

PAPER

A PHP Framework-Based Web-Based Instruction Platform

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ABSTRACT

This paper combines the emerging Internet with actual student classrooms to design a PHP-framework-based web-based instruction platform, aiming to improve students' learning efficiency after class. This system uses the PHP language and integrates MVC-based ThinkPHP, Bootstrap, jQuery's \$, ajax asynchronous request, art-template rendering, and other technologies. The interface of the system is simple and easy to operate, with various layout styles and display effects. Students can increase their interest in learning and improve their learning efficiency by watching the teaching videos on the website. The system summarizes a large amount of teaching resources and information to promote the structure and mode of reform in education and teaching. Such an intelligent platform with permanent knowledge preservation and instant sharing features effectively motivates students' learning efficiency, interest, and initiative.

KEYWORDS

platform, web, instruction, education, framework

1 INTRODUCTION

With the wide application and rapid development of contemporary information technology in the field of education, new teaching modes such as computer-aided teaching and management, multimedia teaching, campus networks, and distance education appear frequently [1–4]. This trend leads to an increase in high-tech content in educational activities, resulting in the emergence of new laws and characteristics in the development of education. Various factors, such as educational goals, curriculum, evaluation, school operations and management, teacher training, scientific research, and teaching methodologies, all evolve with changes in learning methods. In the process of learning, students not only learn cultural knowledge but also need to use new technologies to enhance their learning and innovation capabilities. For thousands of years, the classroom indoctrination of teacher-teaching has been established. The traditional teaching mode, where teachers use chalkboards, chalk, and students use textbooks and pens is being replaced by new teaching modes such as multimedia computers, information superhighways, and the combination of students' self-study and classroom teaching.

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In the modern age of knowledge explosion, how to learn better is a challenging issue for everyone. With the rapid development of computer technology and broadband networks, the university's comprehensive network teaching platform provides new means and methods for university teaching [5–8]. To some extent, the use of online teaching platforms represents a revolution in college education. Since the mid-1990s to the present, computer networks have been widely used in colleges and universities, leading to the emergence of the campus networks in various academic institutions. However, the development of campus network in teaching has been relatively slow, and it has not played its due obvious role. In terms of teaching objects, the more utilitarian distance education while enough emphasis is given to traditional school education. The vigorous development of online teaching, the emphasis on students' actual needs for teaching resources, and the integration of information technology and course information promote teaching reform. This is an effective way to cultivate innovative talents and is the embodiment of the full application of educational technology in teaching.

Under the guidance of certain teaching theories and ideas, web-based instruction is a teaching mode that uses multimedia and network technology to achieve teaching objectives through the multilateral and multi-directional interaction of teachers, students, and media and the collection, transmission, processing, and sharing of multimedia teaching information. Compared with the existing methods, this teaching mode has the following advantages:

Web-based instruction support platform refers to the general term for software systems that provide comprehensive support services for network teaching based on the Internet [9–13]. It is not classroom teaching that replaces the traditional way, but a mode that integrates the web-based instruction mode and classroom teaching. Such a brand-new teaching mode absorbs the advantages of traditional classroom teaching, overcomes weaknesses such as time and space constraints, and gives full play to web-based instruction advantages.

Studies have shown that learners on almost all online teaching platforms spend a lot of time on video courses [14–16]. This is because most of the online courses are delivered through video. At the same time, nowadays, larger user groups of online teaching platforms put high demands on the load capacity of the network. In the traditional client/server (C/S) model, the computing power of the system is completely dependent on the performance of the server. The fault tolerance of this model is relatively poor, and the server can be overloaded easily.

On this account, this study first utilizes Bootstrap framework technology for the front page design and then uses jQuery's \$.ajax asynchronous request method to request data. Further, the data is rendered using the art-template rendering technique, and the web-based teaching platform is coded using the PHP technique.

2 DEVELOPMENT ENVIRONMENTS AND TECHNOLOGIES

PHP has excellent cross-platform compatibility with various platforms. There are currently two mainstream development integration environments. One is based on the Windows operating system. This development environment is based on Windows and integrates Apache, PHP, and MySQL together. The other is based on Linux systems. This development environment integrates Apache, PHP, and MySQL based on Linux. The configuration environment for these two different systems is similar. These integrated environments have achieved twice the result with half the effort for developers. It eliminates the configuration work of servers and databases under different systems, has a simple operating interface, and is free software.

ThinkPHP is the most popular MVC mode for web development today. It draws on the Struts framework, action ideas, and JSP's TagLib tag library. The controller accepts all client requests through the framework. The controller determines the processing method of Action through the configuration file `struts config.xml` and the received parameters, and finally responds to the model. The advantages of referencing the Struts framework include: firstly, it has the advantages of MVC mode, with clear structural hierarchy, low coupling, and high reusability; Secondly, it is an open-source framework with a well-developed system. Finally, it has a powerful tag library that effectively avoids coupling between the view layer and other layers.

MVC is a design pattern composed of M (model), V (view), and C (controller), which is widely present in current software development ideas. The most important advantage of this pattern is that it achieves code separation. In the view layer (V), use HTML-CSS to layout the interface, and the controller (C) uses server-side language.

This paper adopts PHP, and the model layer (M) uses the database language. Each part achieves complete independence. In this way, after establishing the database model and controller, different views can be used to represent and operate. If there are duplicate operations in the data processing of the database, there is no need to rewrite the database model code. In addition, when modifying MVC projects, the required workload is minimal due to the complete separation of various parts.

3 PLATFORM DESIGN

The system is designed based on the PHP framework and MVC pattern. The main sub-functions are course management, teacher management, video management, permission management, and so on. At the same time, the overall structure of the website, the technical architecture of the system, and the functional architecture are further designed. The key functions of the website are realized by using Bootstrap framework technology, jQuery's \$.ajax asynchronous request method, art-template technology, and other technologies.

3.1 Database

Based on the MySQL database [17–19], a total of six data tables are designed as shown in Figure 1.

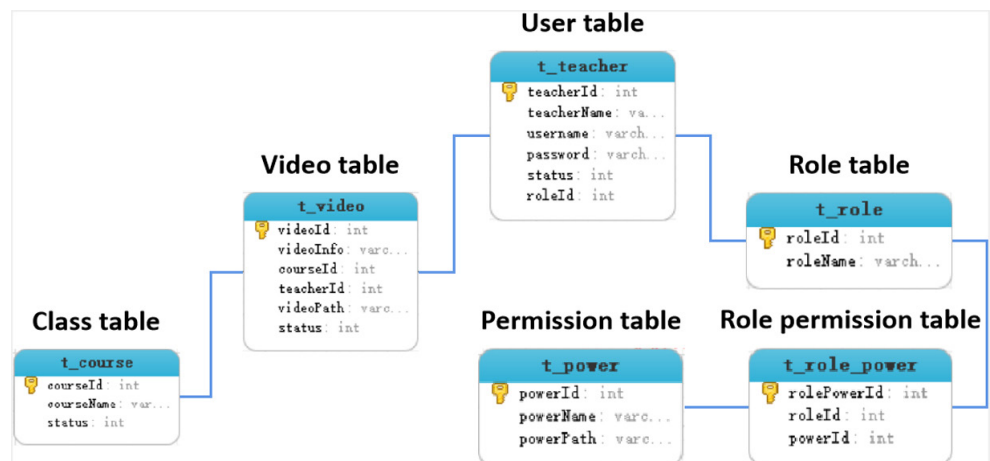


Fig. 1. Components and details of the designed database

In Figure 1, each table has a corresponding foreign key to connect. Specifically, the class table and the video table are connected through the class identity document (ID). The video table and user table are connected by user ID. The user table and role table are connected by the role ID. The role table and the role permission table are connected through the role ID. The role permission table and the permission table are connected through the permission ID.

Data tables are divided into main tables and sub-tables. Therefore, when adding and deleting data, a certain order must be followed; otherwise, the data operation will fail.

A basic description of the database creation source code is shown here. When assigning different roles to users, one user may correspond to multiple roles or just one role. Each role has different permissions, making the permissions of different users have more combinations. Different users can also upload corresponding course videos according to the courses.

The highlight of the source code design is that the designed role table and role permission table are easy to maintain and increase the program's practicability. Since different users may correspond to one or more roles, we only need to assign different permissions to different roles to change the permissions of different users. This achieves the effect that the corresponding permissions can be modified without frequently modifying the user table.

3.2 PHP-based background server

Connection to database. Every Ajax request will initiate an operation to add, delete, check, or modify the database. In order to increase code reusability and reduce frequent database connection operations, database connection code fragments are extracted separately. In this file, the database to be connected, username, password, etc. A sample code fragment is provided below.

```
/Acquire connection object/
Function getConn(){
$url="localhost:3306";
$user="root";
$password="123456";//If there is no password, it is an empty string.
$database="videodatas";
$conn=mysqli_connect($url,$user,$password,$database);
mysqli_query($conn,"set names utf8");
Return $conn;
}
```

\$url represents the address of the machine, \$user stands for the username of the connected database, \$password indicates the password, and \$database is the name of the database to be connected.

Operation on database. Any operation of the user, such as logging in, obtaining various permissions, viewing the corresponding page, adding courses, adding teachers, modifying video status or uploading videos, etc., will send Ajax requests, which include a series of additions, deletions, checks, and modifications. Therefore, the operations of adding, deleting, modifying, and checking (ADMC) the database are also extracted and placed in a folder to increase the reusability of the code. A sample code snippet is given below.

```

/ADMC operation/
function update($sql){
$conn=getConn();
$result=mysqli_query($conn,$sql);
mysqli_close($conn);
return $result;
}
/Increment and return the primary key value/
function insertReturnKey($conn,$sql){
$result=mysqli_query($conn,$sql);
if($result){
$id=mysqli_insert_id($conn);
return $id;
}
return false;
}
/Query operation/
function query($sql){
$conn = getConn();
$result = mysqli_query($conn,$sql);
$list=[];
while($row = mysqli_fetch_assoc($result)){
$list[]=$row;
}
mysqli_close($conn);
return $list;
}

```

After importing the DButil.php file in each PHP script, the connection to the database can be completed and the database can be added, deleted, checked, and modified.

PHP data return. Each operation will trigger an Ajax request to return the corresponding results. Therefore, all the results returned by the PHP server are returned in the form of objects, including the returned data and status code. In the callback function, after the request is successful, you can judge the result of the request according to the returned status code. Such a method of returning an object plus a status code facilitates the subsequent judgment of data request results and determines the processing method of data. A sample code snippet is shown below.

```

if($courseName1==""){
$result=[
"code"=>0,
"msg"=>"Course update failed, course name cannot be empty!"
];
}
if($arrselect){
$result=[
"code"=>1,
"msg"=>"Course update failed, course name is duplicated!"
];
}

```

```

if(!($arrselect || $arrselect2['courseName']=$courseName1)&&$courseName1!="")
{
$sql="update t_course set courseName='{ $courseName1}'where
courseId={ $course1}";
$arr=update($sql);
$result=[
"code"=>2,
"msg"=>"Course updated successfully"
];
}
header("Content-Type:application/json;charset=utf-8");
echo json_encode($result);
?>

```

3.3 Bootstrap-based front-page drawing

Bootstrap comes from Twitter and is currently a very popular front-end framework [20–22]. The concise and flexible Bootstrap is based on HTML (Hypertext Markup Language), CSS (Cascading Style Sheets), and JavaScript, which makes web development faster. It was developed by Twitter designers Mark Otto and Jacob Thornton and is a CSS/HTML framework. Bootstrap provides elegant HTML and CSS specifications, written by the dynamic CSS language Less. Bootstrap has been very popular since its launch and has always been a popular open-source project on GitHub. It's not just NASA's (National Aeronautics and Space Administration's) MSNBC (Microsoft National Broadcasting Company's) Breaking News that uses the project. Some frameworks familiar to mobile developers, such as the WeX5 front-end open-source framework, are also based on Bootstrap's source code for performance optimization.

The advantages of Bootstrap are: improved development efficiency; name definition is standardized and easy to maintain; project development process is standardized; CSS code is clearer and simpler; HTML code is more reasonable; and user downloads can be reduced in large-scale projects.

Bootstrap provides a basic structure with a grid system, link styles, and background. Meanwhile, Bootstrap comes with characteristics such as global CSS settings, definable basic HTML element styles, expandable classes, and an advanced grid system. In terms of components, Bootstrap includes more than a dozen reusable components for creating images, drop-down menus, navigation, alert boxes, pop-up boxes, and more. Finally, Bootstrap includes a dozen custom jQuery plugins. In this system, pop-up plugins toastr, jquery-3.4.1, and chart data visualization graphics are adopted.

3.4 Data request and rendering

Data request. All data request methods in this system are \$.ajax asynchronous request methods of jQuery. First, the PHP server is started, and the correct PHP script path is accessed through Ajax. Further, the corresponding request type (post or get) is set. Finally, the parameter data is passed, and the returned data type is set to json. Note that if the parameters in the form need to be passed during the request, the form serialization operation is required.

In the callback function of a successful request, the corresponding request data is returned. According to the status code and result included in the data object returned by PHP, the corresponding judgment is implemented. The previously mentioned

toastr pop-up prompt plug-in is used to display the page with richer effects. Under different status codes, the data are processed to different degrees, including destructuring assignment, data disassembly, merging, and other operations. A sample code snippet is shown below.

```
//Add teacher
function teacherAdd(){
let f8=$("#form8")[0];//Table serialization
let formData8=new FormData(f8);
$.ajax({
url:"./service/teacherAdd.php",
Method:"post",
Data:formData8,
dataType:"json",
contentType:false,
processData:false,
}).done((result)=>{
console.log("Add teacher:",result);//According to the status code pop-up window
If(result.code==0){
toastr.error("Failed to add teacher,"+result.msg);
}else if(result.code==1){
toastr.error("Failed to add teacher,"+result.msg);
}else if(result.code==2){
toastr.success(result.msg);
reloadTeacher();
}else if(result.code==3){
toastr.error("Failed to add teacher,"+result.msg);
}else if(result.code==4){
toastr.error("Failed to add teacher,"+result.msg);
}
}
```

Data rendering. The established platform uses Tencent's art-Template rendering technology to render the page. After the data request is successful, the data must be processed accordingly; otherwise, the obtained data cannot be used. In order to render the page accurately, the relevant data needs to be processed into the corresponding format. Table 1 presents the effect of page rendering. The sample code is as follows:

```
main:Array(4)
0:{teacherId:"4001",teacherName:"San
Zhang",username:"zhangsan",roleName:"Super administrator",status:"1"}
1:{teacherId:"4002",teacherName:"Si      Li",username:"lisi",roleName:"Super
administrator",status:"0"}
2:{teacherId:"4003",teacherName:"Er
Wang",username:"wanger",roleName:"General administrator",status:"1"}
3:{teacherId:"4004",teacherName:"Zi
Ma",username:"mazi",roleName:"Teacher",status:"1"}
Length:4
__proto__:Array(0)
<!-- Example of teacher managing tables*****-->
<script id="template1" type="text/html">
```

```

{{each main teacher}}
<tr>
<th>{{teacher.teacherId}}</th>
<td>{{teacher.teacherName}}</td>
<td>{{teacher.username}}</td>
<td>{{teacher.roleName}}</td>
{{if teacher.status==1}}
<td class="text-success">Activate</td>
{{else}}
<td class="text-danger">Disable</td>
{{/if}}
<td>
{{if teacher.status==1}}
<button type="button" class="btn btn-danger btn-sm"
onclick="teacherStop(this)">Disable</button>
{{else}}
<button type="button" class="btn btn-info btn-sm"
onclick="teacherStart(this)">Activate</button>
{{/if}}
<button type="button" class="btn btn-warning btn-sm"
onclick="rePassword(this)">Reset password</button>
<button type="button" class="btn btn-primary btn-sm"
data-toggle="modal"
data-target="#settingTeacher" value="{{teacher.teacherId}}"
onclick="doUpdate(this)">Update</button>
</td>
</tr>
{{/each}}
</script>

```

Table 1. Page rendering effects

Teacher No.	Teacher name	Login account	Account permission	Account status	Operation		
4001	San Zhang	zhangsan	Super administrator	Enable	Disable	Reset paassword	Update
4002	Si Li	lisi	Super administrator	Disable	Enable	Reset paassword	Update
4003	Er Wang	wanger	General administrator	Enable	Disable	Reset paassword	Update
4004	Zi Ma	mazi	Teacher	Enable	Disable	Reset paassword	Update

4 PRACTICAL EFFECTS OF WEB-BASED INSTRUCTION PLATFORM

4.1 Account login setting

The account settings for different users are realized through the following code:

```

insert into t_teacher values (null,"San Zhang","zhangsan","000000",1,1001),
                             (null,"Si Li","lisi","000000",0,1001),
                             (null,"Er Wang","wanger","000000",1,1002),
                             (null,"Zi Ma","mazi","000000",1,1003);

```


According to the data in the database, the available user names and passwords are shown in Table 2.

Table 2. Username and password settings in the database

Username	State
zhangsan	Available
lisi	Banned
wanger	Available
mazi	Available

When someone logs in as a banned user, they will be restricted from logging in and will be shown as banned.

4.2 Main page

In the process of data simulation for the system platform, all data, tables, graphics, etc., on the home page are requested from the background database and then rendered on the page, so these data are relatively real and effective. When the homepage is a responsive page, it has different layout styles for different screen sizes. Through different degrees of page viewing, the displayed effects are different (see Figures 2 and 3).

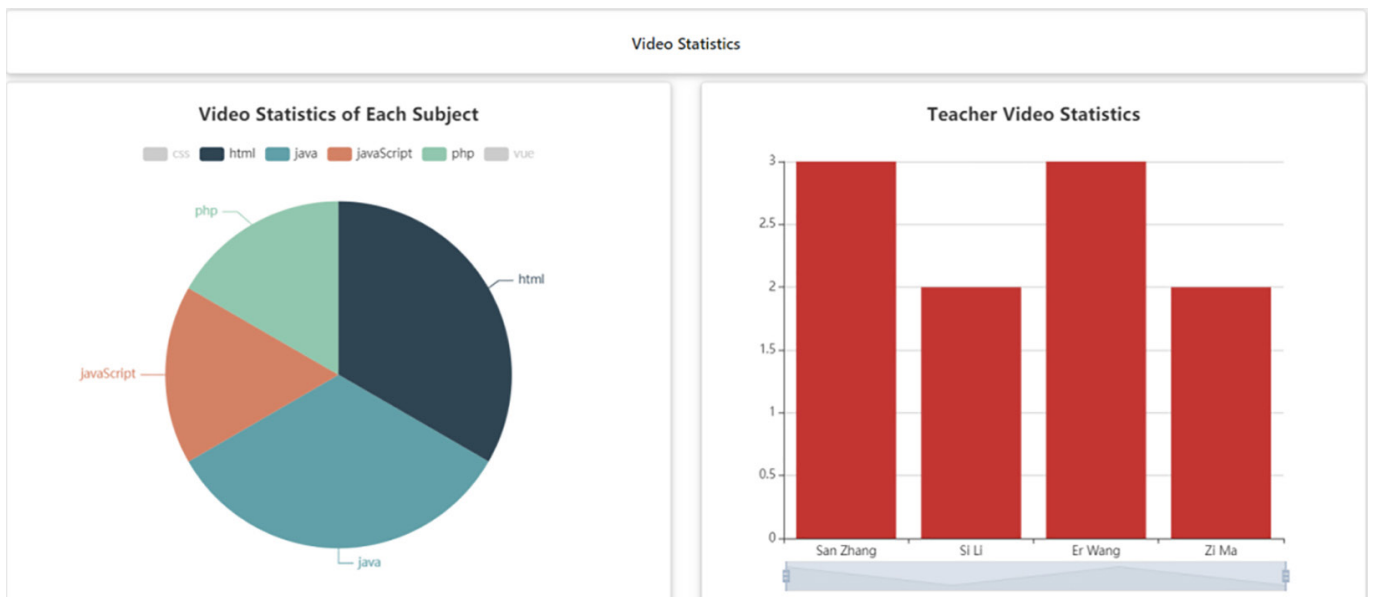


Fig. 2. A full screen mode

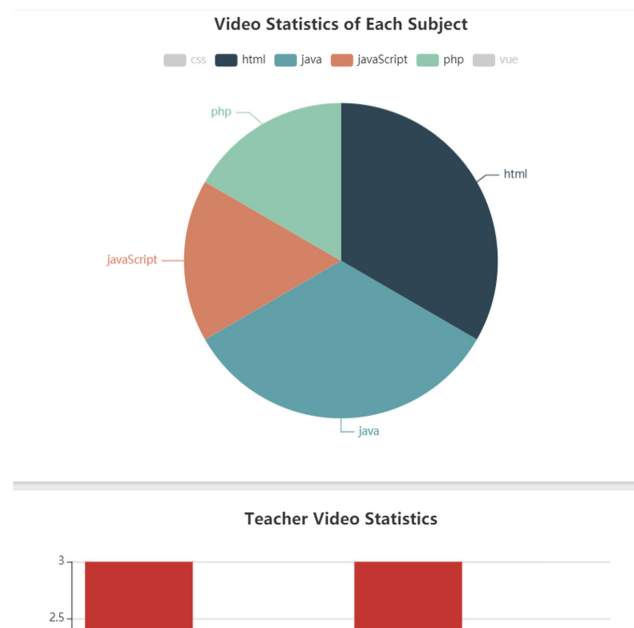


Fig. 3. A non-full screen mode

Side navigation bar. The homepage is divided into the side navigation bar and main content. The number of side navigation bars is differentiated according to the different permissions of different roles corresponding to the user. There are six permissions in total, namely video statistics, permission management, course management, teacher management, video management, and my videos. Users who log in with different permissions display different content.

Main content.

Video statistics module. The video statistics interface is divided into two ECharts graphics. The pie chart shows the statistics of videos for each subject according to subject classifications. The histogram shows the video statistics of each teacher according to teacher classifications.

The code for the video statistics is as follows.

```
{data1:Array(6),data2:Array(4)}
  Data1:Array(6)
    0:{name:"css",value:"2",status:"0"}
    1:{name:"html",value:"2",status:"1"}
    2:{name:"java",value:"2",status:"1"}
    3:{name:"javaScript",value:"1",status:"1"}
    4:{name:"php",value:"1",status:"1"}
    5:{name:"vue",value:"2",status:"0"}
    length:6
  __proto__:Array(0)
  Data2:Array(4)
    0:{name:"San Zhang",value:"3"}
    1:{name:"Si Li",value:"2"}
    2:{name:"Er Wang",value:"3"}
    3:{name:"Zi Ma",value:"2"}
    length:4
  __proto__:Array(0)
  __proto__:Object
```

Note that when the status is 0, it means the course is disabled. At this time, the video is not displayed, or the corresponding area is displayed in gray in the pie chart.

Permission management module. Permission management is divided into permission and role maintenance. Based on permission maintenance, all permission names and paths in the database can be queried and displayed, and permission can be updated and added. In the permission update module, the permission number can be set as the primary key and cannot be modified. Only the permission name and display page are allowed to be modified. In the permission-adding module, the permission name can be added and the permission template page can be selected. It should be noted that the permission name cannot be repeated; otherwise, the addition will fail. This maintenance is mainly to update and maintain permission paths for all six parts, and new permissions can also be added at the same time.

On the role maintenance interface, it is feasible to view the role names and permissions corresponding to different roles and to add and update roles. Adding a role requires selecting a role name and permissions. When updating the role number as the primary key, only the role name and permissions can be updated. In role maintenance, different roles can be added, and different permissions can be set for different roles to realize the management of different users. For example, the super administrator has the highest authority, but ordinary users only have use authority. Note that the role name cannot be repeated; otherwise, the addition will fail.

Course management module. The course management module displays all course names in the database and can perform fuzzy queries on courses, change course status, and update courses. In the course search module, through the search of course keywords, all courses containing keywords in the course name can be displayed. After updating the course status module, the course status can be set to enabled or disabled. In addition, only the course name can be updated, but the primary key number cannot be updated. The course name cannot be repeated; otherwise, the change will fail.

Teacher management module. The teacher management module displays the names, account numbers, corresponding roles, and account status of all users and can search, disable, reset passwords, and update user information for users. In terms of the search teacher function, a fuzzy query function is provided. We only need to search for the keywords in the name, and the names of the teachers who contain the keywords will be displayed. In terms of enabling the disable function, when the user is disabled, they cannot log in from the home page; that is, a pop-up window that says you have been banned will be displayed when logging in. When enabled, users can log in normally. In terms of the user update function, the primary key of the teacher number cannot be modified, but the teacher name, account number, and corresponding role can be modified. The name and account number cannot be repeated; otherwise, the modification will fail.

Video management module. The video management module shows the videos corresponding to all subjects, the teachers they belong to, the video introduction, and the video status. In this interface, videos can be downloaded and video status can be handled.

The status of the video is divided into pending review, review approved, video on the shelf, video off the shelf, and review failed, and each corresponds to the operations that can be performed. The details are shown in Table 3.

Table 3. Video status and corresponding operations

Video Status	Capable Operation
Pending review	Submit review
Review approved	On shelves
Video on shelves	Off shelves
Video off shelves	On shelves
Review failed	Submit review

Different page effects can be rendered according to the different video states in Table 3. Meanwhile, multi-condition query functions such as courses, names, and video statuses are provided. In this way, through the combination of multiple conditions, the desired results can be queried faster and more conveniently.

My video module. My video module displays all videos of the currently logged-in user. This page can also perform multi-condition queries, add new videos, submit new videos for review, put them on the shelves, and take them off the shelves. When adding a video, it is necessary to select the course corresponding to the video and the introduction of the video. After selecting the video file, a loading progress bar will be displayed below when loading.

5 DISCUSSION

The proposed platform needs to be strengthened in terms of website security and functional modules. Of course, the function modules are not comprehensive enough to further require improvement. ThinkPHP is a highly practical and powerful framework, but this paper only uses some of its functions. To learn and master most of the functions, more time and effort are needed to delve into them.

6 CONCLUSION

Due to the epidemic, many primary and secondary schools have opted for online teaching. Therefore, if schools want to complete online teaching in a timely manner, they must have an online course management system. Teachers can upload corresponding videos according to different courses. Students download the videos they are interested in according to their own needs. The downloaded videos can be major or elective. Such an online teaching mode is not restricted by time and place, so students can learn whenever they want and can choose the courses they are interested in. This not only enhances learning interest, stimulates learning potential, and improves learning efficiency, but also saves time for commuting to and from school.

As we all know, there are a huge number of categories of teaching resources. Therefore, the establishment of a web-based instruction platform can better manage, summarize, and classify them and provide students with convenient and fast learning resources. Teaching is a long-term activity. The integration of teaching resource information provides a good reference for future teaching while preserving teaching resources. In this way, knowledge is not only narrated orally by the teacher but also permanently preserved in the form of video and shared with countless people who love learning, maximizing the spread of knowledge.

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