Application of Director in Organic Chemistry Experiment

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In view of the characteristics of high cost of organic chemistry experiment, long period, flammable reactants and difficult disposal of waste, the computer multimedia and network technology is used to assist chemistry teaching and simulate organic experiment process, which can fully arouse students' enthusiasm for learning organic chemistry experiment courses, save teaching time and resources, and improve the teaching efficiency of organic chemistry experiment.

A large amount of materials such as pictures, texts and animation are made for organic chemistry experiment through Photoshop and Flash software based on the multimedia technology in this paper; and the assembly of the chemical experiment materials and the functional testing of the final software are completed using Director software, so that a teaching aid software for organic chemistry experiment with complete system and rich content is designed. Through the development of the software, the application of Director software in organic chemistry experiment is expounded, which provides theoretical and technical basis for the extensive application of multimedia and network technology in the development of teaching software.

1. Introduction

With the wide use of computer multimedia and network technology in assisted instruction, chemistry teaching opens the door to a vast knowledge of digital information (Bharathy, 2015). Compared with the traditional teaching methods, chemistry assisted instruction (CAI) through computer multimedia technology has three characteristics: firstly, rich, illustrated and vivid multimedia courseware (Asiri, 2015; Lu et al., 2015); secondly, shimmer magnification, macro reduction and changing from abstraction to visualization; and thirdly, dynamic description and repeated operation (Demircioglu, 2016; Lunstead et al., 2016).

However, most of the multimedia software that are usually used takes basic knowledge as main content, and multimedia software are mostly based on textbook knowledge and presented by Powerpoint (Orora et al., 2014; Njagi et al., 2015), Authorware, etc., but these software tends to have monotone and weak internal function editing and usually rely on other software to make animation (Jordan et al., 2015). It is especially frustrated in the production of the multimedia software that needs a large number of cartoons for simulation operation (Lattermann and Büchs, 2015).

In this case, it is an inevitable trend to produce multimedia software for organic chemistry experiment with more cartoons using Flash and Director technology (Hrin et al., 2016). At present, there are many chemical experiment software built and put into use (Popova et al., 2016; Nadelson et al., 2015; Ma et al., 2015). Among them, there are famous chemlab developed by Model Science Software Company in the United States, Biointeractive series software developed by Howard Hughes Medical School (Russell et al., 2015; Yearty et al., 2017), Virtual ChemLab at Brigham Young University, interactive experiments coordinated with classroom instruction developed by American EUDCYPEDIA Company, chemistry VL at the University of Oxford, VEST-Lab at the University of Sussex and the Neptune Consortium plan in Italy (Box et al, 2017). In contrast, the overall development in China is relatively backward (Piunno, 2017).

Based on this, the "computer simulation experiment--organic chemistry experiment" software is developed using multimedia technology through the Director assembly technology in this paper, which is of great significance to the development and application of CAI chemistry teaching software.

2. Experimental procedure

2.1 Selection of tools for producing organic chemistry experiment software

In the early stages of software development, consideration should be fully taken to select the development tools. Appropriate development tools directly determines the development efficiency of software and quality of the finished software.

In the process of making this software, it involves the processing of existing pictures and image material and the design of software interface, while the Photoshop software can completely meet the production needs of the software for the bitmap. The animation material needed in this software is mainly developed using Flash software. Director software is used as assembly tool, which provide an easy-to-use development environment similar to standard applications. With this environment, users can even create multimedia movies without any programming and detect movie elements, including programs, at any moment in time.

2.2 Production of experiment material used in Director software

The material involved in the development of software mainly includes four aspects. Firstly, the text material production: the text in navigation interface is produced in Photoshop; the text of experimental part is edited in the Flash software. Secondly, the picture material production: the Microsoft Office Picture Manager tool is mainly used to resize and crop image and make other modifications; the pictures of software interface are made in Photoshop software. Thirdly, the animation material production: the Flash block diagram animation is used to dynamically illustrate the integrated experiment operation. Fourthly, audio material production.

2.3 Software assembly and implementation based on Director technology

The software is assembled after completion of the material production and design of software interface. As the software design is rich in content and the material is more, the size of source file and classification of similar material should be considered in the assembly process, and the source file is formed in accordance with the secondary structure of the software. Various types of chemical material are integrated through Director software, and all the relevant material are introduced into the list of actors to adjust their display position on the stage, and to achieve the jump to the specified frame of other source files. In a similar way, the digital video files, 2D animation files and 3D interactive files are imported into the Director software for design and assembly. Finally, the script program written in Lingo language is directly used for function testing in Director.

3. Results and discussion

3.1 Overall design of multimedia software for organic chemistry experiment

The development of "organic chemistry experiment" software can well assist teachers in classroom teaching and students' study after class. It is a result of common development of multimedia technology and organic chemistry experiment teaching. The "organic chemistry experiment" software is produced according to the teaching process of organic chemistry experiment in university. In order to ensure the comprehensiveness of the content of organic chemistry experiment, integrity of experiment technology and gradualness of teaching process, the software content is divided into basic knowledge, basic operation and comprehensive experiment, as shown in Figure 1. The content plates are independent and closely linked to form a full-featured organic simulation experiment system with complete content.
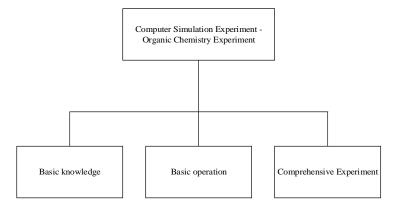

Figure 1: Software content structure

Software development process is generally divided into the following six stages: demand analysis, determine the content, software implementation scheme, material production, assembly test, software upgrade and maintenance, as shown in Figure 2. The demand analysis of software is to determine the content and function that need to be produced for the software. This software is mainly used in auxiliary teaching of organic chemistry experiment. Therefore, the software must have commonality and individuality in organic experiment to ensure the system integrity of organic chemistry experiment. Through screening, the final contents include 9 common operations. namely unit experiments and 19 specific comprehensive experiments. After the content is determined, the scheme for realization of the technology should be determined for various parts of contents, that is, Photoshop software is used for image processing; Flash software is used for animation; Director multimedia software is used for material assembly. All kinds of material are produced according to the determined experiment contents and production tools for a variety of material. The produced material are assembled according to the experiment classification, so as to combine into a complete set of teaching software. After the software is assembled, it is necessary to repeatedly check the running status of the software and normal use of the functions in the software and determine the achievement of the established goal. Finally, the software should be regularly upgraded and maintained.
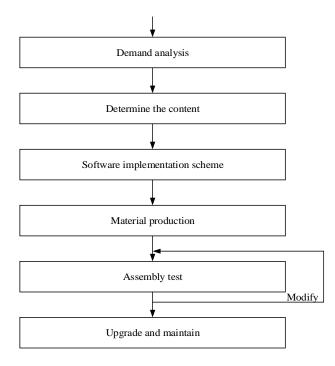

Figure 2: Software production flow chart

3.2 Production results of experiment material

Two kinds of text editing methods are mainly used in "computer simulation chemistry experiment--organic chemistry experiment" teaching software according to the different types of text in the software. The navigation buttons, text and pictures are mainly placed in the navigation page of "organic chemistry experiment" teaching software. As the navigation interface is produced in Photoshop software, the text in the navigation interface can be directly made in Photoshop, saved as a .png image, and imported into the list of actors in the navigation interface when used. In the experimental part, the text is edited in the Flash software with format as needed, and finally exported as a .swf file format.

In "computer simulation chemistry experiment--organic chemistry experiment" teaching software, the material in "experiment presentation" is a two-dimensional animation of simulation experiment process made by Flash software. The production of "experiment process" mainly explains the operation process of comprehensive experiment dynamically with Flash block diagram animation. By taking the "extraction of caffeine" in the comprehensive experiment as an example, the process of making the process animation is introduced, as shown in Figure 3.
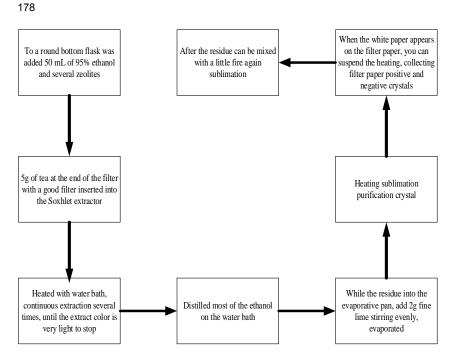
Figure 3: Process animation

As the software itself is the animation simulation of experiment using multimedia technology, the device diagram in the software is not a response device in real experiment. It is still an animation device diagram built by Flash animation component, but the format is picture rather than two-dimensional animation. The Microsoft Office Picture Manager tool in Microsoft Office is mainly used to resize and crop the picture and make other modifications. It doesn't need to be designed into vector diagram in the design and production of software interface picture. The most convenient and powerful bitmap production tool is Photoshop software.

Teaching software interface is designed by Photoshop software in the composition of pictures. The software interface layout, background and font effect are perfectly combined by adding the shadow, embossing and glowing effect of the layer. The two-tier structure design is combined with the separate access and exit interface on the software interface, as shown in Figure 4. The main menu is selected to enter the second menu of each main menu. The secondary menu includes the secondary interface button which can be used to enter two different types of experiments. The button is clicked to enter the secondary interface of the specific experiment.

Figure 4: Interface menu design

3.3 Implementation of assembly technology of multimedia format material in the Director software

Integrate the above prepared chemistry experiment material in the Director software, and then build a software platform. Firstly, realize the software navigation interface, create source files and set screen pixel size; introduce all the relevant material into the list of actors; set the time of frame length according to the order on the time frame, and adjust its display position in the stage; trigger button to achieve jump procedures. Directly import the .avi digital video required in production of software into the list of actors in the Director source file, and place the video file on the elves channel to adjust its suitable position on the stage on the time frame that needs to be presented; export video test and find that digital video will play directly. The example result is shown in Figure 5.

Figure 5: Director assembled digital video

The assembly of 2D animation files and 3D interactive files is similar to the above process. Figure 6 shows the realization of interactive software function. After all material of the software are assembled, the script program written in Lingo is directly tested in the Director. There are several .dcr source files for teaching software assembled by Director software. The import files of the software are published as .exe files and other source files are published as .dcr files. After all the files needed by the software are produced, the software should be overall tested, mainly the jump test between the .dcr files. Finally, when the software is made into a CD-ROM, the special resources used in the software making process such as third-party plug-ins and other files of the software must be put together on the optical disc which should be in normal use.
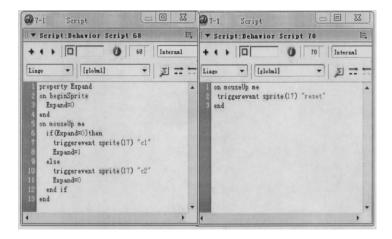

Figure 6: Implementation of Software Interaction Function

4. Conclusions

The organic chemistry experiment was systematically simulated using computer multimedia technology in the "computer simulation experiment - organic chemistry experiment" software. With Photoshop and Flash as main development tools, a large amount of material such as pictures, text and animation about basic operation, unit experiment and comprehensive experiment in organic chemistry experiment were produced and the software interactive interface was designed. The multimedia material was assembled and the functional testing of the final software was completed with the Director tool. There are great innovations in software concept, animation and software structure design. The use of software has changed the traditional teaching modes and methods and thus made the class of organic chemistry experiment more attractive and improved classroom teaching efficiency. This has great practical significance on the research and development of

multimedia technology-aided chemistry teaching software. The multimedia software for organic chemistry experiment designed in this paper is currently in the theoretical research and primary application stage, and the follow-up upgrade and maintenance of the software is not involved. We can focus on the research on software application in the future to make it better meet the teaching needs of organic chemistry experiment.

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