





Design and Implementation of Interactive Visual Communication Teaching System based on CAD Technology

Xia Wei¹ and Yuefeng Han²

¹School of Information Engineering, Zhoukou Vocational and Technical College, Henan 466000, China, 2003090007@zkvtc.edu.cn

²Five year system Technical Colleges Department, Zhoukou Vocational and Technical College, Henan 466000, China, zkhls2021@126.com

Corresponding author: Xia Wei, 2003090007@zkvtc.edu.cn

Abstract. Aiming at the problems encountered in the surveying and mapping equipment management process of university surveying and mapping experiment center, the paper proposes to build an information system serving the management of surveying and mapping equipment. The system is based on CAD framework and implemented by MVC mode. The paper introduces the database design of organizational structure function module and related technologies of development and implementation. The paper solves the problems of record confusion, data loss and difficult statistics of instrument use in surveying and mapping equipment management in the experimental center. Taking surveying and mapping geographic information experimental teaching center of a university as the research object, the laboratory information construction is completed, which greatly improves the management efficiency of the laboratory»

Keywords: CAD; design and implementation; interactive visual; communication teaching system

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1 INTRODUCTION

The cultivation of talents in colleges and universities should not only cultivate students with solid theoretical foundation, but also have certain basic computing ability, practical ability and scientific research and innovation ability. Therefore, experimental practice education is an indispensable part of the process of talent cultivation in colleges and universities. How to build a high-level experimental teaching center, maximize the utilization rate of experimental equipment and investment efficiency of the experimental center has become an urgent problem for experimental education in colleges and universities. Universities have a number of experimental teaching centers, each of which has different instruments and equipment, different experimental methods

and different management methods, all of which have their own characteristics and characteristics. Surveying and Mapping Geographic Information Experimental Teaching Center, referred to as surveying and Mapping Experimental Center, is mainly responsible for the experimental practice teaching of surveying and related disciplines.

At the beginning of 2010, affected by the epidemic, most colleges began to develop network teaching platforms suitable for their own colleges, which resulted in the problems of network congestion and poor data sharing in teaching. In order to solve such problems, three major frameworks were adopted for development. It can be divided into the performance layer, the middle layer and the holding layer, and the middle layer manage the data query business processing tasks. The client does not interact with the data database, which improves the security of the data database and the stability of the network teaching platform. The business demand of this system is the business demand of teachers, students, managers and staff to the system, including the upload and use of teachers' teaching materials, online teaching and learning to answer questions, test placement and batch change into business and other high vocational colleges The students' business needs, choose courses online learning exams to do homework and other vocational college administrators' business needs, control the login of illegal users.

In system functional requirements, its high vocational college school teachers function module, can be through the system network teaching is often implemented high vocational college school students function module, through the system to acquire the knowledge must master the administrator of vocational colleges through the system to manage teachers and students In addition to the requirements of the network teaching system, it also needs to meet the requirements of system stability and data sharing. According to the functional requirements of the system, the teacher function module of middle and high vocational colleges can be used to implement the student function module of high vocational colleges through the network of the system. Administrators of higher vocational colleges manage teachers and students through the system. Network teaching system in addition to the needs of the system, but also to meet the requirements of stable data sharing system.

2 RELATED STUDIES

Hayes et al. [1] believe that any device with a browser and Internet access can enter the system for management operations, and the user experience is consistent, so there is no need for targeted development for specific users. At the same time, Ya et al. [2] used Ajax to realize partial refresh of web pages in the development process, which greatly reduced server-side pressure and improved system efficiency. At the same time, HTML5 was used for web design and development to realize web special effects. Kerimbayev et al. [3] give the administrator login system to assign rights to each user; General management manager into the user's management work, output teachers and students' class situation print out all kinds of teaching and learning information. The education network environment based on Internet has brought great influence to the education management mode and teaching mode [4], it can help solve the problems existing in the traditional classroom teaching, provide strong support to the teaching process, suitable for students to carry out self-discovery independent exploration learning, for cultivating innovative ability and cooperation God's new generation is of great importance [5]. On the basis of SSH integration architecture and analysis of its system structure and integration principle, Reimers et al. [6] a cross-platform scalable teaching support system is designed, which is suitable for multiple levels, multiple objects and multiple network environments. TSS consists of two parts: teaching support and resource management, in which teaching support includes the functions of assigning homework and answering questions for teachers. Teaching resource management includes the management of courseware performance evaluation and forum [7]. For super fusion architecture technology, mainly refers to the one or more physical server consolidation, make them form a unified repository, and then use the virtual technology on several machine has the function of relatively complete and independent of the server into the line simulation, make full application of

the physical server hardware resources This virtualization On this basis, storage virtualization and network virtualization are extended, and then the concrete business logic is rapidly constructed by using the pattern of "what you draw is what you get" [8]. According to a large number of practical research on superman and architecture technology, Alhazzani et al [9] found that the integration of multiple physical hosts into a management platform, joining its terminal, so as to form a rich resource library for unified management of each module. Through the effective application of the hyper-converged architecture technology, Gaber et al [10] utilize the resources to a large extent, and if a host fails, other hosts can still seamless connection to the related work, without any impact.

This paper focuses on the CAD technology, this paper designed online classroom auxiliary tools hundredfold class, so that the classroom effectively through different terminals connected into a whole, to help the majority of teachers to improve the efficiency of teaching and students in class learning enthusiasm and participation, so that students better into the classroom, active classroom atmosphere, improve the efficiency of class learning Research on the technology and art of visual communication in the new media scene of computer-aided interaction. The overall development of the Web end of Hundredfold Classroom separated from the front and back ends was designed and realized. Through component-based development and encapsulation of Axios request, interactive data was carried out with the background based on JSON format. Finally, the whole front-end project was deployed to complete the automatic packaging and deployment of the project equipped with CAD platform to run the whole front-end project.

2.1 CAD Architecture

The CAD based integrated architecture is shown in Figure 1. CAD is a layer composed of client Presentation Layer (CPL), Server Presentation Layer (SPL) and business logic Layer (BLL) data Persistence layer (DPL) and domain Mode layer (DML). SPL is described by Struts framework MVC (model-view-controller). The CAD based integrated architecture is shown in Figure 1. CAD is a layer composed of client Presentation Layer (CPL), Server Presentation Layer (SPL) and business logic Layer (BLL) data Persistence layer (DPL) and domain Mode layer (DML). SPL is described by Struts framework MVC (model-view-controller).

The main responsibilities of each layer in CAD architecture are as follows: The main responsibilities of the Struts framework in SPL are: to verify the input of the client form; Manage requests and responses; Provide controllers to complete page flow and delegate to BLL; Return to the client page display. The main responsibilities of the Spring framework in BLL are to provide loose coupling between SPL and DPL and BLL; Dealing with real enterprise applications; Choice of transaction management; Coordinate dependencies among logical objects; Implement DPL business logic. The main responsibilities of Hibernate framework in DPL are: query database to obtain persistent object PO; Add, delete, and modify data records using PO. The main responsibilities of VO in DML are as follows: serve for data interaction between different layers; An entity is described in the persistence layer section and converted to PO.

CAD architecture can be seamlessly integrated and play a central role. The Web module provides the basic integration of Web applications and provides the basic principle of CAD integration for WebWork Struts and other frames. When a user submits a request through a JSP page, the Struts ActionServlet follows the configuration in Struts-config.xml, To achieve the organic integration of Strus and Spring, Delegating Action Proxy forwards the received user request to the corresponding Struts Action through Spring's request proxy interface Configuration instance for administrator login. According to a series of O/R mapping files and data source or connection pool, the database is connected to achieve the purpose of operating on an object is operating on a row of data in the database, thus completing the Spring layer's response to the operation of DAO interface. In addition, the business objects in the domain model run through all levels of the whole application, and the FormBean class of Struts corresponds to the business

objects in the presentation layer. VO is used in Spring's business implementation class at the business logic layer. Hibernate's DAO implementation class uses VO-PO in the persistence layer.

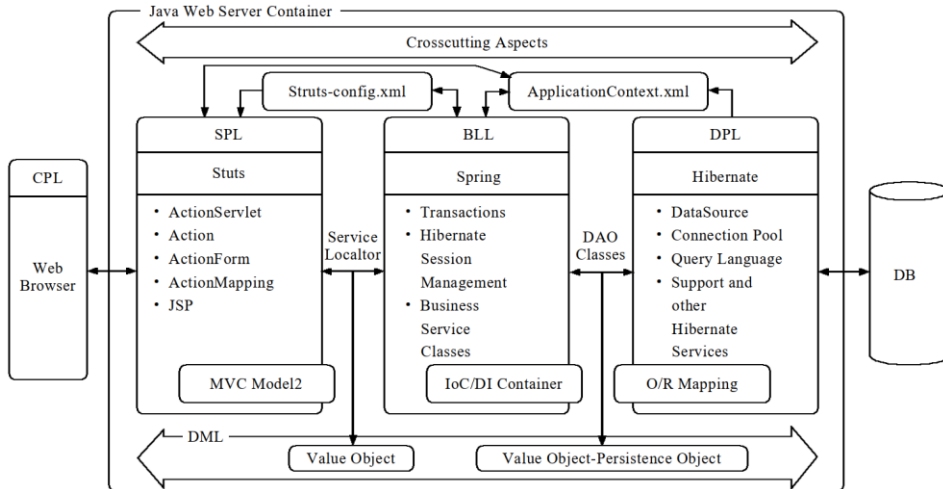


Figure 1: Interactive visual communication teaching system based on CAD.

2.2 Key Technologies of CAD

According CAD technology refers to the programs stored on the server, the user data is stored in the database server, the server is the coordination of standard Web server application server response to the browser's request, the user through the communication between the browser and server, any device with a browser can log in to the related operations, as shown in Figure 2.

Deep learning-based automatic coloring uses deep neural networks to automatically give line art images reasonable color and even light and shadow effects, without human intervention or hinting at the coloring results during the process. Specified coloring methods, on the other hand, require a human to click on a certain area of the image and fill the selected area with color and attach light and dark relationships. The coloring of line images done by this method is faster than manual coloring, and the quality of the output coloring images is more stable. At the same time, I found that there are already some programs that can automatically color or even specify the coloring of a line drawing. For example, Paints Hainer is a program that uses deep learning algorithms to achieve the automatic coloring of anime-style line drawings.

The architecture adopts the mode of three-layer architecture, that is, the presentation layer, the application layer and the data layer. Users communicate with the application server through browsers on different devices. The application server reads the data in the data layer and feeds back to users to complete the reading, storage and modification of user data. The advantage is that there is no need to install different applications in different clients, only need to install the general browser software, saving the client disk space and memory at the same time, simplify the system development and maintenance, there is no need to develop different applications for different users, only need to set different permissions for each group of users on the server.

In addition, CAD architecture is cross-platform and compatible. Any device with a browser and Internet access can enter the system for management and operation. Meanwhile, the user experience is consistent, and there is no need for targeted development for specific users [6-7].

Improve the efficiency of the system, at the same time using Html5 web design and development, the actual webpage special effects.

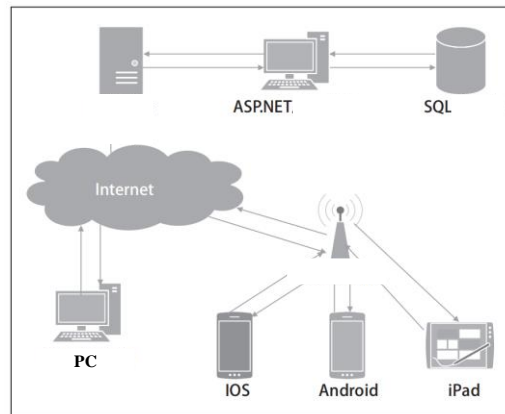


Figure 2: CAD key technology architecture network diagram.

3 ANALYSIS OF RESULTS

3.1 CAD-Aided Teaching System Performance Results

The famous school is a function of this platform is the core, has realized the online classroom teachers teaching through the platform release information in the first place Including course introduction class number, and class time Students choose courses of interest To the agreed time, the teacher to the students through real-time video courses, students and teachers can communicate through chat rooms, complete Online teaching function. In the famous teachers' School, the most core function is to query the famous teachers' classes that are being broadcast. The function of querying the famous teachers' classes is very similar to the function of querying high-quality courses, which will not be described here.

In the development process of the system, we use DAO mode to complete the connection from the business logic layer to the database access layer, to achieve the goal of high cohesion and low coupling of the database operation is nothing more than four kinds: Adding, deleting, and querying to each class (or table) is cumbersome and does not facilitate the expansion and maintenance of the program. Therefore, we abstracted the Base DAO interface, which defines the four basic database operations, and performs database operations through the entity class of the implementation interface. Figure 3 shows the Dao layer class diagram of the class. According to the relevant regulations and borrowing rules of equipment management of surveying and Mapping Experiment Center, the management process of surveying and mapping experiment center and the situation of users are summarized and sorted out. The users of the whole system include students, teachers, laboratory administrators, center leaders (super administrators). CAD-aided teaching system performance results as shown in Figure 4.

The online teaching system mainly adopts CAD method. Students, teachers and administrators send requests to the server at the tourist end. The server performs corresponding operations on the data database according to the customer's request through the verification of the customer's identity, and feeds back the final response results on the tourist at the client end.

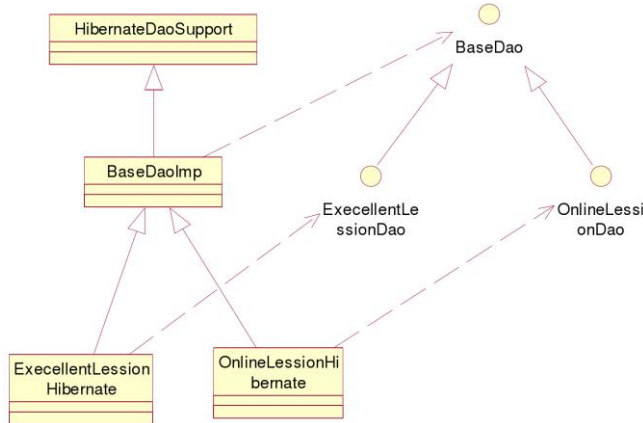


Figure 3: CAD key technology architecture network diagram.

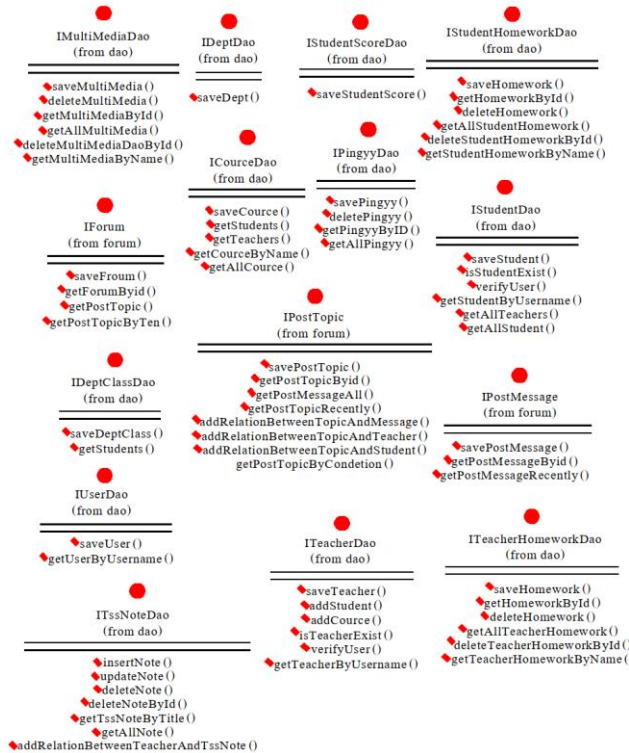


Figure 4: CAD-aided teaching system performance results

The CAD structure of the system is based on the following considerations : (1) the system is easy to maintain and upgrade; (2) Reduce the cost of the system. The online teaching system uses MVC framework, that is, the whole system is divided into model layer, view layer and controller. The specific design is as follows:

Model layer: Encapsulate application and function-related data and corresponding processing methods because model codes may be used by multiple applications at the same time, encapsulating methods and data can reduce code duplication, improve the efficiency of programming, and improve the stability of code. View layer: pages that enable data to be displayed purposefully and interact with users, i.e. pages in HTML language on the browser side. Controller: mainly used to deal with things and respond to the user's request in the view. The controller invokes the corresponding view and model according to the user's request. Responding to the user's request itself is not to respond to the user, but to invoke the view and model to respond to the user.

Database design needs to consider the design of the database model, construct the comprehensive database system, to meet the diverse needs of users According to the different needs of users, developers will demand abstracted from the real world, constructs the corresponding entity in the form of data table, the user's various operations, through the interaction with the database system, the corresponding The form is stored and read. According to the entity relationship diagram above, we designed the following data table: Student table Teacher table Administrator table Video class table Online class table Student -Online Class table student - Learning Situation table Student - Recommended class table Post table Chat room table.

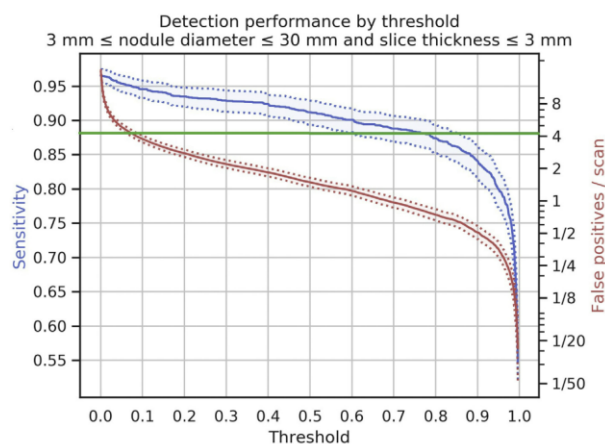


Figure 5: Digital picture book interaction design.

In Teaching video on demand system of the main page as shown in figure 5, in the picture we can see the user registration and login form W, video search bar, video display bar when users click on the register and login form can be used to login and registration function W and click on the video search bar and enter the keyword search to the related video information users can W You can also select videos according to the type of videos you need. The selection of page data storage mode plays an important positive role in improving the speed of the system. Usually, the small and medium-sized data of the page will be cached in the system memory, and the running speed is fast. Large data can be stored in the local hard disk for cache, and large data can also be stored in the database, but the data response speed is reduced. Page caching is also need to choose not all pages are to be for page caching, we need to test was made in the two conditions, one is page access frequency, another is the cached page fragments In the first case we often take the most recently for a long time did not use the page replacement strategy delete rarely visit page after storage The second kind of love As the name implies, the block caching of condition pages is to cache frequently updated fragments of the page to improve the hit probability of the page and CPU utilization efficiency.

In the page introducing efficient data structure to integrate the whole page, then use efficient algorithm for index page Normally the method of the index page is an absolute path search method, the absolute path to the page in the face of the required page request can get page carries valid data. But in reality, it is more complex. So, we need to optimize the configuration of the page with parameters so that the page index is optimized. The strategy of flexible use of time-dependent event monitoring and manual means can ensure the effectiveness of page update, modification and deletion. Time-dependent event monitoring: to specify and standardize the life cycle of a page to update and delete a page. Manual: The administrator manually deletes cached pages by command or other means. During the system design we have made a similar system evaluation and analysis of the CRUD operation of the database system of the important operation, very test system resource scheduling qiao distribution, is a system application development and operation practice the serious restriction factor, so we improve the ability of data CRUD is to improve the performance of the server, at the same time improve The system uses configuration parameter optimization and database memory reorganization to optimize the concurrent ability of the database.

3.2 Analysis Results of Visual Communication System based on CAD Technology

In the process of importing 3d model, the system can be loaded normally. File import failure occasionally occurs. After analysis, it is found that the problem lies in the format of the model, because the file itself has not been optimized by parameters. After binding optimization by modeling software, the file can be correctly imported into the interactive experimental environment. System in reading with high resolution map building model, there is a certain time delay phenomenon, also can model and map based on the understanding process of loading The loading time adjustments from three aspects A number is the face of the model itself need to appropriately control and optimization, the second is the size of the map is given priority to with appropriate, there is no need to all parts of the use of high-definition photos, three is the use of LOD technology, according to the different distance, set up different display section level after this processing, the file load time is further shortened.

In the process of system roaming, it can better complete the control of virtual camera and timely respond to different key disk keys. The virtual environment provided by the interactive experiment platform can make participants feel authenticity and interest. The test results in Figure 6 show that the application of virtual reality technology and OpenGL graphic interface technology can complete the design and development of interactive experimental teaching system in colleges and universities.

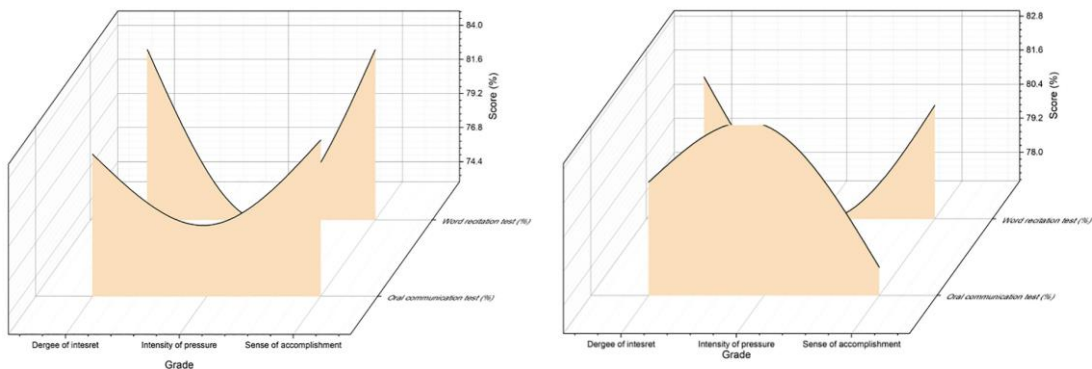


Figure 6: Student test analysis of the interactive visual communication teaching system.

Students generally express that this model has great flexibility and can enhance the interest of experimental teaching. Through 360-degree cognition of 3d model and roaming of virtual scene, it is helpful to improve learning interest and promote experimental practice teaching. The operating environment of the interactive experimental teaching system in colleges and universities was set up. IO devices were used to interact with 3d models. The geometric transformation operation of the mouse on 3d models, the capture of external objects by sensors, and the interactive roaming between keyboard and 3D scenes were tested respectively. There are differences in the user registration information of the two roles. Students need to fill in the student ID information, while teachers need to fill in the teacher id information. Therefore, the page content is designed for the front-end of different systems to obtain the user's name and ID information and carry out unique verification with Axios technology and back-end server, and feedback the verification results to the user interface. To ensure the accuracy of a user's mobile phone number, the system sends a verification code to confirm the information. The login password is encrypted in MD5 mode and then saved. Users need to log in to the system for login authentication. On the login page, users need to select the login identity: student or teacher. Since the registered user name, mobile phone number and ID card information are unique, users can log in in either way. To improve the defense capability of the system against software attacks, the verification code is configured. The verification code is a combination of four digits and letters. The background server randomly generates images and sends them to the front page for user identification.

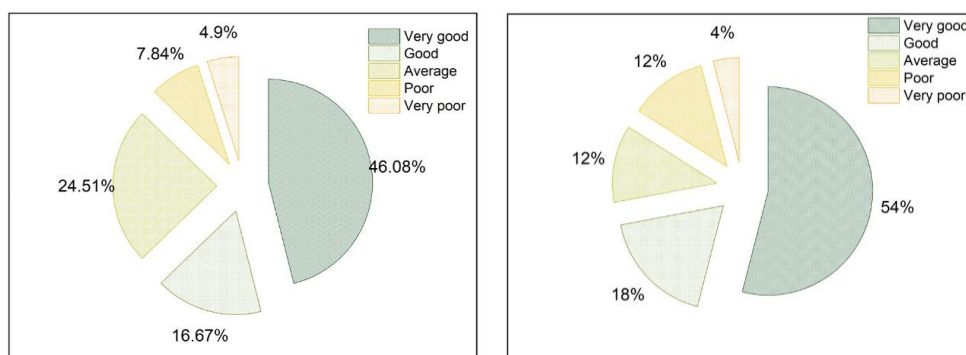


Figure 7: Visual communication teaching results.

To further explore and enrich the proposed method, as the user role of the system in this paper is not only students, the permission setting is diversified, and the data processing capacity is huge. When students and teachers use this system to conduct interactive teaching, Microsoft Web application stress tool is used as a test Tool and the number of threads is set as the first order 50. The number of threads reflects the details of the amount of data processed by the system. The system in this paper is tested. Amount of self-efficacy is used to describe the student to the control effect of own behavior, reflect the students' ability of autonomous learning This section experiments using high self-efficacy group number General self-efficacy quantity number low self-efficacy group number to describe application system in this paper, students and teachers whether interactive learning style of students have a positive impact, the results are shown in Figure 7.

According to Figure 97, after the application of the system in this paper, the number of students with high self-efficacy increases from 11 to 21. The proportion increases from 21.4% to 34.8%, which can be interpreted as the application of the system in this paper increases the number of students with high sense of self-efficacy and the number of students with general sense of self-efficacy and the number of students with low sense of self-efficacy, indicating that after the application of the system in this paper, interactive teaching method improves students' sense of

self-efficacy. Students' autonomous learning ability is greatly improved, and the application effect of this system is good.

4 CONCLUSION

Augmented reality technology can create a THREE-DIMENSIONAL learning environment for students, which can bring students a good sense of immersion and attract students to engage in learning. Augmented reality technology can help students understand the knowledge model and establish their spatial imagination ability. However, the development of the teaching system based on Internet and augmented reality technology is relatively slow. The operation of the system is mostly in the single-machine operation mode, which is not integrated with the Internet. Meanwhile, the system does not have the human-computer interaction function based on natural gestures, which limits the application range of the augmented reality teaching system to a certain extent. Therefore, the research and innovation of teaching system based on CAD and augmented reality technology in this paper has positive significance in the field of education. After the analysis, design, implementation and testing process, the system can achieve various functions according to the design requirements, but due to its own limitations, the system still has some defects, which need to continue to improve. Such as: the system is not full enough in the content setting of each module, which needs to be further improved

Xia Wei, <https://orcid.org/0000-0002-4687-741X>

Yuefeng Han, <https://orcid.org/0000-0002-5801-4240>

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