THE MULTIMADIA CAI SOFTWARE
FOR ENGINEERING DRAWING

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ABSTRACT

An integrated Multimedia CAI system of Engineering Drawing is working in Guangdong University of Technology. It includes a set of multimedia software of a teaching system, exercise system, test system, management system of Engineering Drawing and a Computer Graphics instruction system that was developed by the research group of the Department of Engineering and Computer Graphics. More than ten multimedia-classes are equipped with large screen projectors connected to PIII computers in the network. Also a big PC computer laboratory is set for students' self-study and exercise. The entire multimedia CAI for Engineering Drawing is carried out to all engineering students. This paper introduces the configuration of the computer network, the developing work of the multimedia software, the methods and the effects of using this system.

Key words: Multimedia CAI, Engineering Drawing

1. INTRODUCTION

We began to develop multimedia CAI software in 1994. In 1996, we established the first CAI class with 30 sets of 586 PC connecting in Novell Network to CERNET (China Network), a multimedia teaching class with a large screen projector connected to a 586 computer in the network. Until this year, eleven multimedia-classes and a computer graphics laboratory with 90 sets of PIII computers for teaching Engineering Drawing have been established. Thus we have the capability to conduct a multimedia CAI and completely establish a modern education system.

2. CONFIGURATION OF MULTIMEDIA CAI SYSTEM

The hardware of the CAI system configuration is as fig 1. All students' PIII 667 computers in their terminals have 128M memories, 15G hard disk memories and with the 100M BPS rate. The teacher's terminal has 128M memories and 16G hard disk memories with the 100M BPS rate also. The configuration of this CAI system is illustrated in figure 1.

3. THE SOFTWARE DEVELOPING WORK

Without CAI software, multimedia CAI class is useless. There is no available CAI software for Engineering Graphics at the moment. Therefore we have spent years to develop multimedia CAI software. We have finished all the teaching system, exercise system and some part of the test and management system of Engineering Drawing. A virtual reality teaching system on solid's projection based on WWW is also developed for the students' review.
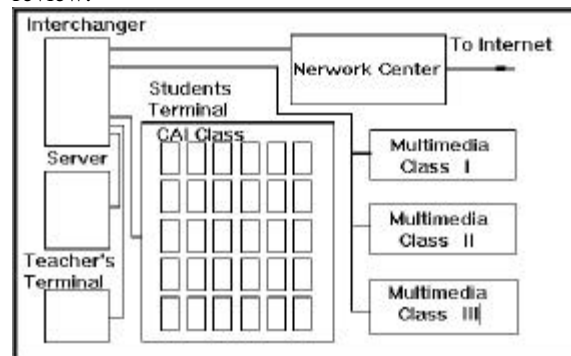

Figure 1 .The configuration of the multimedia CAI system

3.1 The Software Design Model

Whole teaching software of Engineering Graphics occupies a CD-R and was assigned to every student. This CD-R has been published. Other software includes the systems of exercises; test management and Computer Graphics instruction that are setup

on a server. The multimedia teaching system of Engineering Drawing consists of independent chapters. A chapter is formed with pages. Every chapter can be developed by a single person. We adopted the most advanced computer technology to make the multimedia CAI system integrated to ensured the software's optimization and avoid the program's expansion.

3.2 Select Developing Environment and Authoring Tool

According to our country's condition, most colleges and universities have equipped PC-computers with Chinese Windows operating system. To ensure the software compatibility, Pwin 95/98 (Chinese Win95/98) environment is selected. After carefully comparing existing authoring tools, we decided to use "Toolbook" as the software design tool.

The first step after the selection of authoring tool is to write a manuscript of the contents of software. To make the system more vivid and better at interactive and navigation, the various media that consist of voice, graphics, image, and animation etc. were fully utilized to achieve the best result. Thus, it not only fully reforms the teaching method, but also ensures the teaching quality.

After the preparation of the manuscript, various media materials must be made. We spent a lot of time to create and edit the graphics, animation, text, record and edit the voice. Finally they were put together with the language of Open-Script of ToolBook.

3.3 The Preparation of the Media

Engineering Graphics divided into four parts--- Descriptive Geometry, Projecting Drawing, Mechanical Drawing and Computer Graphics. To make the fundamental media, we adopted AutoCAD, 3DSMax, Photoshop, Coreldraw and other media producing and editing software. To make the 3D models with precise size we employed the AutoCAD Solid Modeling technique, and input the result into 3Dsmax to render and form the animation. Images can be prepared in various forms to obtain the necessary precision. We compressed the image files as small as possible. The voice files were edited and compressed to shorten the software size.

4 THE CONTENTS OF THE MULTIMEDIA SOFTWARE

We have developed four kinds of software--- teaching, exercise, test and management. The contents of them are as following.

4.1 The Teaching Style Software

The teaching style software includes a multimedia CD-R that contains whole Engineering Drawing.

This software uses text, graphics; images, animation and voice formed into a complete system. It can replace the traditional textbook. Another teaching style software is the Introduction of Computer Graphics. It introduces the hardware configuration of a computer graphics system, the application of Computer Graphics and the computer graphics program with C++. Figure 2-4 are some picture of these two parts.
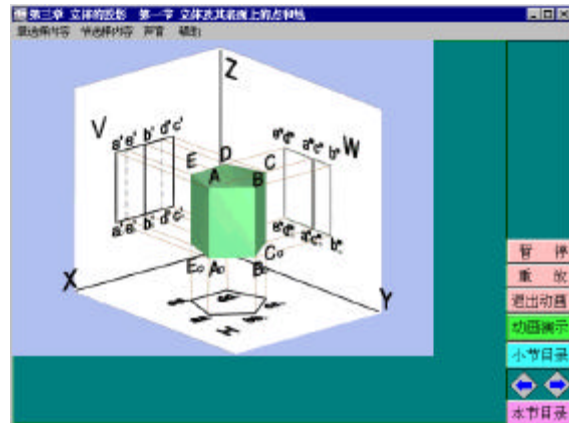

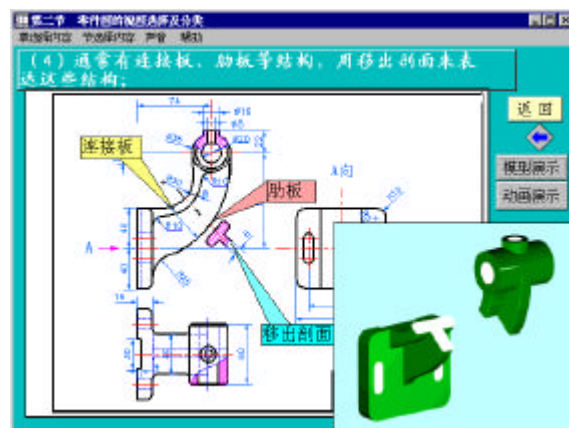Figure 2. The forming of solid projection

Figure 3. Introduction of Detail Drawing

4.2 The Exercise Style of Software

This kind of software includes all the exercises for students. After students complete the exercises, they can get help and exercise analyses. Figure 5 and 6 are two samples of such exercise analyses.
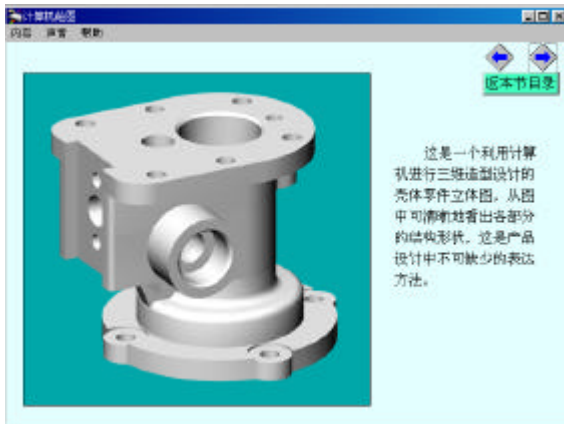
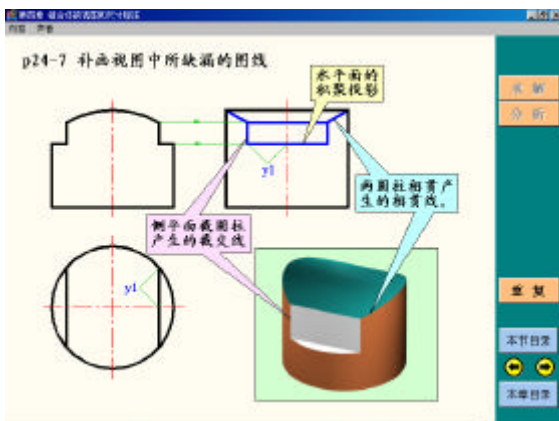Figure 4. Introduction of Computer Graphics

Figure 5. Analyses of the projections of combined solid.

Figure 6. Reading an assembly drawing.

4.3 Test Style Software

This software supplies sets of questions. For every set of questions, the student must answer one by one, and the software can give the records automatically. If the student cannot pass the test, the software will turn to a certain chapter of the teaching part and ask the students to study. After studding, another set of tests will be given to the student to answer. Figure 7 is a page of the test software. In this part students can not only select the answer by click the mouse, but also they can draw lines with the tool that is supplied by the software on the screen to complete the question. For every question's completion, there is a score displayed on the screen, and an accumulated score is also displayed on the screen.

4.4 Management Style of Software

This kind of software can manage students' scores and analyze students' study and give students advice. Thus it saves the teacher's time and energy.
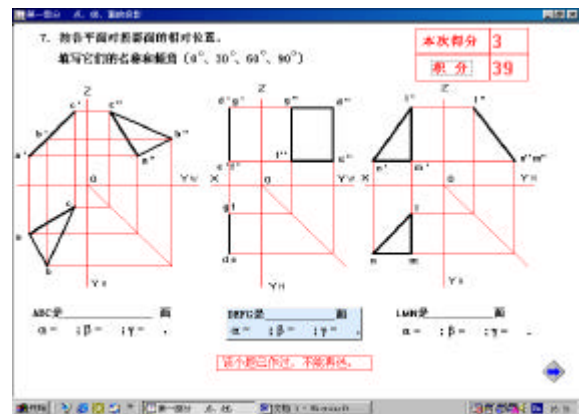

Figure 7.Test part in Projection principles

5 SOFTWARE TOTAL CONFORMITY

To optimize the total effect of the software, we adopted buttons, icons, pull-down menus, hot-words and decorated the interfaces. Figure 8 is the page decoration.
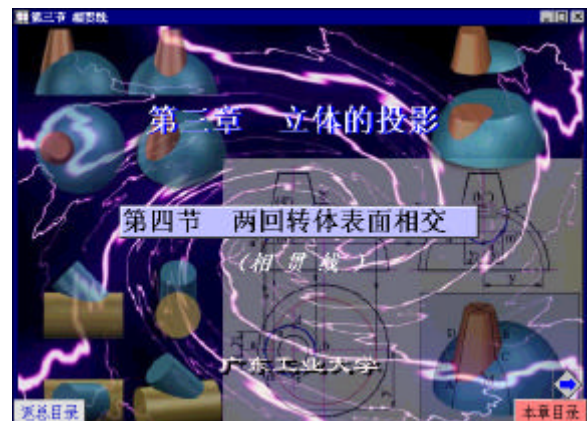

Figure 8. Front page of solid projection

Many beautiful 3D animations increase the effect. Figure 9 is such animation.
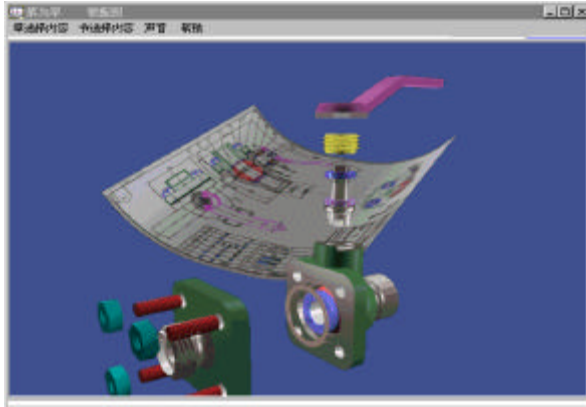
Figure 9. A 3D animation of assembly a valve.

2D animation can display the drawing process step by step. It is a good tool to help the student to understand. Figure 10 is one of the 2D animations.
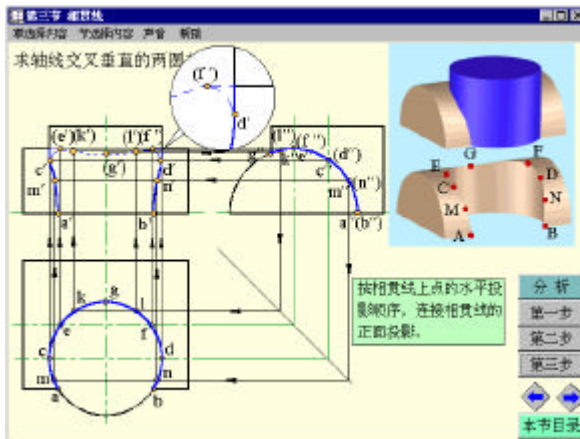

Figure 10. 2D animation to solve the intersection line

6 TEACHING METHOD AND RESULT

With the multimedia software of Engineering Drawing, we have completely reformed the education method. In every step, we adapted graphics, images, animation and voice to vividly represent the teaching contents. .

Students are interested in this new method. We arrange for all students to review and do exercises with the network system. With this method we reduce class-teaching time.

7 CONCLUSION

We are carrying on the teaching reform with the multimedia CAI. We have obtained important progress. The works we have done before give us the rich experience and make us doing faster in the future.

Multimedia CAI has boundless prospects. It will completely change the traditional teaching method and create a modern teaching technique. It helps teachers and students. The studding of Engineering Drawing is no longer dull and dry. It becomes colorful with motion. The multimedia CAI software is a tireless teacher. It can be used repeatedly, interactively and personally. Through the computer network, the remote education can be realized.

8. REFERENCE

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