Application Analysis of Computer Graphics and Image Aided Design in Art Design Teaching

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Abstract. Computer graphics aided art design is a model created by digital methods and concepts. How to integrate existing network teaching resources to build a computer graphics and image-assisted art teaching platform in the new environment will directly affect the teaching quality of computer graphics and image-assisted digital art courses with digital content innovation as the core. On the basis of summarizing the general design methods of art products, this article applies the method of modular decomposition to realize the art design process on the computer. We discuss the use of computer modern design methods to build a computer-aided design platform system in the process of computer graphics and image-aided art design. Research is helpful to promote digital computer graphics and image-assisted art design teaching concepts and digital teaching methods and training methods, and provides theoretical basis and practical test results for the improvement of computer graphics and image-aided art design teaching. The use of digital means to establish perceptual interactive teaching methods can realize the intuitive teaching of spatial form theory, and the use of digital design experience methods can cultivate students' modeling ability and judgment beauty.

Keywords: art design; computer-aided design; graphics and images; design teaching.
DOI: https://doi.org/10.14733/cadaps.2021.S4.13-24

1 INTRODUCTION

Computer graphics and image-assisted digital art design is a subject under the conditions of the high integration of art and technology, natural science and art science [1]. According to its characteristics, computer graphics and image-assisted digital art design education can be divided into computer graphics technology education and art education. In a broad sense, computer

graphics and image-assisted digital art is digital art. In a narrow sense, computer graphics and image-assisted digital art generally refers to the use of computers to process or produce art-related designs, animations, audio-visual or other works of art [2]. Due to the influence of modern digital information technology, the field of design is constantly expanding. Accordingly, the field of design education has also undergone a change from quantity to quality, which has risen to a whole new level [3]. Art is constantly developing towards science, and science is gradually changing. Whether as an activity or skill, "art design education" has undergone a comprehensive and profound change in the digital age [4]. This change has had a strong impact on traditional art design teaching models and concepts. Traditional artistic concepts, rigid theoretical knowledge, and backward teaching methods are bound to be gradually eliminated and replaced in the competition with "digitalization".

Computer graphics and image-assisted digital art design education is an educational research direction that has emerged with the popularization of digitization in the field of art design education [5]. Computer graphics and image-assisted digital art design education aims to cultivate the use of digital media elements such as images, sounds, and digital graphics and images for artistic design. To enable students to combine the new concept of art design with digital technology, they use digital media technology and integrate multiple media expressions to explore and research digital media art design. Liu et al. pointed out that this can train students to have a solid theoretical foundation and good academic literacy in the subject of digital media art design, so as to adapt to the demand for art design talents in the digital information society [6]. Kok and Bayaga believe that the characteristics of particularity, complexity and interdisciplinary nature have brought new challenges to normal teaching management, especially new challenges and requirements for the traditional school-running model [7]. For this emerging education field, art and design education practitioners all over the world are full of passion and expectation, and have devoted themselves to the theoretical research of computer graphics and image-assisted digital art design education. At present, foreign countries are in a leading position in the design and development of teaching management software, both in terms of development methods and software utilization rates. Otey et al. pointed out that European developed countries have achieved very good results in computer graphics and image-assisted digital art design education [8]. They take computer graphics and image-assisted digital art design as the focus of art design professional education, set up new disciplines such as game design, digital communication and digital image special effects, and cultivated a group of high-quality comprehensive computer graphics and image aids. Sung et al. said that the exposure of some shortcomings of information technology and network teaching in art design education and teaching has caused some teachers in art and design colleges to even feel resistance [9]. For example, students rely too much on the computer in the design process, using computer software to piece together the existing graphics in a frame that conforms to the general rules to complete a well-regulated but not individual design work. The back of these works is original. The time that students spend on computer effects in designing works greatly exceeds the time to conceive a design plan, which severely stifles the fleeting design inspiration in the process of designing the plan. It is not an isolated phenomenon that computer operation training replaces modeling ability training. In addition, in online teaching, teachers cannot directly communicate with students face-to-face, lacking interpersonal influence; online teaching has higher requirements for students' conscious and active learning, without the strict requirements of teachers. Some students with poor self-consciousness are used to passive learning, which is difficult to obtain good learning effect. Ng and Chan believe that the development of network technology has provided a new way of teaching and changed the traditional teaching mode [10]. The curriculum is highly valued by universities around the world, and countries all over the world are actively carrying out this work. Mahdi et al. point out that the construction of multimedia network courses makes full use of modern educational technology to promote teaching activities [11]. It uses network teaching methods flexibly, integrates a large number of resources, uploads courses to the Internet, and shares resources, which provides a broad space for students to learn by themselves.

Parametric drawing can be realized through the graphics module. For the development of graphics modules, secondary development technology of high-level language and professional drawing software can be used, and the function call of professional drawing software by high-level language can be used to realize the generation of powerful graphics drawing. In addition, some professional drawing software has very powerful functions. You can use the secondary development language module UG/Open GRIP provided by UG for secondary development of UG. For small professional software, designers can also consider programming their own drawing programs. However, the designer must be familiar with the content of computer graphics. In addition, as modern professional software has become more and more powerful and provides an interface for secondary development of high-level languages, the graphics program compiled by the designer has limited functions. The development of modern CAD generally adopts the secondary development technology of high-level language and professional drawing software. This article takes the digital design creation method as the guide. This enables students to observe themselves in the visualized perceptual experience, and regroups the record of the path of spiritual generation through digital technology, so that students can personally experience and recognize the abstract reality theory of meaning in creation. For the development process of design thinking and the process of design logic, the quantitative changes in the processing of visual elements have contributed to the accumulation of design experience and the qualitative change of design capabilities.

2 ANALYSIS OF COMPUTER GRAPHICS AND IMAGE AIDED DESIGN TECHNOLOGY

2.1 Graphic Analysis and Graphic Processing

The purpose of graphic analysis is to understand what are the geometric elements that construct the graphic. The contours of electromechanical parts graphics are generally composed of geometric elements such as straight lines, arcs, circles; some graphics are made up of several basic graphics, and there are certain relationships between parts of some graphics. After analyzing the characteristics of the graphics, you can make different treatments according to different graphics.

When compiling a drawing program, it is generally necessary to perform mathematical processing of graphics, that is, to construct mathematical models of graphics. You use mathematical formulas to describe graphs, the purpose is to make graphs truly reflect the numerical relationship between quantity and quantity, which is very useful for programming. The graphics processing part generally includes basic graphics processing, transformation graphics processing, geometric intersection graphics processing, parameterized graphics processing and geometric mosaic graphics processing. The processing of basic graphics includes the representation method of straight lines on the plane and the representation method of circles.

The processing of transforming graphics is to transform graphics into new graphics by translation, rotation, reduction, enlargement, etc., which is mainly achieved by applying geometric transformation methods, which are often achieved by changing coordinates. Of course, for point sets of more complex shapes, it is often very cumbersome if geometric transformation methods are used. If matrix transformation is used, the problem will become simple. Therefore, for the processing of graphics, appropriate processing methods should be selected according to different situations in the design to complete the processing task of transforming graphics.

The main function of geometric intersection processing is to find the coordinate value of the intersection point. For the connection point in the graph, in addition to directly determining the coordinate value, it is usually done by geometric analysis using the known dimensions in the graph, and the connection is calculated by the mathematical relationship.

Due to the "three transformations" of commonly used parts, the shapes of the graphics are similar, only the size changes, and often only a few main parameters are given to determine the size of other parts. For this kind of graphics, it is very convenient to use computer graphics. These

standard graphics are compiled into general parameterized drawing subroutines. When calling, only certain parameters are needed to automatically draw the required graphics. The integrated diagram of the computer aided design platform is shown in Figure 1.

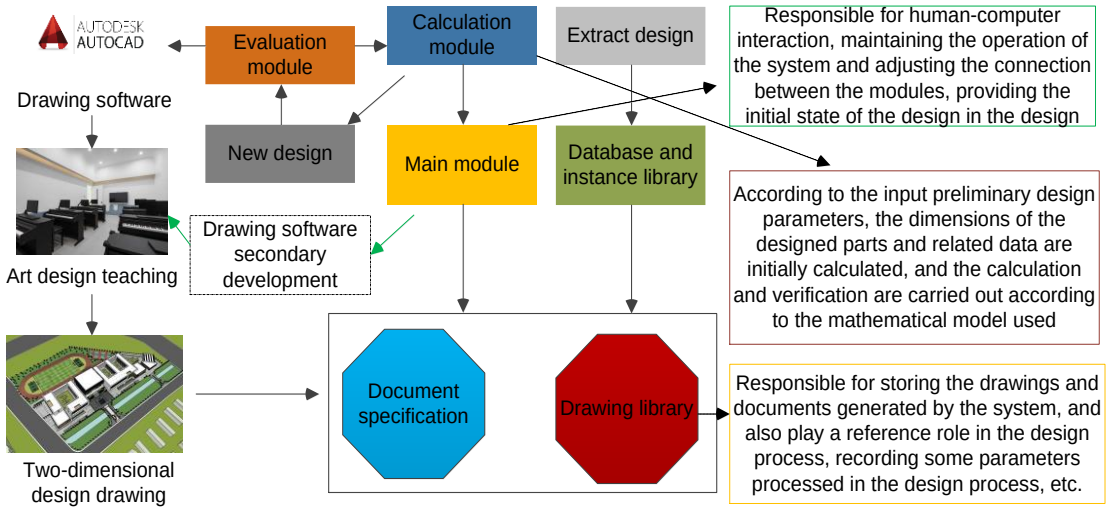

Figure 1: Computer-aided design platform integration diagram.

2.2 Secondary Development of Professional Drawing Software

The Auto CAD system provides many kinds of interface methods, such as SCR files, DXF files, DXB files, as well as development tools such as Lisp and C language. Through the interface, the running result of the high-level programming language program can be sent to the graphics module and converted into graphics; on the contrary, the graphics module can also convert the graphics into data files and return the high-level language program through the interface.

(1) SCR interface mode

SCR is a collection of a series of commands, options, and data, compiled into a command group file, which is an ASCII code file that can be generated by a high-level language. The user can choose a high-level language as the main language, and expand a series of procedure calls in this language to generate SCR files. Auto CAD reads this group of commands from it, performs them one by one in batch mode, and generates corresponding graphics.

SCR files are an important graphical interface. No matter which method is used to make SCR files, you must be familiar with Auto CAD commands, system prompts and response methods; secondly, you pay attention to the specific role of spaces and carriage returns in SCR. When using high-level language programs to automatically generate, you also pay attention to the output format of some high-level language programs. The SCR file is simple and easy to create. It can directly call all the entity commands, editing commands and auxiliary drawing commands of Auto CAD, giving full play to the powerful drawing and graphic editing functions of Auto CAD. However, because the SCR file is a process file and runs slowly, it can only generate graphics through a combination of commands, and cannot modify the existing graphics database. Therefore, SCR and DXF are generally used in combination.

(2) DXF interface method

The DXF format file is a graphics exchange file, which is an ASCII code file with a special format. The interface mode is shown in Figure 2. The DXF file is an intermediate interface file. On the one hand, the DXFOUT command is used to convert the internal database format (.DWG) of the Auto CAD graphic file into a .DXF file format for reading by high-level language programs; on

the other hand, the high-level language is directly generated by writing sentences according to the structure and format of the .DXF file. The former is convenient and intuitive, but more cumbersome, it is not conducive to maintenance and expansion of the software; the latter belongs to the category of software secondary development and has a certain workload. It can easily generate DXF and has good reusability.

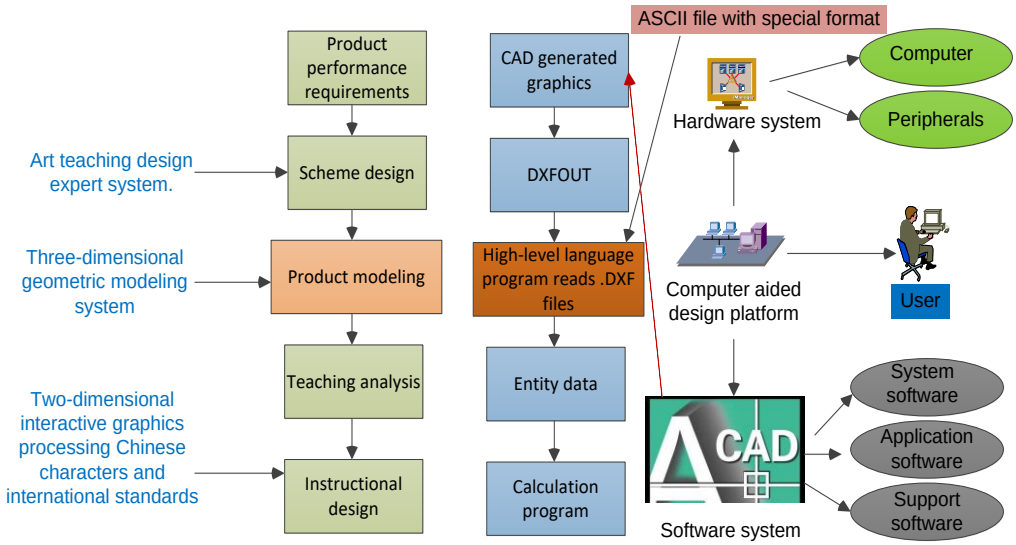

Figure 2: DXF interface analysis,

(3) Auto Lisp language interface mode

Auto Lisp language is an editing language with computer-aided features embedded in Auto CAD, and it is also an important tool for developing and applying Auto CAD. The Auto Lisp language includes multiple functions of the Lisp programming language, makes up for other shortcomings besides the powerful graphics editing functions of Auto CAD, expands the functions of Auto CAD, and expands its application range. Auto Lisp can directly generate graphics or modify the graphics database, realize data exchange through read-write functions and high-level languages, can automatically generate .SCR interface files, and easily implement animation technology.

The Auto Lisp language is a very powerful interface method. There are many similarities with the DXF interface method. In addition, some are not available in DXF. Auto Lisp is easy to learn, flexible and convenient. However, its running speed is about five times slower than that of DXF files, its computing power is poor, and the operation and processing information is generally not as much as DXF.

2.3 Diagram Document Module

The graph document module mainly includes graph library and document library, which is responsible for storing the existing or generated graphs and description documents of the system. In order to achieve output automation, it is necessary to customize the initialization environment of the drawing and document module and control the graphics and document format through a high-level language, so as to facilitate the designer to customize drawings and documents that meet the standards.

In actual CAD operations, a large number of engineering drawings are often drawn, which requires the establishment of a graphics library. The graphics library is generally established by graphics processing software, and the drawing environment is initialized through the secondary development of the drawing software through a high-level language, and the format of the engineering drawings is customized. It is best to create a separate subdirectory for the graphics library to store existing and generated graphics. The establishment of the graphics library is relatively simple. However, in the operation, when a large number of engineering drawings have to be drawn, a large amount of engineering design data must be accessed and managed. At this time, an effective connection between the database and the graphics library is required. In particular, it is a key problem how to quickly call and view the corresponding graphics from the graphics library while consulting the data in a large number of databases.

The main function of the document library is to automatically generate design specifications and other description documents. The basic idea is to provide designers with a relatively complete document template. Most of the data and related design information in the design process are stored and recorded, and instructions such as instructions are automatically generated. If there are special requirements and regulations on the format of the document, it can be adjusted manually in the follow-up work. The computer graphics and image aided art design process is shown in Figure 3.

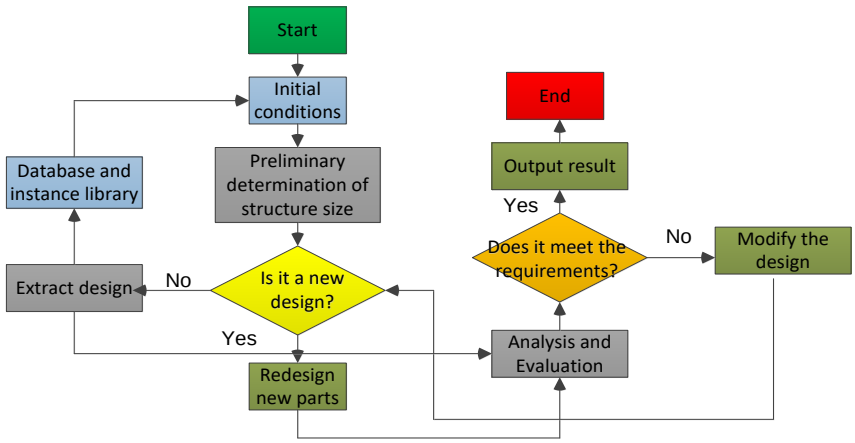

Figure 3: Computer graphics assisted art design process.

Word is currently widely used word processing software. In CAD operations, you often encounter the need to save the design results in a document. Using some related technologies to automatically save the results can make the program more versatile. This involves the automatic generation of documentation. The general solution is to use OLE technology, which can make the program more powerful. OLE technology makes compound documents possible. For example, you can insert various objects such as BMP images, Excel worksheets and Excel charts in Word to facilitate user design jobs.

3 EXPERIMENTAL ANALYSIS OF ART DESIGN TEACHING

3.1 Quantification of the Results of Digitized Thinking Training

Computer graphics and image-aided art design is a process of thinking activities, and thinking training is a very important part in the teaching of computer graphics and image-aided art design. Thinking training needs to solve: what is design, what problems should be solved by design, how the design is developed, and what is the logic of the design. And these contents are not only

completely abstract, but also require personal experience to understand and feel. Numerical techniques provide a broad platform for mental training at different stages, as well as digital training techniques for new concepts. The digital training method is also the digital design method for students to enter the design creation in the future. Entering this platform, a strong visual experience can arouse the students' curious mind, and the process of exploring and discovering independently can arouse the students' thirst for knowledge, which is the best state for entering the learning habit.

Visualization is one of the most impactful sensory experiences that digital technology brings us. Multi-sensory stimulation also brings about changes in perception and aesthetic appreciation. A large number of abstract forms that cannot exist, cannot be seen, or cannot be established in the real world have been created by computers, forming new combination relationships. The abstract performance of computer design software in the virtual environment is infinitely rich. These abstract forms exist beyond the experience and concepts of the real world, but they stimulate a certain emotional experience of people with the real and rich texture. Experience the similarity between people can resonate, which leads to understanding. Computer graphics and image-assisted edge extraction is achieved by relying on the quantification of the results of visualization and digitalization, as shown in Figure 4.

(a) Original image (b) Processed gray image (c) Extracted edge

Figure 4: Edge extraction of computer graphics and image aided design.

The thinking training of the form of space is also based on the platform of numbers that can truly walk into the space, combining and comparing the "space" with different elements, and completing the cognition of the space in the process of continuous observation and discovery. In Autodesk and 3 ds Max, elements of different or the same form are constructed according to a certain training theme, which can be combined with space at will, and various attributes can be given to the elements: color, material, texture, light effect, etc., and items can also be adjusted for different numerical parameters, and can be rendered from multiple angles to present completely different effects. And this process is completely unrestricted and is carried out by the students themselves. Everyone's creative potential can be stimulated through the observation and discovery of elements, combinations, and attributes in the process of human-computer interaction in the virtual space.

The visual processing ability of the digital design method is also reflected in the acquisition of creative inspiration. An element can have multiple development directions and evolutionary results, and has acquired a wealth of spirituality and a large number of creative results before feeling dull, and can achieve a large amount of processing power. The combination of a large number of elements and multiple elements can easily realize the quantification of virtual results. The quantification of virtual results is to provide multiple creative sources and more directional choices for in-depth design. This process is based on the exploration and discovery process of the digital platform, using a discovery vision and a multi-dimensional perspective to observe, search, dialogue, and discover. The spiral observation method is the basis for all discoveries. This is a

change in method and a change in concept. Observation cannot be a two-dimensional sketch, nor can it be a camera-framed picture. Observing from a single angle, the result can only be one-sided, and cannot reflect the true state. Only by observing with a multidimensional perspective and a multidimensional perspective can we break through the imprisonment of inherent thinking and truly have the ability to discover the world. This is the source of creativity and the beginning of creation. The image segmentation of computer graphics aided art design is shown in Figure 5.

(a) Original image (b) Gray image (c) The effect of segmentation

Figure 5: Image segmentation of computer graphics assisted art design.

The digital platform has greatly freed up people's thoughts. Through a large number of digital creations, uninterrupted inspirations appear and are injected into the design, and the inspirations are constantly produced. The quantitative change of the virtual result directly changes the design result.

3.2 Record of Design Path

In the early stages of visual perception training, a large number of visual elements can be constructed with the help of digital design methods, and the combination of space and elements can be continuously discovered and explored. The moment the inspiration stays is very short, and the interference of other information will make it disappear very quickly. When the traditional methods such as writing and shorthand have not yet had time to record the time, it has been replaced by a new sense. However, thinking training is a platform based on numbers. Digital technology can completely record the design path. The thinking process is preserved in its entirety. Not only can it be reversed, but it can also be compared.

The sparks generated at each stage of thinking training are very important. The excitement point represents the point of insight or a turning point in a certain stage of the thinking process. With the deepening of thinking, this series of logical excitement points formed the prototype of design logic. With the help of a digital platform and a certain training theme, students can explore, try and discover themselves in the visual perceptual experience, so as to personally experience and realize the development process of the very abstract design thinking and the process of design logic in the theoretical description. This is exactly what we set the purpose of digital thinking training at different stages in our teaching practice. In each class of art design teaching, the trend of students' excitement is shown in Figure 6.

The digital platform saves the entire design path during the training process, and provides very detailed data for the sensory experience at that time that has passed away with the disappearance of inspiration, and all the details associated with the experience at the time can be reproduced, and the lost can be recovered. Different themes may have different results. Every seed will sprout. This is a process of creation, or "creation". Only a computer can achieve synchronization with the emergence of the human brain's spiritual sense, which is unimaginable by

traditional hand-painted expressions. The complete record of the design path plays a crucial role in clarifying the context of thinking and development and restoring the logic of the design.

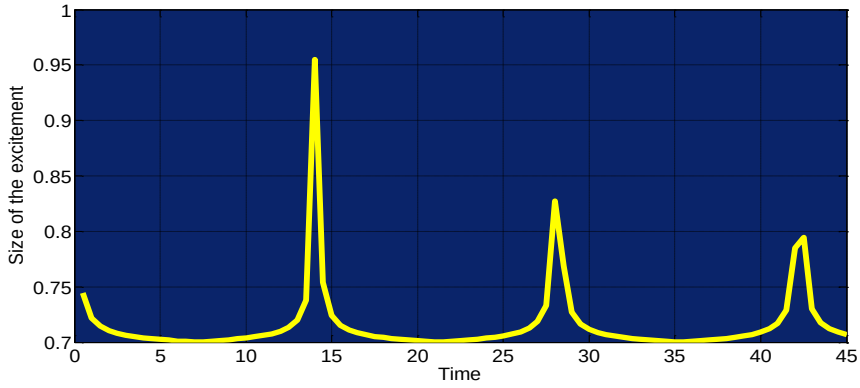

Figure 6: The trend of student excitement in each class of art design teaching.

3.3 Visualization of Design Logic

Numerical technology has broken through the normal angle of view of human beings, and we have seen things that the world cannot see with the naked eye. We look at the world from a completely different perspective, and people's perceptions have also undergone tremendous changes, and the appreciation of beauty and the scope of aesthetics have been greatly expanded. The beauty of the abstract world that we have never seen can only be seen through virtualization. With the help of digital technology, one can step into it. Virtual simulation technology has realized the visualization of abstract concepts. The digital platform can reveal the rules and logic of the design. People can approach the theory intuitively, and the idea can be easily recognized and easily understood, and the reason can be easily understood.

The important spatial modeling theory of computer graphics aided art design should explain not only the language of space, but also the combination of form and space, and how the language of shape can shape the sense of space. These contents are all multi-dimensional combinatorial relationships built on the basis of space, and the theoretical texts and design logic are very abstract. In the past teaching, teachers usually use some physical models and engineering examples to explain the rules of design. However, the physical model is limited by its volume, proportion, material and many other aspects, and can only explain a small part of the content; and the engineering example is often the result of the design, even if there is a design process, it is usually presented in slices or cross-sections. Teachers with rich design experience will construct their theoretical models in their heads during the course of the explanation, trying to describe most of the abstract concepts from multiple angles, trying to restore the original theory to a more realistic model. As for students, their understanding is also to construct an imaginary model in their own minds according to the teacher's explanation. Because they have almost no design experience, there is a huge gap in the construction of each other's imagination in the process of teaching and learning.

The digital platform and digital design methods enable students to unconsciously enter the space, perceive the language of spatial form, and understand the rules of design in the process of independent exploration and sensory experience in the visual virtual space. They were inspired to enter the real design state step by step according to the logic of design development. Figure 7 shows the time-consuming model making in Max.

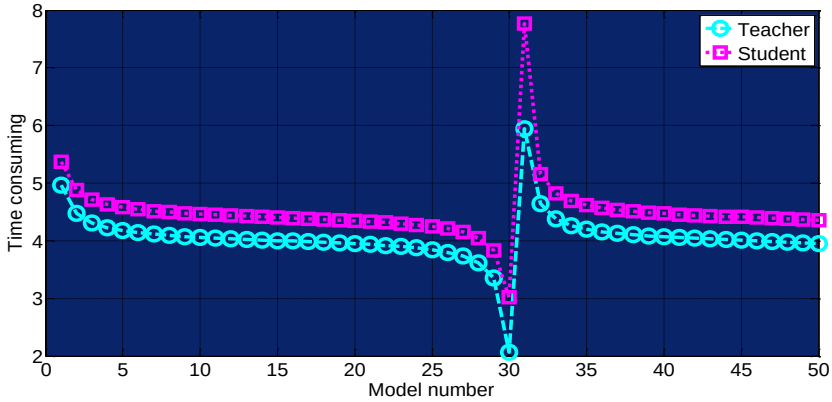

Figure 7: Time-consuming process of model making in Max.

3.4 Digital Design Expression

Digital technology has brought about a huge change in the creation of computer graphics and image-assisted art design, which is reflected in the strength of digital design expression methods. In the hand-painting era, it is "intentional to write first". The things that the mind thinks of are usually the things that have been seen before, and they are the recurrence of experience. The interpretation of the word "create" in Cihai is: "do something that has never been done before." The things that have been seen and existed cannot be said to be creation, but a combination of countless experiences. This kind of combination needs internal rules as support, otherwise it is very difficult to establish this kind of combination. In previous teaching, students often combine materials that they have seen in different places and they like. They bring a lamp here and a cabinet there. However, because the original logical relationship of each material is destroyed, the materials lack the support of internal laws, and the attributes are often mutually exclusive, so this combination cannot be established, which leads to the failure of the design. The new digital design method provides different stages and different technology and software platforms, which can make the design thinking and presenting the most straightforward and visually realistic.

3ds Max's powerful three-dimensional modeling function and the simulation of the material, texture, color, light and other spatial atmosphere effects of the indoor space are more realistic, which can make the relationship between the design elements more straightforward. Complicated lighting, spatial form, spatial volume, scale and proportion, concrete design language, abstract design language, spatial color, interface material and other complex design methods of the space environment do not have to wait until the final completion to see the effect. These are changeable, reversible, and intuitive in the virtual scene. They can be adjusted, modified, and improved at any time. Therefore, the evaluation of the design results has been greatly advanced. For example, the illuminance and luminous efficiency of a lamp must be controlled within a range. Different trials and comparisons can be made in the model space, and the best effect can be realized in advance. New materials and new technologies do not need to be evaluated after the actual application is completed. Instead, the final results have been seen through digital design expressions in the design process. The evaluation of design results has been advanced from the previous implementation to the design process, avoiding blind spots and errors in the design. It not only improves the quality of the design, but also reduces the common problems that often occur in the design. Figure 8 shows the error before and after the use of computer graphics aided design.

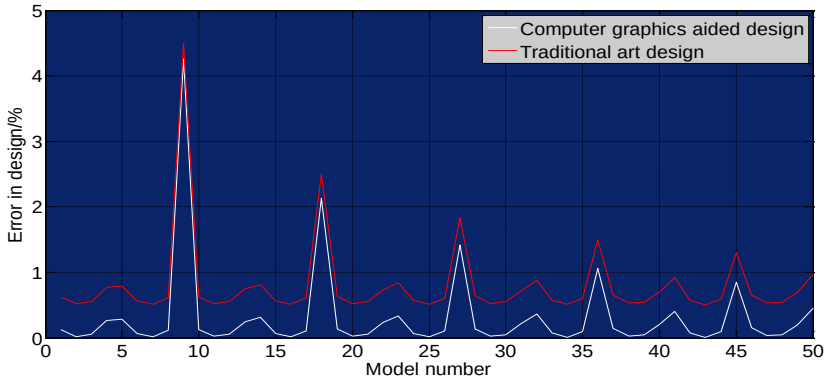

Figure 8: Errors before and after the use of computer graphics aided design.

4 CONCLUSION

Aiming at the application of computer-aided design in computer-aided art design of computer graphics and image, this paper analyzes and discusses the theoretical foundation and application technology of product computer-aided design software design. We researched and discussed the integration, construction and development methods of the computer-aided design platform, and drew the system integration diagram and program flow chart of the computer-aided design platform system; discussed the composition, classification, function, characteristics and development trend of the computer-aided design platform system. The structure of the main modules in the computer-aided design platform and related interface technologies are discussed and explained, and the solutions and implementation methods to be solved in the module design are given. A general solution is given to the interface problems involved in the design platform. Computer graphics and image-assisted art design teaching digital application research solves the problems of computer graphics and image-assisted art design teaching concepts. Through the use of digital technology to design an intuitive teaching method that is effective and suitable for students' reality, it restores the original design essence and design logic, and realizes the renewal of teaching and learning concepts. The goal of training talents has changed from a skill-based to a thinking-type, and at the same time it has also contributed to the formation of a more scientific evaluation mechanism for teaching results.

5 ACKNOWLEDGMENT

Henan Educational Science "The 13th Five-Year Plan" Planning Project: Colleges and universities take the opportunity of fighting the epidemic to enhance the effectiveness of the "five education", Item Number: 2020YB0572.

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