



# Research on the Application of Web-Based Distance Education Teaching Support Service

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**Abstract.** The distance education teaching support service is the product of the development of network technology. It is based on the computer and uses advanced means such as the Internet to build an Internet-based environment, relying on big data platforms and cloud computing technology to achieve information resource sharing. This paper firstly expounds the distance learning system and its business process; secondly, it analyzes the problems and solutions encountered in the process of classroom upload and download by the traditional teaching management mode. Finally, through the investigation to understand the user's use of online education teaching support services, and to sort out the statistical analysis results, draw conclusions, and put forward improvement measures for distance education teaching support services.

**Keywords:** distance education teaching · resource sharing · analysis results · improvement measures

## 1 Introduction

With the development and popularization of Internet technology, distance education has been paid more and more attention. The advantage of distance education lies in unlimited time and space, which improves the flexibility and efficiency of learning, and allows students to learn in various scenarios, improving the comfort and convenience of learning [1]. On the basis of traditional distance education, the web-based distance education teaching support service application has become the development trend of distance education. It has the functions of educational resource sharing, teaching process management, interactive learning, and learning evaluation, which is of great significance for improving the quality and efficiency of distance education [2]. This paper focuses on the application of web-based distance education teaching support service, aiming to discuss from the following aspects:

(1) An overview of the application of web-based distance education teaching support services: including the concept, history and development trend of distance education, the characteristics and advantages of web-based distance education teaching support service applications, etc. (2) Principles and key technologies of web-based distance education teaching support service application: including system architecture, management of teaching process, sharing of educational resources and realization of interactive

learning, etc. [3]. (3) Ideas and methods of web-based distance education teaching support service application design: including requirements analysis, system design, database design, system implementation and other aspects. (4) Practice and application of web-based distance education teaching support service application: Taking the web-based distance education teaching support service application of a university as an example, this paper introduces in detail how to design and implement web-based distance education teaching support service application, so as to improve Educational quality and efficiency. (5) The future prospect of web-based distance education teaching support service application: the development trend and bottleneck of web-based distance education teaching support service application in the future, how to overcome the existing problems, and provide better services for a wider distance education field service and support etc.

The application of web-based distance education teaching support service is the current development trend of distance education, which is of great significance to improve the efficiency and quality of distance education. This article aims to analyze its principles, key technologies, design ideas and methods, practice and application, and future prospects, so as to provide reference and inspiration for scholars and researchers in the field of distance education.

## **2 Related Theoretical Basis**

### **2.1 Distance Learning**

Distance teaching is a new model of teacher-student relationship based on traditional education, using modern communication as a means to establish a network environment, and realize multiple functions such as interaction with students and teachers and sharing of learning resources. Its essence is to support face-to-face communication between teachers and students through computer technology and multimedia interactivity [4].

Network-based distance teaching refers to the connection of educational information and other resources through mobile terminal equipment or wireless network to realize remote control and provide students with learning materials and homework guidance [5]. Its essence lies in the use of computer technology and multimedia interactivity to support face-to-face communication between teachers and students.

### **2.2 Web Technology and Distance Education Support**

In the distance education support, it mainly means to meet the different needs of users by analyzing, using and processing the information provided by users. The remote teaching resource library, network server and interactive client are all established for user services.

### **2.3 Teaching Support Model Based on Web Service**

In the traditional teaching mode, teachers and students communicate face to face, which will reduce the learning efficiency after a long time. The distance education network provides an interactive and open platform for teachers and students to solve this problem.

The information is collected, stored, analyzed and processed through the web service interface; users can configure the resources they need to obtain anytime and anywhere according to their needs and meet their needs and other functional modules to form a model based on the Web teaching support system [6].

In the traditional classroom, there is a certain time difference between teachers and students when they communicate face to face, which affects the progress of learning, while the teaching support of distance education can be realized through interactive technology.

In the web service based on the Web environment, in the traditional classroom, there is a time difference when teachers and students communicate face to face, which affects the learning progress. However, with the development of Internet network technology and the wider application range, the increase in the number of users and the increasing usage, communication between teachers and students has become a possible trend; and distance education systems can use interactive technology to Information is transformed into teaching resources and its management is realized [7]. But in the distance education network, teachers and students can communicate in an interactive way, which solves the problem of time difference in the traditional teaching mode.

The remote teaching support system based on web services is based on the data flow and completes the analysis and design of user needs, resource management and development environment (B/S).

In the web-based distance education system, teachers can manage according to teaching content, students' learning progress and curriculum standards. At the same time, the sharing of user data and resources can also be realized through interactive technology [8].

In the distance education network, teachers can update, maintain and upgrade the system at any time according to the needs of teaching management. This requires it to provide real-time and flexible interactive functions. Through the application model, it can be seen that: firstly, it supports online learning services; secondly, it supports mobile terminals (such as mobile phones) (or tablet computers) to query and download online course information and can view it remotely; secondly, it supports curriculum standards, resource sharing mechanisms, and teachers and teachers. The teaching communication platform between students realizes the management of user data and resources.

### **3 Application Design of Web-Based Distance Education Teaching Support Service**

#### **3.1 Design Principles of Web-Based Distance Education Teaching Support Service Application**

The basic principles of the design of distance education teaching support service system are:

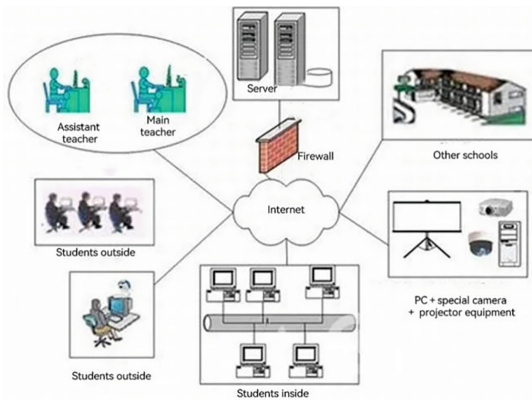
1. Modularization and strong scalability. Due to the different usage methods of teachers and students in traditional classrooms and some problems and uncertainties in the application process. Therefore, in order to solve these difficulties, it is necessary to continuously improve and optimize the functional module structure of the development tools [9].

2. **Strong scalability.** The design of the distance education teaching support service system is a huge and complex engineering project. During the development process, the development of various technologies such as software engineering and databases needs to be considered. All these require that the system design must be open to adapt to the future distance education. Teaching mode and environment changes; in addition, full attention should be paid to its scalability (including data storage and processing).
3. **Easy maintenance.** Because there are many functional modules on the market that have not been fully integrated. Therefore, good protection measures should be provided for the application so that it can be continuously improved and realize its value in the future system [10].
4. **Openness.** Since the teaching mode of distance education is a very complicated project, it is necessary to consider that there may be certain differences between different types, different time periods and different user needs (such as time span, etc.) The scale continues to expand and become more fuzzy; on the other hand, we should also pay attention to the openness of system design, so that it can meet the data processing requirements of more application fields.
5. **Generalization and standardization.** Because the teaching mode of distance education has strong application and practical characteristics, it should fully consider the system construction, data transmission and processing in the development process, so that it can meet the requirements of different users for the same functional module [11].
6. **Practical.** In order to allow users to better use computer technology to serve learners, a network course system (websedic) is designed that meets the development needs of the times and can be widely used and promoted by the society; at the same time, it should also be noted that the system should have certain scalability., in order to meet the requirements of users in different application fields for course architecture, network bandwidth and transmission methods.
7. **Portability.** Since the distance education teaching mode is one of the highly practical and highly flexible technology-intensive project types, it should be developed and designed with the concept of sustainable development as much as possible; when choosing which method to use Whether the system is suitable for a certain type of application environment and equipment conditions should be considered to determine which technology or tool to choose and how to realize data communication and sharing between different functional modules [12].

## **4 Design and Realization of Teaching Support Service Application Platform for Distance Education**

### **4.1 Structure of the System**

The traditional teaching support service system mainly includes: distance education resource management, curriculum setting and release, online examination, teacher training, student message and other modules (Fig. 1).



**Fig. 1.** System structure diagram

(1) In terms of user authority control, a method based on the combination of role relationship and authority assignment is adopted. The model realizes its functional requirements by authorizing different types of personnel; at the same time, it also establishes a corresponding level of data interface and converts the information into a system-level file in this way to store it at any time for calling, querying, and statistical processing; Design and develop a remote teaching support service management platform, the data exchange of the platform can be realized through the interface [13]. (2) In terms of course management, the system adopts a method based on the combination of role relationship and authority distribution. Users can perform different levels of operations on teachers and students, and can also increase or decrease some functions according to the corresponding level restrictions; at the same time, a functional module for online examinations and correction of test papers is also designed: administrators, teachers and students three Participants who make up the platform jointly use the model to realize their role. (3) In terms of course management, it adopts a method based on the combination of role relationship and authority distribution. The system interface is friendly, simple and clear, which is convenient for users to operate and use.

## 4.2 Teaching Platform Modularization

The modular design of the teaching support service system is to effectively upgrade the traditional education teaching mode, making it more adaptable to the distance learning environment, and providing students with better, more comprehensive and higher-level online assisted learning. In this case, it is necessary to put multiple different types of courses on one page for users to choose the corresponding resources according to their own needs (Fig. 2).

First analyze from a functional point of view:

The first aspect is to meet the requirements of both teachers and students for the use of the system; the second aspect is to realize the teaching support service, and at the same time, to design and develop the distance education teaching platform, to realize the interaction between teachers and students. The third aspect is the design and development

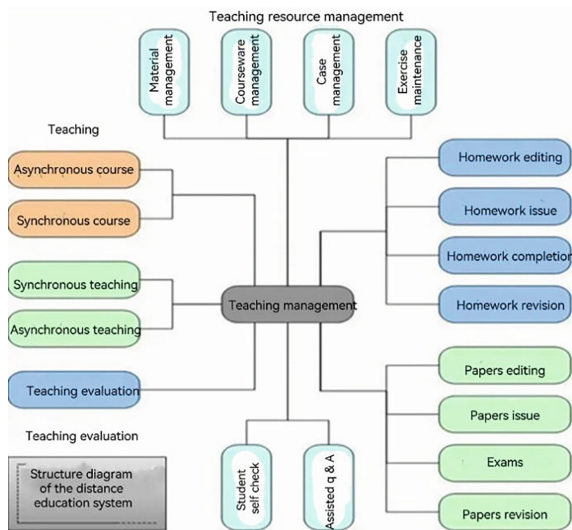


Fig. 2. Modular design diagram

of the teaching platform, which to a certain extent meets the user’s needs for the use of distance education in the network environment, and also provides a good foundation for the development of network technology. The modular design of the teaching platform is mainly to divide it into different parts, and then divide it in different functions, so as to meet the user’s application requirements in the distance education network environment.

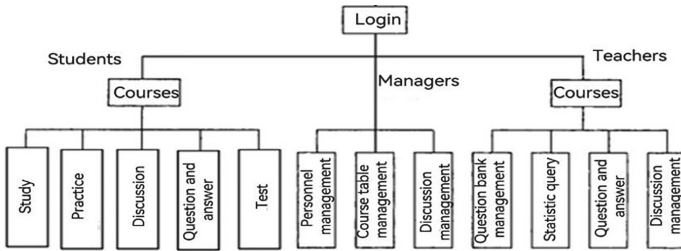
4. Real-time monitoring and processing information data and other related content mainly include: server log records The detailed status of all documents and other resources is stored in the analysis system, which will also affect the operating efficiency of the distance education teaching support service platform to a certain extent.

## 5 Operation of Teaching Support Service System in Distance Education

### 5.1 Functions of the System

The distance education teaching support service system is a multifunctional and multi-type network community provided for distance education institutions and individuals. It has the following functions:

1. Management and maintenance. In the development process, “user interaction” and background database technology are adopted. By inputting and exporting the data information of the online teaching system, and realizing the corresponding operation according to the relevant requirements; at the same time, after analyzing and processing the data collected by the front end, it is sent to the server of the distance education institution to receive and release the required information content, time and completion. The user’s task situation is fed back to the terminal service personnel to realize the management of teaching information and resources. 2. Remote service. During the



**Fig. 3.** Functional diagram

development process, the system will collect data through the server, including: user registration, login address authentication; teacher role login authorization; after logging into the teaching system, students can learn courses online and query grades and other functions, and an application platform that supports online Q&A functions. The main purpose is to provide a convenient, efficient, convenient and reliable interactive environment to support the system requirements analysis report and maintenance that needs to be realized. 3. Management and protection. In the development process, the “friendly man-machine interface” is adopted, and the user can manage the operation interface, set the authority of the teacher’s role, and realize the functions of login, registration and authorization in the system (Fig. 3).

## 5.2 Add Some Data Applications to the Application of Distance Education Teaching Support Service System

### 1. Application Scenarios of Distance Education Teaching Support Service System.

The application of distance education teaching support service system is mainly reflected in the following points:

- (1) Through big data technology, realize the effective management of learners’ personal information, interactive passwords, etc. For example, teachers can set up a “teaching plan publishing group” within the class on the Internet and students can upload their own file content and other resource sharing platforms; at the same time, they can also transmit the course videos downloaded by students and the answers to exercises after class to the remote network in real time. Go to the education network or mobile terminal.
- (2) Use big data technology to collect and analyze information such as learners’ teaching situation and workload, and provide accurate data support for the distance education teaching management department. For example, teachers can publish the internal learning situation of the class on the Internet, and check, test and count the courses downloaded by students; at the same time, they can also realize real-time analysis and sorting of uploaded files according to big data technology [15].
- (3) Share resources to different types of users (such as administrators) through mobile devices so that they can use various distance teaching service software or application systems anytime and anywhere to support their daily teaching activities, etc. 4. Through the relevant resources provided by the distance education teaching support

service system, teachers can choose courses suitable for their own needs to study according to their own needs.

## 2. Application test of distance education teaching support service system.

After designing and implementing the web-based distance learning support service, we applied it to the distance learning college of Xiamen University and conducted a period of application testing. Application test results show that the system has reached the following main technical indicators. System functions: The system has rich functions and generally meets the application needs of academic circles and students. System performance: The system is stable, safe, and reliable, with strong access responsiveness, strong scalability, and easy maintenance. On a Pentium IV 2.4G computer with 512M memory, there are about 50 people online each time, and the access speed is relatively fast, with an average response speed of about 0.8s; on a DELL server with up to 3.0G and 2G memory On the Internet, the number of people online each time is about 120, and the average response speed is about 0.75s. Effects of use: easy to use, intuitive and powerful. Interactivity increases teacher effectiveness and student learning effectiveness. The detailed test results of the system are as follows:

### (1) System static test.

In the static test of the system, the code is mainly checked statically using the PC-Lint static code analysis tool. PC-Lint produced by GIMPEL SOFTWARE is a software quality assurance tool similar to a stricter compiler. It can perform the most careful syntax check on C and C++ codes under Windows and Unix platforms. It can not only check general syntax errors, You can also check for potential errors that are grammatically correct but not easy to spot. Using PC-Lint, some suspicious codes were checked, and then related codes were corrected, and some suspicious data type conversions were casted.

### (2) CPU and memory usage.

As can be seen from Table 1, during the test period, as the number of users increases, the average CPU usage of the IM server increases steadily; however, for the database server, due to the large amount of processing, reading, writing and uploading It will only be done when the customer logs in, and relatively little processing is required in other cases, so the average CPU usage of the database server increases with the workload, which is not as obvious as the IM server. In general, the average CPU usage of the IM server and database server increases with the number of users, which is also expected before the test.

**Table 1.** Average CPU usage

Number of users	IM Server (%)	Database server (%)
5000	6.6	5.2
10000	11.4	7
20000	19.4	10.6



**Table 2.** Average memory usage

Number of users	IM Server (%)	Database Server (MB)
5000	25.24	625.25
10000	37.31	671.84
20000	59.58	783.26

As shown in Table 2, as the number of users continues to increase, the software memory overhead on the IM server and the overhead of the entire database server show a corresponding linear increase, which is also expected. It can be seen from these two tables that the CPU usage is relatively low and the memory overhead is moderate, so the program design is reasonable.

(3) Response time.

As Table 3 shows, the average response time was independent of the number of users throughout the tests. As the number of users increases further, the average response time.

(4) User volume load test.

The main purpose of stress testing is to conduct a comprehensive test and evaluation of the server load. For example, measure the maximum number of online users that an IM server can actually handle, that is, the capacity of the server. Under the constraints of relevant service quality indicators, the number of services that an IM server can effectively provide is limited. This article uses a “fake client” to simulate a login. The console pseudo-client only has the ability to log in and send text messages, so it is a shortcut for normal client functionality. In the experiment, the fake client was set to continuously send text messages after logging in to the server to increase the load of the stress load test. At the beginning of the test, the IM server could only accept connections from about 10,000 users. When the number of users exceeds 10,000, the connection response time is significantly reduced, often causing fake clients to fail to log in. By improving the server-side data structure, a server can finally handle up to 26,000 fake client connections within 24 h.

(5) System functional test.

**Table 3.** Average response time (unit: second)

Action	5000	10000	20000
Initiate a chat	1	1.1	1.1
Get premiere information	0.3	0.3	0.3
Send a second message	1.3	1.3	1.2
Get a second message	1.2	1.2	1.1
Add contact	0.4	0.4	0.4

In this test, we use the WinRunner 7.6 script tool to repeatedly test several major functional modules, such as the text communication module and the online update module, in a batch-like manner. The issue was determined to be a memory leak caused by some resources not being fully freed, and the issue was addressed by optimizing the code.

## 6 Conclusion

With the popularization and application of distance education, traditional teaching methods can no longer meet the needs of modern learning. In order to improve the interaction between teachers and students and the relationship between teachers and students, great breakthroughs have been made. This paper analyzes and studies the role of distance education technology in the field of mobile communication, network platform construction and management.

Firstly, it introduces the impact of this topic on the current social development of our country; then, according to its characteristics and its functional modules, it designs and develops a teaching support service system based on web applications, and in the design and development of its basic functional modules, it introduces the distance education technology. It is applied to the teaching mode of mobile communication, network platform construction and management, etc., and it is deeply analyzed; finally, it is proposed that the system realizes the required data transmission mode, interactive mode and information content. On the basis of the system, the distance education teaching support service management platform is designed, and in the process of software development, relevant functional modules and applications are realized in combination with actual needs. Through the above analysis, the system has strong applicability, can meet the teaching needs of distance education, and has good promotion value.

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