Development and Discussion of Web-based Interactive Teaching System in Ubiquitous Learning Environment

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Keywords: Ubiquitous Learning; Web-based Interactive; Digital Electronic Technology; Experiential Learning

Abstract: By example of web-based teaching system development in the *Digital Electronic Technology*, design is made in the three-layer B/S mode or browser/server mode in this paper to render learning help to students and answers to questions concerned and effectively implement teacher-student and student-student communications and interactions. By web-based interactive teaching, students can more conveniently get to knowledge of related areas both at home and abroad and make independent learning schedule in the current ubiquitous education context to implement web-based teaching of digital electronic technology.

1. Introduction

Students of new generation grow up in the company of the Internet and all kinds of ever-developing and -changing Internet-based learning styles are easier to be accepted by such a student group [1]. Therefore, attention shall be attached to design philosophy, distribution mechanism, and advanced, scientific, innovative and reasonable content composition in the process of teaching reform by Internet technology [2]. Optimal configuration shall be made on the Internet technology, teaching shall be made in innovative education form, full play shall be given to the role of the Internet, objective of learning whenever and wherever and effective teaching reform shall be realized, and a web-based system suitable for the ubiquitous learning environment shall be developed.

2. Research on Teaching Contents and Methods of Course of Digital Electronic Technology in the Ubiquitous Learning Environment

Digital Electronic Technology is the foundation of learning all the science and engineering majors, which is a highly practical course of tremendous amount of information. And as electronic technology is constantly developing at the moment, new technologies and products are constantly emerging, leading to increasingly high graph and text task load in the course of *Digital Electronic Technology*. Traditional teaching methods and materials are hard to adapt to teaching requirements of this course; meanwhile, they are not beneficial for students to learn in fragmented time. In that case, it is essential to apply a web-based interactive teaching system to this course, which will become inevitable result in development of this course and inevitable trend of modernization of education technology. And web-based interactive system of digital electronic technology is exactly a new teaching model put forward in light of the above, which aims to train students' ability of critical thinking and skill of generating new knowledge while creating an experiential learning process and opportunity for students without restriction in time and place.

2.1 Research on contents of theory teaching

Theory teaching is an important means in teaching and overall process in which a teacher

  DOI: 10.25236/iccse.18.027

imparts knowledge and skills to students, mainly including teacher's instruction, students' questions and answers, teaching activities and some teaching aids used in the teaching process. Major forms of expression in traditional theory teaching include blackboard teaching and PPT teaching. Such simple blackboard teaching and PPT multimedia teaching methods are hard to embody abstract electronic circuit knowledge, making students hard to digest such important knowledge and difficult to assure teaching effects.

In order to solve the above problems, column setting and demand analysis are made in the system to plan to provide some excellent teaching materials and video materials for theory teaching in the web-based system for reference of students whenever possible. In the part of students' preview, special learning websites shall provide relevant knowledge points. Key, difficult, fallible and obscure points in the course shall be interpreted at length in the preview. Before class, students can make preview by such media files and repeatedly learn key and difficult points and their respective weaknesses. In other words, they can learn in a selective way with a purpose. Opportunities shall be created for students to get to cases similar to actual application to effectively reduce students' learning time.

2.2 Column demand analysis in the teaching system

The system shall fall into three modules: teaching area, learning area and interaction area.

In the first place, the web-based teaching area shall regard teachers as key users in the teaching system. After a teacher chooses a course for instruction, the web-based teaching system shall provide the teacher with the following functions concerning this course: (1) Preparation of course description: for preparing and revising basic information and description of the course whenever possible. (2) Provision of teaching plans: teachers can release electronic teaching plans for students to make independent learning or preview. Teachers can reedit loaded web-based course wares. (3) Provision of teaching materials: for releasing the school's web-based resources for digital electronic technology. (4) Uploading of resources: teachers can upload course-related learning resources in the web-based course by login for students to download and consult.

The learning area shall deem students as key users and can implement the following columns: (1) Course notice: students can view course-related notices and message released by admin. (2) About learning methods: students can view learning contents and methods of the course and precautions in the learning process. (3) Web-based course: for browsing course-related web-based course wares, web-based teaching plans, course outlines, teaching schedules among others provided by teachers for reference (to see whether there are existing videos on the Internet). (4) Course assignment: students can browse, complete and submit teachers' assignments. After teachers read over and give remarks on assignments, an assignment analysis report comprising teachers' comments and scores shall be generated. (5) Downloading of resources: students can download course-related teaching resources in the system for off-line learning. The system shall adopt diversified teaching means to provide students with sufficient teaching resources and improve some weakness in traditional teaching means.

In the meantime, a special system-interaction area for teacher-student communications shall be offered in the web-based system. In the interactive system, teachers may ask questions concerning teaching contents for students to think and answer; if students fail to answer such questions, they can discuss with each other and speculate possible solutions before teachers make judgment and revelation. This process shall fully mobilize students' abilities to do thinking activities and to connect such thinking activities to existing knowledge.[6] Next, teachers shall interpret key ideas and techniques on the screen and analyze solutions with students. In classroom, teachers shall extract part herein to analyze difficult and key points in the project in combination with teaching contents. As a result, student-student and teacher-student interactions shall be fulfilled fully.

Last but not least, subject to development of digital electronic technology, new resources not included in textbooks shall be introduced to the web-based teaching system in the ubiquitous learning environment, including video database, the latest technical developments, domestic and foreign electronic technical information among others and contents of the course shall be

elaborately designed to revise the syllabus and teaching schedule of the course of *Digital Electronic Technology* and make reasonable arrangement of teaching contents. By the web-based interactive teaching system, students can more conveniently learn the course's classroom theory teaching contents and get to knowledge of relevant areas both at home and abroad as well as make independent learning schedule to implement web-based teaching of digital electronic technology.

3. Thought of Design in Web-based Multimedia Teaching System

Out of demand for setting a web-based interactive teaching system as required, the thought of design in its web-based teaching system is as follows:

So far, C/S model is mostly adopted in design of web-based teaching system. C/S model or client/server model refers to a compound system comprising one or more clients and one or more servers as well as the underlying operating system and communication system, which allows distributed computation, analysis and expression. C/S model is a secondary structural model whose major defects include: difficulty in installation, upgrading and maintenance; sharp rise in system's maintenance cost and cost to use; software's long cycle of development and poor adaptability. Such defects make it hard for the C/S model to satisfy users' needs.

Therefore, in order to fulfill functional demands of the web-based teaching system, the web-based teaching system shall adopt a three-layer B/S model or browser/server model. The B/S model is in the following working mechanism: a client makes a request via browser to the Web server for accessing database in the form of hyper text; the Web server activates a corresponding server program such as JSP or ASP after receiving the request from the client; the server program transfers the HTML language to SQL syntax and submits the request to the database; the database server verifies the legitimacy of the request, processes data and returns the processing result to the server program after receiving the request. The server program integrates and transfers the result to HTML and forwards via the server to the requester's browser. This model can support the whole process of web-based teaching activities, which is simple, flexible and convenient in use.

4. Implementation of Web-based Teaching System

4.1 Structural design of web-based teaching system

Subject to needs of interaction and self-learning of the teaching system, the designed web-based teaching system shall have the following abilities: provide a consistent course ware interface standard to facilitate teachers to make system extensions; adopt object-oriented database technology to save teaching resources, render a variety of real-time interactive techniques, and facilitate students and teachers in learning and communication; support multimedia data in many formats; have sound expansibility and provide all kinds of tools for web-based communication and study. In order to fulfill the above functions, the following simple and visual web-based course system architecture is specially designed in this paper:

Fig.1 Course system architecture

4.2 Modularized structure of web-based teaching system

In accordance with different needs of teacher and student users, the web-based teaching system mainly adopts a frame structure and makes reasonable layout of functional area and operating area in limited display space to achieve good display and operating effects. Since this system is a teaching system developed on the ground of teaching needs in the college department grade, it is designed according to its characteristics to cover such main modules as course announcement, selection of web-based courses, basic information of courses, web-based learning system, teacher-student interaction and communication system, and management system.

4.3 Implementation of main interface of web-based teaching system

As far as the web-based teaching system is concerned, its development environment is WINDOWS2003 SERVER+IIS, programming languages include HTML+ASP+VBSCRIPT script language, and major editing software articles include DREAMWEAVER MX+PHOTOSHOP+SQL. Wherein, DREAMWEAVER is for website editing, PHOTOSHOP is for graphic processing and SQL is for connecting to database and making data operations.

First of all, such preparatory work as creation of database and sheet design shall be done fully. In terms of design environment, IIS settings shall be completed in the WINDOWS SERVER to facilitate supply of the browse service in system design.

The new database created shall be named NETTEACHSYSTEM where such sheets as admingl, lessondir, lessonword and nmpeg shall be separately created for mainly saving user information, course name and contents, teacher-related information and so on.

5. Characteristics and Outlook of Web-based Interactive Teaching System of Digital Electronic Technology

5.1 Characteristics and innovation of web-based interactive teaching system

First of all, as far as theoretical studies are concerned, the web-based interactive teaching system of *Digital Electronic Technology* reforms teaching contents, methods, and means and training models to organically combine knowledge transference with training on ability to innovate, successfully solve the long-standing problem that knowledge transference is not geared to ability training, train students' awareness of self-learning and ability to innovate in a staged, step-by-step and focused manner. The provided web-based materials help students further understand basic theories in this course while understanding corresponding advanced and cutting-edge knowledge and achieving teaching effects of linking such theories with practices. In the teaching process, relevant questions in the interactive teaching system are make full use of to mobilize the initiative of teachers to guide students to think and practice with such questions, improve students' abilities to conduct surveys, search for information and make independent study in extracurricular time, make students more experienced and enhance students' initiative to learn and practice.

Secondly, the system makes the following innovations in system application: (1) **System's openness**: the B/S-based web-based course system of *Digital Electronic Technology* has an incomparable open environment compared with other teaching media. Each learner can acquire all kinds of learning materials by web-based terminal without a special client system. [7] **(2) Flexibility:** the system has sound foreground and background design style to completely separate work of teachers from that of technicians to greatly improve the efficiency of web-based course ware development. A teacher only need make separate teaching pages and upload such pages by background management to corresponding module. It makes maintenance and update of contents of teaching site pretty easy, unlike teaching contents in the carrier of static webpages which are hard to be revised and updated. **(3) Interaction:** compared with traditional teaching media, one important characteristic of the web-based teaching system is its interaction. Interactive activities are pretty common among teaching activities; teachers demand students' feedback about learning condition; students demand teachers' answers to some learning questions and so on. In this process, teachers give recognition and praise to students who make positive participation, particularly those who can

correctly answer questions. After the plan is implemented, it is found that recognition and praise show significantly positive effects on college students, enable students and teachers to have an approach for conversation and improve students' enthusiasm for study. It is fulfilled in the web-based teaching system by application of such advanced technologies as three-layer B/S structure, HTML and ASP programming technologies, SQL database technology and IIS system [4] and reasonable design, which is a focus in development of the system. The system's interactive function is mainly implemented by interaction and communication module and teaching evaluation module.

5.2 Room for improvement and outlook

In design and implementation of the web-based teaching system, some functions are still required to be further improved, which have the following problems: (1) The web-based testing function in the teaching evaluation module is restricted to objective questions only at the moment and the teaching system has no function of making a multimedia course ware in design and lacks targeted web-based materials. (2) The web-based classroom in the web-based teaching system fails to implement teachers' requirement to teach lessons in a web-based way and students' requirement to learn lessons in a web-based way, which is restricted to watching teachers' teaching videos only at the moment. (3) The system is short of full range of web-based learning process monitoring mechanisms [5] including monitoring and acquisition of web-based learning behavior data which satisfy research needs and design of a special evaluation model by taking data as important reference to make scientific evaluation on students' specific web-based learning conditions. The system does not have designed and built columns in this aspect yet.

6. Conclusion

Concerning the system's problems and existing technologies and faculty, improvement shall be made later by starting with the following aspects: Firstly, teachers shall interpret difficult points in teaching for students in a focused way in audios and videos while preparing lessons to enable students to differentiate key points from non-key points in the knowledge to be learned in the following lesson before class. In this way, students can learn with purposes according to their own conditions in class; teachers shall add relevant preliminary knowledge while preparing lessons to facilitate students to understand the knowledge acquired. Secondly, current application of the knowledge which students are learning to practice shall be added to enable students to know areas of application and usage of a chapter's contents or a theory which they are learning. Thirdly, strengths and weaknesses as well as future orientations of development of the knowledge which students are learning shall be added.

Some restraints and difficulties in the web-based teaching system will be readily solved under our constant improvement and effort though it has all kinds of problems in web-based system teaching and influences expected teaching objectives to some extent. Such a new teaching pattern will provide students with abundant information and create an experiential learning process and opportunity for students.

Acknowledgment

This work is supported by Jiangxi Education and Science Task in the "13th Five-Year Plan" (No.: 16YB146; 17YB216); School-class Teaching Reform Task of Jiujiang University (Task No.: XJJGYB-15-13).

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