of all levels of interface. Through the comprehensive and reasonable full application of digital technology, we strive to achieve reasonable courseware structure design, clear and concise content, convenient operation and use, and truly realize the combination of art and technology. This article introduces the operation test process of jewelry creative design teaching, tests it in the actual teaching environment, and evaluates the teaching effect.

2 SCHEME DESIGN OF CAD JEWELRY INNOVATION DESIGN TEACHING PLATFORM

2.1 Technical Route of CAD Jewelry Innovation Design Teaching Platform

A reasonable technical route can ensure the smooth realization of the set goals. The technical means used in this article is to consider the future expansibility of the system, using Delphi development language and SQL Server database to develop a network-based CAD jewelry innovation design teaching platform. The topological structure of the remote control in the local area network of the CAD jewelry innovation design teaching platform is shown in Figure 1.

2.2 The Structure and Function Design of CAD Jewelry Innovation Design Teaching Platform

The network-based CAD jewelry innovation design teaching platform selects the integrated development model and uses Delphi language for development. According to the business needs of the CAD network teaching platform and the technical characteristics of the CAD network teaching platform, the system adopts the C/S and B/S structure modes. The teacher computer is the master computer, and the server program is installed on it, while the student computer is the controlled computer and the server program is installed on it. We first run the Server program on the teacher's computer to obtain the user's IP address, then obtain the relevant information of the host running the client program from the network through the IP address, and finally send commands through various remote-control functions to computer program at the end. In this way, students and teachers can communicate through the network. The system is composed of teacher terminal, student terminal, manager terminal and platform system server. The teacher client uses the most mainstream terminal equipment and systems, which can reduce costs. Configure certain video capture devices, such as cameras, projectors, scanners, etc. Before teaching, registered teachers log in to the teacher client, upload the necessary courseware for teaching, and make full preparations for the teaching.

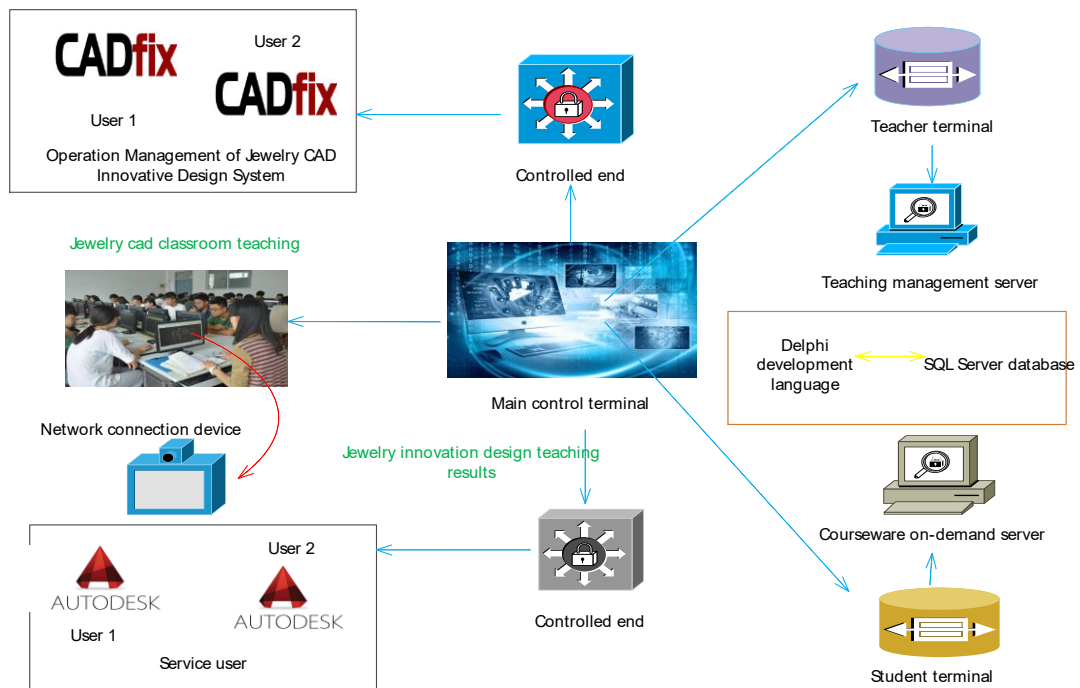


Figure 1: The remote-control topology diagram in the local area network of the CAD jewelry innovation design teaching platform.

At the same time, teachers submit their own teaching plan, and after approval, they can start teaching at a suitable time. When the lecture is in progress, the various videos, audios, courseware and other materials prepared by the teacher are shown to the students, and the students can also choose some content to learn independently with the courseware on-demand server. Teachers can use various interactive functions on the platform to carry out rich real-time teaching interactive activities, such as teacher-student dialogue, designate a certain student to ask him to answer certain questions, and discuss various questions with students on the forum to answer students.

The student client is equipped with a simple camera or scanning device to communicate with the teacher or pass their written things to the teacher. After registering, students can learn about the teaching information of each teacher at any time, enter the multimedia classroom they need, watch the teacher's live broadcast, and can ask the teacher questions in text or signal video and audio. Of course, they can also communicate with the teacher on the forum. The teacher discusses the problem. The content of the teacher's class is recorded. If some parts are not clear, you can re-watch the content of the teacher's class.

The administrator client manages the registration information, personal data, remarks, passwords, security, etc. of teachers and students, and approves the platform's information release and broadcasting.

2.3 Model Design of CAD Jewelry Innovation Design Teaching Platform

The main functions of the system can be divided into the following three modules: teacher function module, student function module, and administrator module. The teacher management module

can publish teaching articles on the system, manage students' lower-level teaching computers through student numbers, publish homework for students, upload courseware for students' reference, ask questions in class, answer student questions, and demonstrate CAD drawing operations online. The operating data is displayed to the upper computer of the student at the same time. After logging in to the system, students can read teaching materials online, and can ask questions online, share learning experiences, or answer questions raised by teachers.

The client display screens of students and teachers are displayed by reading XML files. When the teacher needs to control the student's lower computer screen, the teacher client issues a command to the background business process, the background business process is connected to the lower computer student business process, and the student business process receives the command, generates and displays the XML document and publishes it to the student visual layer, the student visual layer displays the teacher's operation on the student screen according to the data.

As long as the server is in the listening state, when the client makes a connection request, the server accepts the request and establishes a connection, and then the server port can be manipulated to connect to the client port. When the client control information arrives, the server responds, first accepts the client's control command and analyzes and processes the client's control command, and finally sends the processing result to the client through local variables.

If an application uses the TCP/IP protocol, it can only be used for point-to-point connections between the server and a single user. The system designed in this article is different. We combine the two technologies of shared data structure and multithreading on the basis of the Delphi environment, so that multiple users can connect to the server, and at the same time, the problem of exchanging information between multiple users has been solved.

Thread refers to a point of execution of a program during execution. Any program may have multiple threads running at a certain time during its execution. Threads are independent, they all have their own stack space, and they cannot access each other. But the resources, data codes, and address space used by all threads in the same process are the same. The process running takes up CPU time, and the threads in the process run by priority or time slice rotation. In the priority method, the thread priority is low, the amount of time is less, and the thread priority is high, the amount of time is more; while the time slice rotation method can ensure that each thread has the same amount of time. As for which method should be selected, it mainly depends on the real-time requirements of the program operation and the mechanism of the time regulator in the system.

Multi-threading technology can well support multi-user functions. This specific process is that the server receives an endless loop of connection requests from the client.

2.4 Design of CAD Teaching Microtasks

The micro-task is proposed to complete the overall task. Using the students' previous experience of learning other commands, the teacher guides the students to let them find the area command button by themselves. According to the naming rules of the commands they have learned in the past, you find the area command shortcut keys with the students. This part of the content teachers let students learn with the help of textbooks. The level of students must be uneven. Those with stronger self-learning ability can master the operation method, while those with lower receptive ability cannot. At this time, the teacher asks the students who have made it to demonstrate the operation method on the teacher computer. On the one hand, it can enhance the memory of the students in the meeting, and it can make the students who have not mastered it learn again and strive to master it. The advantage of finding students to operate is that it can concentrate students' attention more than teacher operations. The mode of micro-task-driven teaching method is shown in Figure 2.

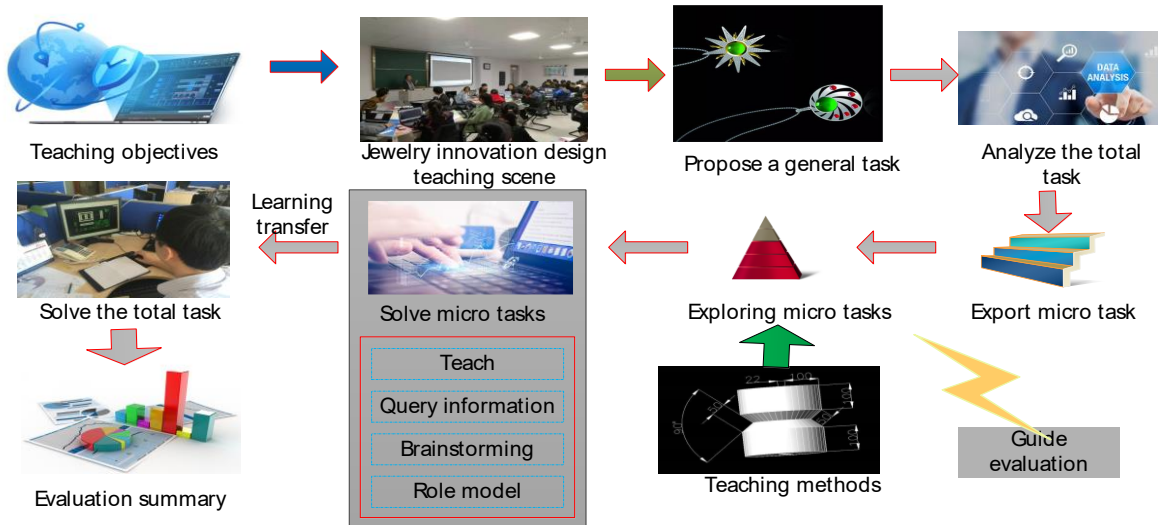


Figure 2: The model of jewelry CAD micro-task-driven teaching method.

The Boolean operation of the area is the most difficult point in the teaching of this lesson. Boolean operations mainly refer to the formation of graphics through the union, difference, and intersection operations of region objects. This part of the study requires students to master the shortcut keys corresponding to the three operations and their respective drawing methods. The teaching method mainly adopts physical teaching, with the aid of pre-prepared teaching aids-color cardboard, demonstrates the effect of the pictures after the intersection, union, and subtraction operations, to help students understand abstract concepts. After each knowledge point, students are asked to draw prescribed graphics. The course implementation process is shown in Figure 3.

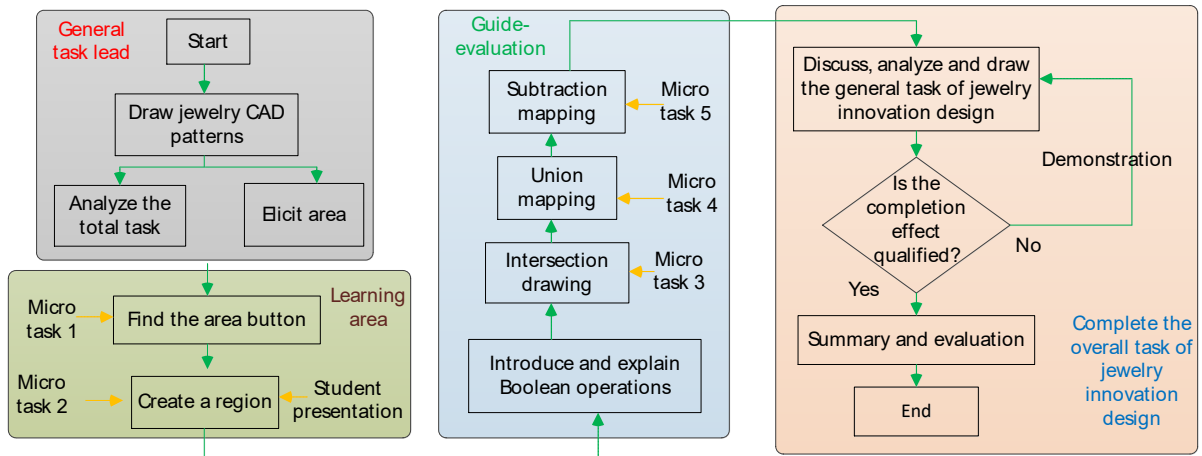


Figure 3: Flow chart of implementation of microtask-driven teaching method.

3 TESTING AND APPLICATION OF JEWELRY CRAFT CAD INNOVATION DESIGN TEACHING

3.1 Operational Test of Jewelry Craft CAD Innovation Design Teaching

The jewelry craft CAD innovation design teaching needs to go through many running tests after the production is completed. This is an important part of the courseware production, and it is also the last pass to ensure the quality of the courseware. In the production process, a large number of teaching contents are divided into different modules, and different software is used to produce them separately. These separately produced materials are finally imported into a software to be assembled and combined and then packaged for output. The final output executable file must be fully tested and evaluated. The test content includes whether the courseware runs smoothly, whether internal links are reasonable, whether the interaction design is convenient and practical, whether the overall effect achieves the original design purpose, etc. Only after a comprehensive test can the problem be discovered and solved specifically, and the design goal is finally achieved.

1) Test platform

The teaching of jewelry craft CAD innovation design is based on Director software as the realization platform. The executable .exe file output by the platform does not require high hardware requirements for the running computer. The computer can be installed with Win2010 or Win XP or above. The CPU is an Intel Pentium 4 or AMD Athlon 64 processor; the operating system is Windows 7; the memory is 2GB or higher; a separate 256MB graphics card is required, and the system must be installed with Quick Time (Windows version) for playback software. The computer with the above configuration can ensure the normal operation of the courseware. The higher the computer configuration, the faster the courseware will run. In order to verify the computer hardware and operating system requirements of this courseware, the finished courseware was tested on computers of different models and configurations. Figure 4 shows the visualization of the hardware test operating environment of 100 computers.

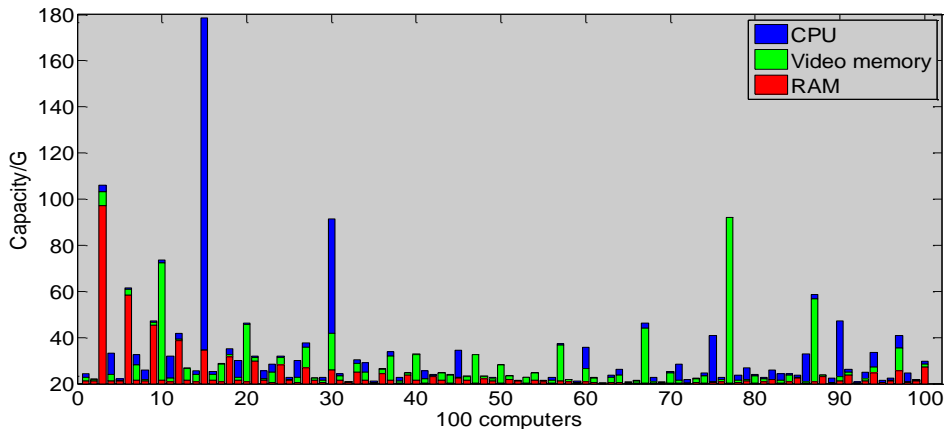


Figure 4: Visualization of the hardware environment of 100 computers.

2) Effect test

The running effect test evaluation includes the opening and closing of the courseware execution file, whether the interface layout arrangement is presented according to the design intent, the rationality of the navigation button settings in actual use, and the convenience of interactive control. After entering the main interface of the courseware, the process from the main interface to the sub-level interface is a progressive process from the list to the content. In actual use, the jump from the main interface to the lower-level interface is done by clicking the text

button. Through the operation and use of the various modules of the courseware, the interfaces at all levels can achieve the expected switching changes, in line with the original design intent. Figure 5 shows the effect of innovative jewelry design processing.



Figure 5: Treatment effect of jewelry innovation design.

The navigation system of the courseware adopts the form of classification link control, and the corresponding knowledge point modules correspond to the specific content of its subordinates. The navigation setting adopts two navigation directions: horizontal and multi-directional, and all text control buttons are distributed at the top and bottom of the screen. The image buttons are arranged on the right side of the screen, corresponding to the text buttons on the left. From the main interface to the lower-level interface in a linear way forward, you can click the corresponding picture on the screen to realize the forward progress from the upper-level interface to the lower-level interface by clicking the corresponding picture on the screen. The lower-level interface can return or jump to the upper-level interface by clicking the "return" button at the bottom of the screen or the text control button at the top of the screen with the mouse. The video navigation is set at the position below the video, which can realize the playback control of the video. Through the operation and use of the courseware navigation settings, the navigation direction of the interfaces at all levels is clear and conforms to the original design intent.

The interactive control of the courseware is actually hierarchical control according to the settings of the navigation system. The interactive control of each part of the courseware can be realized by clicking the text control buttons or picture buttons on all levels of the interface with the mouse, so as to realize the independent selection of text, picture and video browsing, teaching or learning. Among them, the equipment browsing section can realize the three-dimensional observation of the three-dimensional modeling process equipment by operating the mouse. Through the operation and use of the interactive control of the courseware, the interactive control of all levels of interface is basically smooth, in line with the original design intent.

3.2 Teaching Effect Test of Jewelry Craft CAD Innovation Design Teaching

After the completion of the courseware production, on the basis of self-testing, we apply it to actual classroom teaching for application testing to test its actual use performance and teaching effect, determine the actual value and effectiveness of the courseware.

1) Teachers' evaluation of CAD innovative design teaching

Through the actual use of courseware by teachers of this major, the overall design and reasonable interaction design of courseware for jewelry craft teaching content are fully affirmed. The traditional craft teaching methods have been beneficially expanded, with outstanding teaching characteristics, clear and rich content, and a large amount of information. Through the three

aspects of clear structured knowledge module design, simple navigation interface design, and easy-to-use interactive design, the original complicated course content becomes concise and clear, the teaching process becomes relaxed and lively, and it is easy for students to learn about the jewelry craft knowledge module. Absorption and digestion enable students to have an overall understanding and mastery of jewelry craftsmanship. It provides a useful pavement for students to enter the actual jewelry craft operation. The entire courseware embodies the full integration of teaching content design and digital technology, and is an innovation in the form of traditional craft teaching. The evaluation scores of 240 teachers on CAD innovative design teaching are shown in Figure 6.

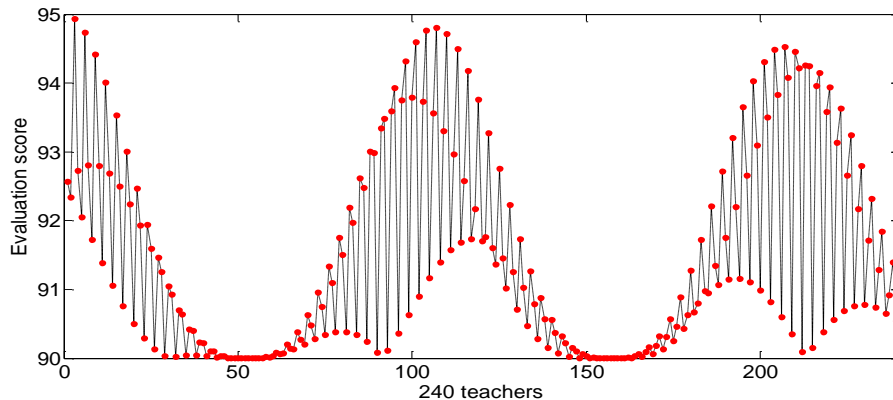


Figure 6: Teachers' evaluation scores of CAD innovation design teaching.

2) Students' evaluation of CAD innovation design teaching

After the courseware was made, three first-year classes of the major were organized (the students in this part are all students who have not yet entered the jewelry craft laboratory) to conduct a test on jewelry craft teaching. Three teachers teach the course to three classes in the traditional ppt format and the CAD innovative design teaching format. After the course is taught, students are asked to evaluate the teaching effect in terms of the novelty of the courseware, the structure of the courseware, the interface style, the fun and the interactivity. The specific evaluations of the students who took the test are as follows:

Students appraised that the CAD innovation design teaching is different from the traditional PPT teaching courseware. Its presentation is novel and unique. The teaching content of the whole courseware has a clear structure, a strong interface design style and features of the digital age. At the same time, students recognized the fun and interactive exercises of the courseware, and believed that the convenient and easy-to-use interactive design of the courseware helped them understand the course content, master it, and review after class. It can be seen that the students' evaluation affirmed the practical value of this courseware. Figure 7 shows the evaluation scores of 1,250 students on CAD innovative design teaching.

3) Whether the teaching of jewelry innovation design meets the design requirements

The combing and frame design of the teaching content of jewelry craftsmanship is one of the focuses of this article. The courseware selectively uses and arranges the various technical content, highlights the key points, and has clear levels to make it have practical value and typical teaching. It solves the single defect of the transmission of process knowledge in traditional process teaching.

Interface design and teaching content adopt concise and systematic principles. The combination of teaching content and interactive design mobilizes students' learning initiative and promotes the improvement of students' learning ability.

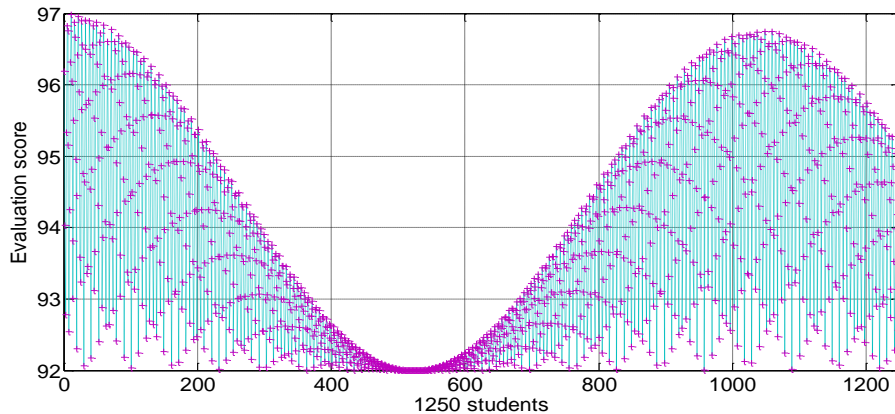


Figure 7: The evaluation scores of 1,250 students on the teaching of CAD innovation design.

The teaching of CAD innovative design is made by a variety of software. The interface design style is simple and the layout is reasonable. The comprehensive application of video, animation, sound, interaction and other elements enhances the technicality and rich audio-visual effects of the courseware.

The courseware navigation design is clear and reasonable. In operation, the function buttons work normally, the operation is convenient, and the use is simple, which solves the actual problems in teaching. The proportions of teaching content, teaching design, production technology, and operation application are shown in Figure 8.

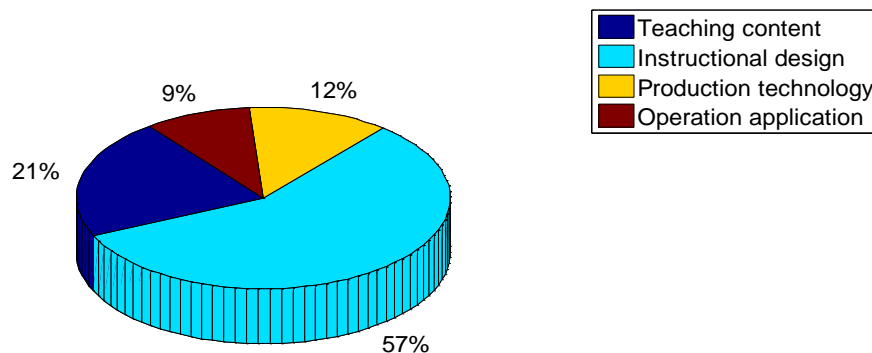


Figure 8: Proportion of teaching content, teaching design, production technology, and operation application.

4) The limitations of the teaching of innovative jewelry design

The overall effect of the courseware has been tested and adjusted to meet the design requirements. But there are two main problems with the courseware. One is due to the wide variety of courseware teaching content. Although the content design has been sorted out and summarized, due to the file size and space limitations of the courseware itself, the expansion and extension of each knowledge point module can only be done with points. It is difficult to cover everything. The second is that in the interactive design of courseware, due to the limitations of the author's grasp of the software platform used, the interaction method is relatively simple, and it is awaited in the future teaching process. Applying digital technology to modern teaching is a

meticulous, complex, and highly technical work. In this process, we strive to achieve a high degree of unity between technology and art.

4 CONCLUSION

In order to enhance the interactivity in the teaching process, we realize the collaboration in the learning process, enhance the openness of the teaching system, and solve the asynchrony in the teaching process. Applying the network to CAD jewelry innovation design teaching will greatly promote the development of jewelry innovation education. Through the application of digital technology, the overall development of jewelry craft CAD innovation design teaching has been completed. Based on the application of digital technology, various media materials related to jewelry craftsmanship are integrated into a courseware system in a systematic and modular way, which makes the teaching process of jewelry crafts break through the traditional teaching method. Through testing and application, the teaching quality of the jewelry craft course has been further improved, and the goal of applying digital technology to optimize the teaching effect has been achieved. Combining the teaching goals and teaching needs of jewelry craftsmanship, starting from the educational, scientific, artistic and technical aspects, the CAD innovative design teaching has been innovatively designed. The main teaching content of the jewelry craft course is expressed with reasonable digital technology, including the digital design of the structure design of the teaching content and the way of expression. This article mainly includes teaching content modules, courseware structure, interface style, interactive design and other aspects, thus realizing the combination of science and art. This courseware promotes the renewal of teaching methods of jewelry crafts courses, and is an exploration and breakthrough in the construction of digital course materials. The results can be used for remote network teaching to achieve the purpose of resource sharing.

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