Application of Computer Aided Design Software in Interior Design

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Abstract. The core course of interior design major is the course of computer-aided design. Through the characteristics, goals and existing problems of the computer-assisted course of interior design, this paper also overcomes the improvement development trend and mode of this course to achieve the high quality of design and the employment problems of students, reflecting the perfect integration of engineering and learning. Design concept, to achieve the unity of professional needs and industry standards, the coordination of learning and employment, the consistency of design content and work goals.

Keywords: Interior Design, Computer-aided Design, Design Reform, Decoration

1. Introduction

At present, the method of computer-aided design mainly gives detailed design according to conceptual design. Industrial designers describe the appearance of products through drawings or models [1-2]. Traditional computer-aided design systems, such as Autodesk's Auto-CAD, can assist designers to complete the depiction of product shapes [3-4]. But the conceptual design depends to a large extent on the designer's experience and design inspiration. Existing computational aided modeling tools can assist designers in constructing models, but our research is to propose an interactive design method to assist designers in better conceptual design [5-6].

This course selects the design content based on the core skill requirements of the decorative design industry design and management first-line job groups and interior decorators, interior architects, rendering designers and other professional posts, and develops curriculum standards based on job standards to simulate job jobs. The process implements the design process. The design mainly adopts the method of project simulation and actual combat. The project simulation design operation drives the mastery of software knowledge, and the design is carried out around the advanced operation technology and job tasks of the design industry.

2. Computer aided design software

In this research, the individual design plan is initially composed of a set of graphic elements, which are stored in the 3D model library. However, the computer software system should automatically consider some factors that affect the structure of the design results. For example, it is necessary to assign a low-cost objective function to an incoherent object to ensure the reproduction of coherent
objects. All the goals form the external environment in which the design plan evolves. We define constraints in the "control file", such as the size of the object and its primitives, the number of primitives contained in each object, and so on. After setting the evolution environment and initial restrictions, users only need to assign fitness to each new generation. However, some restricted conditions of regeneration, such as the possibility of mutation and the type of crossover (the way the parent gene is combined during regeneration), will change during the evolution process. For example, some useful features are evolved through generations, reducing the possibility of mutation, and the chance of losing these useful features is also reduced. This article focuses on the new developments in the application of genetic algorithms in computer-aided design systems.

We build a database for primitives, each of which is a 3D model. First, a number of graphic elements are combined to form individual design schemes. For example, the first 3 graphic elements are combined to generate the first individual, the next 3 graphic elements are combined to generate the second individual, and so on, 30 graphic elements are needed to generate 10 individuals. These individuals will be displayed on the computer screen, and the designer will evaluate and assign fitness to each individual. Then, the system regenerates the population according to the principle of being proportional to fitness, and uses crossover and mutation in the process of regenerating offspring. The results of each generation will be displayed in 3D graphics. This process will produce more and more adaptable design schemes that are more popular among designers. The whole design process is shown in Figure 1.

![Diagram](image)

**Figure 1.** The design process.

The way of data storage is the key to achieving genetic manipulation. Define geometric primitives and the chromosomes that interact with surrounding primitives, consisting of 5 genes, 9 gene positions in total (Table 1).

| Gene   | Gene locus | Numerical range of gene locus | Phenotype                      |
|--------|------------|-------------------------------|--------------------------------|
| Types  | 1          | 0–9                           | Block, cylinder, cone, sphere, etc. |
| Sign   | 1          | 0–2                           | "Create", "Add", "Subtract"     |
| Direction | 3      | -1–1                          | x,y,z points                    |
| Size   | 3          | 0.01–1                        | Length, width, height           |
| Colour | 1          | 0–9                           | Red, blue, yellow, etc.         |

Several graphic elements together constitute an individual design plan, and what controls the interaction of a graphic element with other graphic elements is the "sign" chromosome. A "created" primitive can be displayed, but it is not connected to other primitives. The first primitive is always the "create" primitive. An "additive" primitive is combined with the primitives it can touch. A "minus" primitive is to be removed from the primitive group. Therefore, what kind of design gets depends to a large extent on the order in which the primitives are introduced.

Each graphic element is represented by the five genes mentioned above, and the geometric shape of a graphic element is generated after decoding. In biology, genotype interacts with evolutionary
environment to form phenotype. In this study, the phenotype is the geometric shape of a primitive. Then, several graphic elements are combined to form individual design schemes. The same fitness function is applied to the graphic element and the individual design plan. The process of image element combination is the combination of chromosomes. When displaying an individual, the information is read according to the gene position in the chromosome. Therefore, it can be guaranteed that observable genetic information appears in the offspring, and the tendency and way of evolution can also be analyzed. Figure 2 illustrates the method of combining image elements and chromosomes. The reason why this example can be combined into a wine glass is controlled by the "direction" gene.

Figure 2. Interior design assistance process.

The genetic data of design individuals and graphic elements are stored in the same way. That is to say, in Figure 3, a chromosome with 9 gene positions is used to represent a picture element, and 3 picture elements form an individual, then a chromosome with 27 bits is used to represent an individual. Under this method, the entire design scheme is phenotype. This method has obvious advantages: it makes the whole system more concise conceptually, and allows direct comparison between parent and child. We can change the size of the variability in the evolution process by changing the mutation probability, crossover type and other variables, so as to meet the needs.

3. Countermeasures for the reform of indoor computer-aided design courses

3.1. Revise the design plan and rationally plan the curriculum
In the past, courses were offered in the second semester of the first grade or the first semester of the second grade, with class hours ranging from 48 to 64 periods. It is very difficult to fully master the content and skills of the course in such a short time. Moreover, as students continue to improve their ability to master knowledge, their understanding and needs for computer-aided design will change. According to this situation, we have revised the design plan of the computer-aided design course. The course involves three semesters. The courses are taught in semesters according to the progressive relationship of knowledge and skills. The new model is organized according to the three-stage pre-employment design and implemented with the company. Design process outsourcing and other methods of cooperative design.

3.2. Build a modular curriculum system and implement a project-based design plan
The computer-aided design course is rich in content and has many knowledge points. The 3DSMAX design software is mainly used to express the three-dimensional scene effect, and it is also integrated into AUTOCAD, PHOTOSHOP and other design software. The early stage of the course focuses on the operation method of the software, the teaching plan is arranged according to the order of the chapters of the textbook, and the design content is made according to the content of the textbook. Students cannot systematically master the design process. According to the needs of the job and the actual project operation, and integrating the knowledge, skills and attitude requirements of the relevant
professional qualification certificates, we now introduce the real design project into the curriculum design and subdivide it into multiple sub-projects. Each sub-project is a small work flow, from shallow to deep, step by step, mastering the rendering method of indoor 3D scene renderings in completing tasks. The whole project can link up the theoretical knowledge and practical skills of 3DSMAX, CAD, PHOTOSHOP, and highlight the training of students' professional competence in vivid and interesting. After mastering the complete work process, the students' comprehensive competence is strengthened in the form of reports, comments, and calibration.

3.3. Development of "workbook"-style teaching materials
At present, there are a dazzling array of teaching materials and reference books for computer-aided design, but it is difficult to find a teaching material that is completely suitable for design, especially for project design. In view of this situation, we are professionally rooted in the development of the industry, cooperate with well-known decoration design companies, refer to the latest international teaching materials to compile design models, and develop a batch of three-dimensional teaching materials that closely integrate the actual production and reflect the latest technological achievements and real production processes. The textbooks related to computer-aided design have been practiced and have outstanding effects, mainly with the following characteristics:

(1) The theoretical part of the content of the textbook should be concise, concise and easy to understand, covering the knowledge required by the corresponding professional qualification standards;

(2) The productive training part is connected with the corresponding vocational qualification standard skill training, prepared with reference to the actual work process and typical project cases, with training steps, technical indicators, assessment and evaluation standards, etc.;

(3) The combination of graphics and text is professional, practical, and maneuverable. It can be adopted by the front line of enterprises as a "work manual" and become industry technical standards or vocational skills training materials.

3.4. Adopt a variety of design methods and means
According to the training objectives of the course, in order to cultivate applied talents that meet the needs of the market, this course adopts a variety of design methods. Through project design, task-driven, competition and other design methods, students' comprehensive knowledge, application skills and professional qualities are effectively improved. Reflected in:

(1) Task-driven design method for embedded projects. There are many knowledge points in this course. If you study according to the knowledge system, students often cannot connect the knowledge they have learned to complete the actual design. For this reason, we carefully selected cases that can cover the knowledge points of the course and are extracted from the actual projects of the enterprise and introduced them into the design. Through the process of "propose tasks → analyze tasks → complete tasks → learn while doing → summary", the design style of interactive innovation, promotion of individuality, application and collaboration is reflected. With the gradual deepening of the case, the students not only exercised their skills, but also unknowingly consolidate their theoretical knowledge, and truly apply what they have learned.

(2) A competitive design method that simulates professional positions. In the project case design process, competition-style design methods are also introduced to promote the overall improvement of students. In addition to the need for students to master the work process, operating methods, and design skills, the computer-aided design course is more important to strengthen the high quality and efficiency of student drawing to meet the needs of the design industry under the market economy. In each project, a certain small competition is set up in the course to sum up experience, exchange experience and innovate methods through the competition. The competitive design method effectively taps students' potential for active learning, effectively stimulates students' enthusiasm for independent learning, exercises their acumen and agility, and cultivates a sense of collectivism and a sense of interaction of unity and cooperation.
(3) Use modern educational technology. In the design process of this course, the key points and difficulties are demonstrated through multimedia courseware, video recording and other means to help students learn theories and master practical skills. These design methods not only provide students with high-speed and high-capacity information resources, but also increase the attractiveness and appeal of the design with its dynamic scenes combining sound, shape, sound, and painting, and huge virtual design functions. Students create an environment that can fully mobilize learning interests and activate creative thinking.

(4) Establish an interactive learning website to enrich design resources and improve design quality. The curriculum has a moodle interactive network design platform, which teachers use for classroom design, homework correction, and extracurricular Q&A guidance. Students use this platform outside class to personally study the content of the course units, online questions, discussions, homework, and tests. Through the network design platform, synchronous or asynchronous interaction between teachers and students, students and students can be carried out, which stimulates the collaboration and participation of students in learning, and helps learners to solve the problems encountered in learning in time.

Practice has proved that the rich design methods and means stimulate students' interest in learning and make teaching and learning easy and enjoyable. Teachers mainly play a guiding role in design. Students learn from real cases and projects to understand the development of the industry, master the first-line design skills of the enterprise, and learn from passive to active. The harmonious interaction of teaching and learning creates a new classroom surroundings.

3.5. Innovate the school-enterprise cooperative design organization form to meet the requirements of the combination of work and study

School-enterprise cooperation is the most discussed topic in recent years. This major has also been actively promoting school-enterprise cooperation and has signed cooperation agreements with many companies. When the school and the enterprise cooperate to a certain degree, various problems are prone to occur. Both parties hope to find a new way to cooperate. This course has found an innovative design organization form in the cooperative design process.

(1) Mini order education. It means that students strengthen specific professional skills through pre-employment in "school-based enterprises" or enterprises. Nowadays, the number of large-scale enterprises in the decoration industry is gradually decreasing, the number of specialized and characteristic enterprises is gradually increasing, the number of job segments is increasing, and the difference in core professional skills required to be mastered by the job is increasing. Therefore, the number of talents required for each position will not be large, and a specialization direction micro-order cooperation training method has emerged. Computer-aided design is a course that trains students to independently draw 3D scene renderings. Mastering this course can provide necessary skills for various design positions and can also achieve employment independently. The company selects several outstanding students to strengthen training through micro-orders, so that they can better master unique professional skills to be competent for specific positions, and have a good job promotion and migration ability.

(2) Design process outsourcing. Introduce industry backbone enterprises or growth-oriented enterprises to invest in the establishment of "school-based enterprises" in the school, establish studios, and realize enterprises in the form of "design process outsourcing", implement design training and realize cooperative employment. Students, enterprises, and schools achieve a win-win situation, thereby establishing a long-term school-enterprise cooperation mechanism. In the process of process outsourcing, through the introduction of actual work projects of the enterprise, the students are organized into multiple project teams to simulate the actual work process. Under the guidance of the company's part-time teachers and class teachers, the project team members collaborate to complete the project, and cultivate students' collaborative cooperation Ability and comprehensive skills in analyzing and solving practical problems have strengthened students' resilience to market demands and improved their job skills and professional quality capabilities.
3.6. Sharing of human resources, improving the overall quality of the design team
Through the establishment of enterprise teacher workstations and enterprise backbones serving as part-time teachers, we have realized the exchange of staff positions. While improving the quality of teachers, we also build a stable high-quality part-time teacher resource bank.

1) Select key teachers as academic mentors, and hire industry technical experts as corporate mentors. Use the rich experience and experience of the tutor to help students make academic plans and cultivate good study habits and methods. And use the "pass, help, and lead" method to teach students to gain work experience and improve professional skills.

2) In the design process, corporate mentors are allowed to participate in professional planning, curriculum construction, design reforms, and textbook revisions throughout the entire process, making professional development more forward-looking and curriculum construction closer to market needs.

3) In the design process, let academic tutors and corporate tutors discuss design methods, learn new technologies and new processes, learn from each other and exchanges, learn from each other and improve together.

4) Provide high-quality design management and technical support at each stage of students' learning, so that students can master knowledge and skills in stages and levels, and strive to achieve the goal of training talents in their profession.

3.7. Strengthen design quality monitoring and break through traditional assessment methods
We set up a design supervision group, a practical design working group, a quality education working group and other working institutions to evaluate and feedback on the design content, and monitor the design process throughout the design process; guide young teachers and part-time teachers on design methods; manage design work Put forward reasonable suggestions; monitor the production training at each stage, the pre-employment situation at each stage, and the internship at each stage, and form a teaching evaluation mechanism combining qualitative and quantitative evaluation to promote the improvement of design quality. Break through the traditional assessment plan, emphasize the assessment of the learning process, let the corporate mentors participate in the evaluation and scoring, and provide timely feedback. Encourage students to use their hands and brains, use creativity and tools to achieve the desired results, and at the same time fully assess the students' comprehensive ability.

4. Conclusion
Computer-aided design for the interior design major of higher vocational colleges is a course that needs continuous reform and continuous innovation. In order to be in line with the market and be at the forefront, we need to constantly adjust the design plan, update the design content, strengthen the school-enterprise cooperation method, and coordinate the relationship with other design courses. It is necessary to continuously inspire students' thinking, cultivate their ability to research, analyze and solve problems, enhance their competitiveness in the future interior design industry, and promote the improvement of the overall level of design.

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