



Construction of Online Teaching System Based on SpringBoot Framework for Normal University Students' Informatization Teaching Ability Training

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Abstract. In order to cultivate and improve the informatization teaching ability of normal students, this paper develops an online teaching system for the informatization teaching ability cultivation of normal students. In this paper, the author uses the front-end vue.js + back-end Springboot to separate the front and back ends, and uses Javaweb technology to develop the system. According to the characteristics of information-based teaching, this system designs an online teaching platform of mixed teaching mode. Teachers talk about basic theoretical knowledge in the traditional classroom, and improve the practical application ability of normal college students' informatization teaching with the help of online learning system outside the classroom, so as to realize online and offline mixed teaching. With the help of the advantages of Internet technology, this system realizes the effective integration of offline theoretical course professors to online practical training, carries out innovative reform of blended teaching, and creates an excellent online learning environment for information-based teaching for normal students. This system can effectively improve the teaching ability of normal students and further promote the development of education in China.

Keywords: Normal students · Informatization teaching · Design of teaching mode · Hybrid Teaching

1 Introduction

Education plays a strategic role in China's priority development, and normal students are the main force of China's future education. Therefore, China has always attached importance to the training of normal students. However, at present, there are many problems in the training of normal students. Many normal college students' teaching courses often only stay in the traditional theoretical classroom, but the teaching content is usually "false", and the theoretical content accounts for too much, which leads to the disconnection between knowledge content and subject teaching, and it is difficult for normal college students to deeply understand professional knowledge. Moreover, the lack of real learning tasks and teaching cases in teaching materials makes it difficult for normal students to combine professional knowledge with daily life, which leads to normal

students' involvement in teacher work in the future, and it is also difficult for them to actually impart their knowledge to students. As early as February 2018, the Ministry of Education issued the notice of the Action Plan for Revitalizing Teacher Education (2018–2022). The notice puts forward important opinions on building the informatization teaching ability of normal students. The notice pointed out that we should pay attention to the information technology application ability of normal students, study and formulate the standard of information technology application ability of normal students, and improve their information literacy and information teaching ability. Therefore, we should pay attention to the related work of improving the information-based teaching ability of normal students, because this is the requirement of the state for the construction of normal universities under the current background. Therefore, in the training plan for normal students, we should not only attach importance to the training of normal students' professional knowledge teaching ability, but also attach importance to the training of professional knowledge and information tools. Normal students should learn how to use the knowledge and tools of all kinds of teaching software, and learn the effective combination of professional skills and information tools, so as to lay the foundation for the future teaching work in the information-based teaching environment [5]. At present, due to the limited teaching environment of campus informatization teaching ability, it is difficult to provide normal students with sufficient conditions to improve their informatization teaching practice ability. Therefore, finding a new teaching mode is an important turning point that can effectively improve the information-based teaching ability of normal students. According to the characteristics of using Internet technology in information-based teaching, we can design a hybrid teaching mode to improve the information-based teaching ability of normal students. Blended teaching is to combine traditional teaching with Internet technology, make full use of the advantages of Internet technology, and optimize the educational model. Combining the blended teaching mode with the cultivation of normal college students' informatization teaching ability can make teachers use Internet tools to teach with IT teaching software, make informatization teaching ideas deeply rooted in people's hearts, and exert a subtle influence on normal college students' informatization teaching behaviour [4].

According to the above description, the author thinks that the Internet technology can be used to develop an online teaching system for normal students to cultivate their information-based teaching ability, so as to effectively solve the above problems. This system adopts the mode of separating front-end vue.js and back-end Springboot, and is developed by using Javaweb technology. The system sets up two user ports, teacher client and student client, and designs online classroom courses through three stages of teaching ability training plan: resource retrieval ability, information teaching resource integration ability and professional teaching software use ability. It can effectively stimulate normal students' interest in learning, improve their ability of information-based teaching, and then improve their practical ability of information-based teaching. Teachers can adjust the arrangement of information-based teaching curriculum plan in time through the feedback of students' homework in the system, which can effectively increase the teaching time and improve the teaching efficiency [9].

2 Key Technology

2.1 Springboot

Springboot is a professional framework that can build a complete web application background quickly and efficiently. The framework is developed by Pivotal. This framework can make developers no longer need to focus too much on configuration templating, but only pay attention to the realization of business logic requirements. It can help developers solve many complicated configuration problems, reduce the difficulty of system implementation, and then effectively improve the comprehensive efficiency of developing web systems. WebSocket is the core function technology of the application system in the background. WebSocket server needs to connect, manage and send and receive data during the system operation. Springboot can add related dependency packages to the files of maven project building management tools. Developers use springboot to provide effective help and support to WebSocket server [1].

2.2 Vue.js

Vue is a progressive framework for building user interfaces. Unlike other large frameworks, Vue is designed to be applied layer by layer from bottom to top. Vue's core library only focuses on the view layer, which is not only easy to use, but also easy to integrate with third-party libraries or existing projects. On the other hand, when combined with modern toolchains and various supporting class libraries, Vue can also provide drivers for complex single-page applications. The famous family bucket series of vue.js, including vue-router, vuex, axios, plus vue-cli, is a core project from routing, data flow management and http request. The rich resources of vue community meet various needs in our daily development. Vue Scaffolding (VUE-cli) in VUE.js is a standardized development tool (development platform) provided by vue officially. It provides command line and UI interface, which is convenient for creating Vue projects, configuring third-party dependencies and compiling Vue projects. Vuex is composed of five parts: state, actions, mutations, getters and modules. It is a state management mode specially developed for Vue.js application. Axios framework (full name Ajax-I/O-System) is an http client for browsers and node.js based on promise, which can use Promise API [7] (Fig. 1).

2.3 Ajax

Ajax is asynchronous JavaScript and XML, which is a way to handle data interaction in web technology. It is not a new programming language, but a new method of combining technologies. Ajax integrates many existing web development languages with DOM technologies, including HTML, JavaScript™ and DHTML. Ajax is a new interactive web application development technology. Ajax can represent a technical language that combines XHTML and CSS in line with web standards. Ajax is used in asynchronous mode, so that when some web page data is updated, the server does not need to process the request information of the whole page, which is conducive to the development of a web application that occupies less memory and can make the system run faster, thus greatly improving the experience of the target users of the system in the process of using it [8].

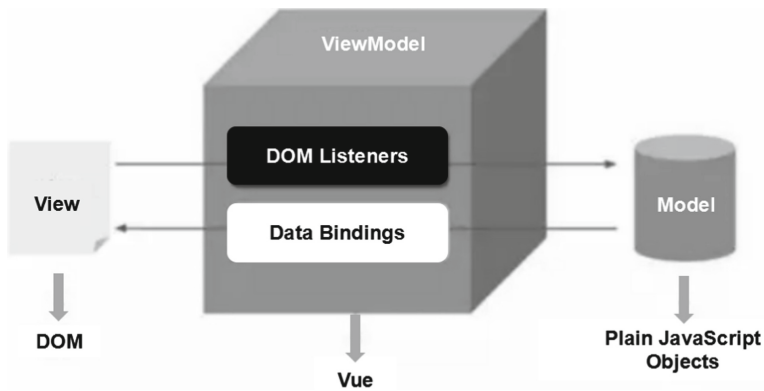


Fig. 1. MVVM mode diagram of vue

2.4 Development Environment

The online teaching system platform for normal college students' informatization teaching ability training is divided into two aspects: hardware environment and software environment. Windows 10, 64-bit computer with 16G memory in hardware configuration. This computer is equipped with Intel Core i5-10200H processor to ensure the reasonable operation of the physical environment for system development.

The software configuration of this platform is the front-end development framework Vue.js, the development tool is Visual Studio Code 2017, and the language used is HTML + CSS + JavaScript. The back-end development framework is SpringBoot, the development mode is SSM mode of spring + springmvc + mybatis, Apache tomcat is selected for server construction, and MySQL 8.0.28 is used for database. The back-end development tool is IntelliJ IDEA 2020. When using the SpringBoot framework for system development, maven project management tools are needed to manage all kinds of required libraries, and these libraries should be packaged into executable packages in jar format. Finally, these Jar packages are deployed on web servers. By describing the introduction of the above technologies, we finally determined the feasibility of building the development environment of the online teaching system for normal students' informatization teaching ability training.

3 Requirement Analysis

3.1 Function Requirement

Colleges and universities should explore ways and means of training by using curriculum learning and experimental teaching, so as to cultivate normal students' IT application ability in the current new era, and contribute to building a three-dimensional and systematic training system for normal students' teaching ability. The online teaching system for training normal students' informatization teaching ability can provide teachers and normal students with simple, convenient and practical informatization teaching

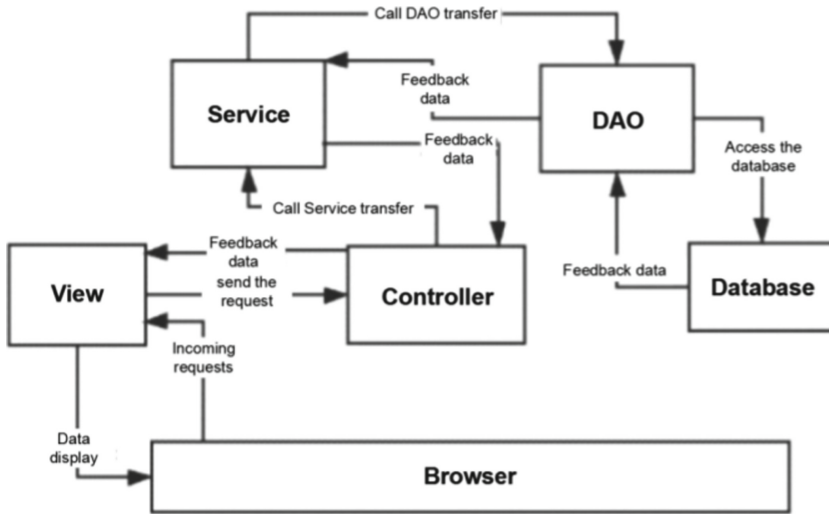


Fig. 2. Overall architecture of the system

functions. The system has developed four main functions: online classroom, extracurricular resource database, homework submission and teaching evaluation. Teachers and normal students can be free from the influence of time and space, so that they can learn in a fragmented way anytime and anywhere. In order to change the uneven level of information-based teaching resources, this system can make the teaching resources selected by teachers share and transmit on the platform, which is convenient for normal students to read and learn. The system has achieved a comprehensive learning system integrating “online learning, online homework and online evaluation” and achieved the purpose of knowledge exchange through the construction of online courses.

3.2 Global Design

The online teaching system platform for normal college students’ informatization teaching ability training is designed with B/S architecture and developed with MVC thought. The overall design architecture of the system is shown in Fig. 2.

The front and back of the system are separated, and the business model, user layer and controller of MVC mode are separated. The front-end interface design of the system is the view layer, which is designed by vue.js The task of the user interface of the view layer is to make users interact with the system through the browser. The browser submits the user’s access request and information to the server control layer through AJAX, and also needs to receive the request and other instructions returned from the back end.

In this paper, the back-end of the system is designed with the idea of layering. The back-end part includes controller layer, service layer and DAO layer, and the architecture of the system adopts springboot framework. The role of the controller layer is to realize the front-end interaction, receive the front-end request, respond to the data request of the service layer, and then return the packaged JSON data to the client for system interface display. Service is equivalent to the business logic layer, which is responsible for the

main business logic of the system and designs the algorithm code. Service layer can use the relevant data of MYSQL database to realize the basic functions of the project by calling Dao interface. The DAO layer is responsible for data persistence, and its main function is to encapsulate the method of contacting the system with the data into the CRUD interface, so that the database can be accessed in the DAO layer, because the system can write the operation statement code of adding, deleting, modifying and searching SQL in the XML file of the DAO layer [10].

4 Function Realization

According to the needs of teachers and normal students in colleges and universities, the information-based teaching ability training system for normal students has developed two user ports respectively, and developed four main functional modules: online video course learning, extracurricular resource learning, homework submission and teaching evaluation.

4.1 Student Client

4.1.1 Online Classroom

Click on the online classroom module, and users can see the online video classroom classification that will be divided into three ability training stages: the ability of information-based teaching resources retrieval, the ability of information-based teaching resources integration and the ability to use professional teaching software to cultivate normal students' information-based teaching ability. Click on the course of information-based teaching resource retrieval ability, and users can learn how to use search engine tools, text translation and resource downloading tools, manuscript reading tools, and superstar digital library. Entering the integration stage of information-based teaching resources, students and users will learn online education video downloading, digital text processing skills, graphics and image teaching resources acquisition skills, digital audio resources acquisition and processing, multimedia courseware development and production with PPT and Focusky, fine micro-courses production with CamtasiaStudio, etc. In the class hours of professional teaching software use ability stage, students of different majors learn different contents here. Normal students of physics, chemistry, biology and other subjects will learn to use the "NOBOOK Virtual Laboratory" software, and Chinese normal students will learn to use the "Chinese 100-point" software [3].

4.1.2 Extracurricular Resource Pool

Click to enter this function module, and student users can enjoy the information-based teaching resource library that is not required to study in the online classroom. Users can browse the resources according to their own needs, and the contents of the resources include: excellent PPT examples and templates classified by disciplines, knowledge supplement of instructional design theory model, electronic teaching materials, etc. There are download buttons at the bottom of all kinds of materials. Click Download, and the background will save the files to the default storage location of the system. Part of the downloaded java function implementation code is shown in Fig. 3 [6].

```

Public AjaxResult uploadStart(HttpServletResponse response) {
    //get the file path to download for the item
    String path = this.getClass().getResource("/").getPath() + "static/启动.txt";
    //through the path, get the file
    File file = new File(path);
    //determine whether the file exists
    if(!file.exists()){
        return AjaxResult.error("File does not exist! ");
    }
    FileInputStream fileInputStream = null;
    OutputStream outputStream = null;
    try {
        fileInputStream = new FileInputStream(file);

```

Fig. 3. Code for realizing file download function

4.1.3 Job Submission

After each class, the system will provide the function of submitting homework within a time limit. In the course stage of cultivating the ability of information-based teaching resources retrieval, students use the learned software to retrieve teaching resources, and the homework requires the submission of retrieval results. There are two forms for the submission of results: one is to integrate the resource retrieval results into docx document and upload them to the system, and the other is to directly submit the downloaded files to the system. For the file uploading function, part of the code of the function realization is shown in Fig. 4. The browser submits the file to the server in the form of stream during the uploading process. Course assignments in the integration stage of information-based teaching resources need to submit the completed PPT, recorded and processed audio and video. Some courses' homework requires submitting the process video of specific operation, and can rely on the screen recording function of the homework submission place of this system. After the user enables the screen recording tool, the user's operation will be recorded into a video file and saved. The code of the screen recording function written in Java language is shown in Fig. 5 [2].

4.1.4 Teaching Evaluation

Users can click the Enter Teaching Evaluation button, and they can see the scores and evaluations given by the teachers after each assignment submission. Students can adjust their learning ideas according to the teachers' evaluations, and they can also reply to the teaching evaluations given by the teachers, put forward their own problems in the learning process, solve them in time, and quickly improve their information-based teaching ability.

```

//1.set up diskFileItemFactory target , handle file upload path or size limit
DiskFileItemFactory factory = getDiskFileItemFactory(tempFile);

//2.get ServletFileUpload
ServletFileUpload upload = getServletFileUpload(factory);

//3.handle uploaded files
try {
    String msg = uploadParseRequest(upload, req, uploadPath);
    //repost
    req.setAttribute("msg",msg);
    req.getRequestDispatcher("info.jsp").forward(req, resp);
} catch (FileUploadException e) {
    e.printStackTrace();
}
}
}

```

Fig. 4. File upload function code

```

/**
 * use javacv Screen recording
 */
public class VideoRecode {
    //thread pool screenTimer
    private ScheduledThreadPoolExecutor screenTimer;
    //get screen size
    private static final int WIDTH = 900;
    private static final int HEIGHT = 600;
    private Rectangle rectangle;
    //video class FFmpegFrameRecorder
    private FFmpegFrameRecorder recorder;
    private Robot robot;
    //thread pool exec
    private ScheduledThreadPoolExecutor exec;
    private TargetDataLine line;
    private AudioFormat audioFormat;
    private DataLine.Info dataLineInfo;
    private boolean isHaveDevice = true;
    private long startTime = 0;
    private long videoTS = 0;
    private long pauseTime = 0;
    private double frameRate = 24;
}

```

Fig. 5. Screen recording function code

4.2 Teacher Client

In addition to browsing the functional content consistent with that of the students, when the teachers click on the videos or materials of the online classroom and extracurricular resource libraries, there are buttons for deleting, changing and adding at the bottom of the page. Teachers can maintain and manage the data of students. Online classroom video teaching resources are recorded by teachers through cameras, audio and video equipment and screen recording software according to the teaching plan. The resources of the extracurricular resource pool are uploaded by the resources most suitable for normal students selected by teachers through browsing various kinds of software. The teacher enters the homework function module, and by clicking Enter, you can view each class's homework submission by class hour, give a grade, evaluate it after class and submit it. Teachers can also get feedback of students' learning effect according to each student's homework submission, and adjust the arrangement of teaching curriculum plan in time according to the feedback information.

5 Conclusions

With the advancement of the Internet era, the information construction is constantly strengthened, and Internet technology is gradually integrated into all walks of life, including education. Therefore, in order to keep up with the development of the information age, the country needs to cultivate a large number of new teachers who can integrate the Internet information technology and the teaching ability of subjects. As the reserve army of education, normal students are precisely the key groups who need to cultivate the ability of information-based teaching. This system realizes a comprehensive learning system that basically integrates "online learning, online homework and online evaluation", and achieves the purpose of knowledge exchange through the construction of online courses. But there are still many shortcomings. Therefore, all sectors of the society should pay equal attention and attention to it, and increase the investment in the cultivation of normal college students' informatization teaching ability. Normal students can not only carry out targeted information teaching skills training through this system, but also participate in related skills competitions, ability display and other activities to strengthen their application. There is a lack of professional skills training and ability training in this system. It is hoped that colleges and universities can optimize this part and integrate professional practice into it, which can promote the improvement of information teaching ability of normal students and realize sustainable development.

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