Design and Implementation of Interactive Smart Classroom System for Preschool Education Major

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Abstract. In the introduction, this paper first expounds the characteristics and requirements of preschool education major, then analyzes the present teaching situation of preschool education major, and puts forward a feasible optimization scheme according to the present situation. Then it gives a brief overview of its meaning, coding mechanism and transmission protocol based on streaming media technology. Finally, it designs a web-based intelligent classroom system for preschool education, which combines web technology with streaming media technology to form a perfect functional module of live teaching, which not only ensures the high quality and fluency of live broadcast, but also ensures the real-time interaction between teachers and students. The application of Java language and ssh framework is also used to design the server applications of the system, which ensures that the system has complete auxiliary teaching functions, so as to solve the existing problems of preschool education, optimize the teaching mode of preschool education, and form a perfect complementary relationship with offline teaching.

Keywords: Preschool education · Web technology · Streaming media technology · Smart classroom system

1 Introduction

The preschool education major involves the curriculum contents of culture, psychology, art, education and other aspects, and the teaching structure and form are relatively complex compared with other majors. Preschool is the golden period of children's ability development in all aspects. Good preschool education plays a key role in the development of children's logical thinking ability, autonomous learning ability and language expression ability, so teachers engaged in preschool education are more strict. The teachers of preschool education should not only reserve rich knowledge of preschool education, but also effectively combine the professional knowledge learned in school with the knowledge related to preschool education, so as to ensure the comprehensive teaching quality of preschool education for children. [1] The preschool education should innovate the educational management methods, improve the cohesion of educational content, and

create a favorable development environment for the follow-up stage work of preschool education major. In order to better improve the comprehensive quality of students majoring in preschool education, colleges and universities should formulate strict educational management standards, optimize the curriculum structure, and take quality education as the main course and bring it into the training system of preschool education professionals.[2]The staged talent education and training is the core of professional education in colleges and universities, and the foundation of professional education in colleges and universities is to enhance the stability of educational development. In order to better adapt to the changes of social development's demand for talents, we must constantly optimize and innovate the talent training, establish multi-level education curriculum application modules, enrich educational content, improve the acceptability of preschool education talent training, make different preschool education talents give full play to their strengths, and provide better opportunities for the steady advancement of preschool education in the future.[3].

During the teaching process of preschool education major, there are many problems, such as outdated curriculum content, imperfect teaching mode, disparity between teachers and students and lack of communication. The preschool education major has accumulated a lot of experience in education management, and has formed a huge basic education system. In order to promote the synchronization of teaching information, ensure the effective information interaction between professional education courses and modern education environment, and improve the timeliness of educational information replacement, the preschool education major can be reformed by informatization. The informatization reform of preschool education can be started from the following aspects: firstly, the selection of teaching materials should collect various information, and the convenience of network should be used to provide students with new knowledge, so that the informatization reform of preschool education can be integrated; Secondly, it is necessary to strengthen the information communication between professional education and industry development, and formulate and revise talent training strategies in time according to the current situation of industry development; Finally, we should strengthen the interaction between teachers and students and build a good relationship between teachers and students.

2   Technical Overview

2.1   Streaming Media Technology

The streaming media technology refers to the processing and transmission technology of media files that can be continuously played in the network by encoding, compressing and other special operations to form streaming file formats. The realization of streaming media technology mainly depends on streaming media protocols, and the transmission protocols of streaming media are divided into various types according to the underlying protocols they depend on. As shown in the Table 1 yuan, the current mainstream streaming media transmission protocols are compared. In the absence of streaming media technology, people want to browse multimedia files by downloading them to their own computers first, and they can only open them after all the downloads are completed, which wastes memory resources and download time. The emergence and wide use of

Table 1. Comparison of mainstream streaming media protocols

Name	RTMP	HLS	RTSP
Full name	Real Time Message Protocol	Http Live Stream	Real Time Streaming Protocol
Upper layer protocol	TCP/ HTTP	HTTP	RTP/RTCP
Software model	C/S	B/S	C/S
R&D source	Adobe	Apple	Microsoft
For clients	Browsers that support Flash products, browsers that support5 HTML	Apple's Safari browser and browsers that support HTML5	Player
Format requirements	FLV F4V	MP4	Without
Server requirements	Dedicated Flash Server Flash Media Server Red5	Common HTTP Server	Dedicated RTSP streaming server
Live broadcast requirements	Special encoder upload Flash Media Encoder	Dedicated encoder uploads Apple development tools	Server dependent, custom upload
File playback requirements	The FLV and F4V file servers are automatically decomposed into F4f data files and F4X index files	TS data file, M3u8 index file	Related to the server, related to the player

streaming media technology is to meet the needs of users to download and play on the Internet, and they can watch all the content smoothly by loading the beginning of the file without waiting for all the downloads. The streaming media technology has three characteristics, namely, continuity, real-time and timing. In the process of streaming media files being played and downloaded, a series of related data packets transmitted on the Internet are called streams. [5].

2.1.1 Streaming Media Transmission

The traditional streaming media services use TCP, UDP, RTP and other protocols for transmission, but these protocols have some shortcomings. In order to transmit more efficiently, RTMP came into being. The RTMP protocol is an application layer real-time information transmission protocol published by Adobe. Its main purpose is to multiplex and subcontract multimedia data transmission streams, and it is widely used in the live broadcast function platform. Its operation requires TCP protocol, the bottom transport layer of network protocol, to ensure the timeliness and reliability of data stream

```
static int try_connect(struct rtmp_stream *stream){
        if (dstr_is_empty(&stream->path)) { warn("URL is empty");
            return OBS_OUTPUT_BAD_PATH;}
        RTMP_Init(&stream->rtmp);
        if (!RTMP_SetupURL(&stream->rtmp, stream->path.array))
            return OBS_OUTPUT_BAD_PATH;
        RTMP_EnableWrite(&stream->rtmp);
        set_rtmp_dstr(&stream->rtmp.Link.pubUser,     &stream->username);
        set_rtmp_dstr(&stream->rtmp.Link.pubPasswd, &stream->password);
        set_rtmp_dstr(&stream->rtmp.Link.flashVer,    &stream->encoder_name);
        stream->rtmp.Link.swfUrl = stream->rtmp.Link.tcUrl;
        if (dstr_is_empty(&stream->bind_ip) ||
            dstr_cmp(&stream->bind_ip, "default") == 0) {
            memset(&stream->rtmp.m_bindIP, 0, sizeof(stream->rtmp.m_bindIP));
        } else {
            bool success = netif_str_to_addr(&stream->rtmp.m_bindIP.addr,
                    &stream->rtmp.m_bindIP.addrLen,
                    stream->bind_ip.array);
            if (success) {
                int len = stream->rtmp.m_bindIP.addrLen;
                bool ipv6 = len == sizeof(struct sockaddr_in6);
                info("Binding to IPv%d", ipv6 ? 6 : 4);}}
```

Fig. 1. The critical code for creating the stream function

transmission. After the link of transport layer protocol is established, RTMP protocol also needs to establish RTMP Connection with client and server by "shaking hands" based on the link of transport layer. The Connection is responsible for transmitting control information. In order to facilitate the transmission of specific audio and video data and the command information controlling the transmission of these information, the CreateStream command will create a Stream function connection to increase threads, as shown in Fig. 1, which is the key code for creating the stream function.

When the RTMP protocol is transmitted, the data will be formatted by itself. The Message in this format is called RTMP Message. In actual transmission, in order to better realize multiplexing, subcontracting and fairness of information, the sender will divide the Message into Chunks with Message ID. Each chunk may be a separate message or a part of the message. At the receiving end, the chunk will be restored to a complete Message according to the length of data, message id and message contained in the chunk, thus realizing the sending and receiving of information.

2.1.2   Coding Scheme

Before encoding, it is necessary to collect audio and video data sources, and then use encoding software to encode and compress these audio and video data sources according to corresponding algorithms, and encapsulate audio into ACC and video into H.264

Coding scheme	Producers	Release time
H.265	MPEG/ITU-T	2013
H.264	MPEG/ITU-T	2003
MPEG4	MPEG	2001
MPEG2	MPEG4	1994
VP9	Google	2019

Fig. 2. Streaming media encoding scheme

Coding scheme	Producers	Release time
AAC	MPEG	1997
AC-3	Dolby Inc	1992
MP3	MPEG	1993
WMA	Microsoft Inc	1999

Fig. 3. Audio coding scheme

format data packets. Prepare for subsequent data transfer. [6] As shown in Fig. 2, the streaming media video coding scheme table shows different coding schemes, producers and their respective release times. Under the same image quality, the coding efficiency of H.264 far exceeds that of MPEG2 and MPEG4. So H264 is used more frequently than other encoding methods. Figure 3 shows the streaming media audio coding scheme table. Compared with the other three coding schemes, the AAC coding scheme in the table has more advantages. The audio compression ratio of AAC is 18:1 as a high compression ratio of audio compression processing. By comparison, it can be found that its overall performance is better than that of audio compression algorithms of the same performance specifications, which is why the system in this paper chooses the ACC encoding algorithm.

2.2   Development Environment

In this paper, the construction of intelligent classroom system development environment of preschool education is divided into two parts. One part is the realization of live broadcast function based on streaming media technology, and the other part is the realization of Web-based system server application and interactive function.

Firstly, the development environment required by streaming media technology is described. A complete streaming media system should include the following components: coding tools for creating, capturing and editing multimedia data to form streaming media format; A server to store and control streaming data; A player for clients to browse streaming media files. [9] FFmpeg is selected as the coding tool in this paper. Audio is compressed and encoded by the above AAC coding scheme and video files are compressed and encoded by H.264 coding scheme, and the two coding files are encapsulated

into MPEG2-TS and FLV formats. The principle is to convert the audio collected by the microphone and the video digital signal collected by the camera into a stream. After that, the system sends the encapsulated audio and video files in MPEG2-TS and FLV formats to the streaming media server through the RTMP protocol to complete the streaming operation. [8] The streaming media server is built by Nginx and NGINx-RTMP-Module Module in Linux CentOS 7.0 operating system, which can fully match and adapt to CDN technology. Finally, Flash player is built according to JWplayer framework as a client player.

Then, the development environment of the Web system is described. The functional design of the server is completed by JAVA language and SSH framework. JAVA JDK8.0, Eclipse editing environment, Maven, Tomcat server and MySQL database need to be downloaded and installed. Add the JDK environment variables to the system environment variables, then connect the MySQL database to the Tomcat server, add Maven to the Eclipse editing tool, and integrate the SSH framework under Maven. The above related technologies and development environment ensure the feasibility of the development of preschool education smart classroom system.

3   Demand Analysis

3.1   System Requirement Analysis

The talents cultivated by preschool education major are preschool teachers. In the course design and teaching process, we should pay attention to the professional core courses, and put the focus of teaching on the training of students' professional basic theories and basic skills, as well as the improvement of their understanding and performance ability of professional knowledge. [10] in the prevalence of Internet and multimedia environment, the construction of preschool education online teaching system needs to have good interactivity, on the design of the course to fit their own demands, and add other forms of knowledge outside the textbooks, to develop students' cognition and understanding of the course for the preschool education, the solid foundation for future employment. So this article the preschool education of wisdom classroom system function according to the user's location will be set for teachers and students, two side corresponding to set up three functional modules: live courses, expand information, on display, both to meet the learning needs of students, and can communicate with the teacher online interaction, still can online through work practice. While improving the professional knowledge and skills of preschool education, it also brings the relationship between teachers and students closer. This online teaching model can be combined with the traditional offline teaching model to form a perfect teaching model, so as to optimize the teaching structure of preschool education major in colleges and universities.

3.2   Overall Design

The overall design of preschool education smart classroom system is based on Web, according to the MVC design pattern to develop the functions of the system, using Nginx server as a proxy server to play the role of load balancing, to determine and distribute
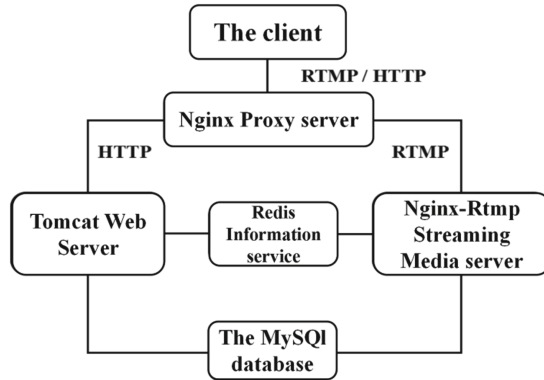
Fig. 4. Overall structure of preschool education

the front-end operation requests. Java is used as the script development language of the system server, Tomcat 8.0 is used as the web server of the system, and Nginx-RTMP-Module is used as the streaming media transmission server. The cooperation with CDN technology makes the performance of the streaming media server more powerful. MySQL database is used as the underlying data support of the system, responsible for data storage and interaction with server applications, and Redis and MySQL are used to form a master-slave database structure, in order to relieve the pressure of frequent access to MySQL database. The overall design architecture of preschool education smart classroom system is shown in Fig. 4. B/S architecture and MVC design pattern realize the separation of the front-end and back-end design of the system, and the interaction function of back-end service module is developed and configured by Java language and SSH framework.

4 Function Realization

The intelligent classroom system of preschool education in this paper divides the users into two categories, and the student end and the teacher end are designed. The student side includes three functional modules: live class, expanded data and works display. The teacher side and the student side are also set up three functional modules to supervise and guide students to learn.

4.1 The Student End

Live class: Students who enter this module for the first time can select the course category and course name they need to learn according to their own needs and preferences, and then enter the live class. The system will automatically match the live course for students according to the class and name of the course selected by students, and send a live message notice to students 12 h before the start of the live course, and the replay can be viewed 4 h after the end of the live course. Students can learn professional knowledge in live classes. For example, students who choose art courses can learn painting skills

```
var saveDan=[],index=0,tm;
var autoAnimate=function(){index++;
index>saveDan.length-1 && (index=0);
saveDan[index].appendTo($("#boxDom")).animate({
"right":$(document).width(),},10000,function () {
$(this).css("right",$(".list-info").width()-$(this).width()).remove();});}
$("#btn").click(function () {var txt=$("#text");
var randomTop=Math.floor(Math.random()*($("#boxDom video").height()-40));
if(txt.val().trim().length==0)return;
var span= $("").text(txt.val()).css({"color":randomColor(),"top":randomTop,
"right":$(".list-info").width(),"z-index":888});saveDan.unshift(span);
$("txt.val("");clearInterval(tm);index=saveDan.length-1tm=setInterval(autoAnimate,1000);});
$(document).keydown(function (e) {var e=e||window.event;e.keyCode==13 && ($("#btn").
click());});
```

Fig. 5. Bullet screen implementation code

such as coloring and sketching, and how to use art to convey knowledge to children. In addition, questions can be asked to the teacher in the form of bullet screen, and real-time online interaction can be conducted with the teacher. As shown in Fig. 5, it is the key code for the realization of the bullet screen function. This module can not only improve the master degree of preschool education students' professional knowledge, but also draw the distance between students and teachers, enhance the interaction between teachers and students.

Development materials: This module is an electronic version of materials uploaded by teachers after finishing, which can be downloaded and studied by students. The electronic materials are mainly composed of two directions: professional instructions and professional promotion. The professional instructions submodule collates the professional requirements of preschool teachers in recent years and the application methods of professional knowledge in real preschool children's teaching scenes, etc. The professional promotion submodule is the learning materials of various branches of preschool education, such as Fudan University's "children's songs piano accompaniment spectrum 108", art courses "stick figure quick 200 cases". Through the study of this module, students can have a deeper understanding of their future professional career, and can also expand their professional knowledge outside the classroom and books.

Display of works: Students can play freely in this module, and publish their works for comments by classmates and teachers. They can publish their works in various forms such as pictures, videos, etc., such as: a stick figure, a handmade work, a short piece of piano playing, etc. In this module, we pay more attention to students' autonomy and imagination. According to the study of live courses and expanded materials, we can give full play to our talents, and make excellent works that we think we are good at in the reference samples provided by the course materials. We should further communicate and talk with our classmates and teachers, and find out the shortcomings through others' evaluation of our own works and gradually improve them.

4.2 The Teacher End

Teachers play the role of educators and guides in the wisdom classroom system of preschool education. Three main modules are set up in the teacher's side corresponding to the students' side. In the live classroom module, live courses such as painting, crafts, music and preschool education related theories are screened, planned and taught. In the process of live teaching, online real-time interaction is carried out with students according to the barrage students' messages. After the teaching, students' questions and needs are summarized and combined with curriculum planning to adjust and improve the course schedule and content. The work of editing, sorting, revising and uploading electronic materials is completed in the expanded materials module to ensure that students can see the latest and most suitable materials for the development of preschool education; Comments and scores the works uploaded by students in the works display module. Using the preschool education wisdom classroom system provides feasible ways and methods to improve the present situation and teaching mode of preschool education, improves the interaction between teachers and students, improves the relationship between teachers and students, and promotes the healthy development of preschool education.

5 Conclusions

At present, the educational environment is under the background of informatization, and the teaching methods of preschool education major must meet the requirements of the development of the information age. Based on the perspective of informatization teaching, we should re-examine the current teaching mode, re-construct and implement teaching, improve the original teacher-student relationship, and establish a harmonious and equal teacher-student relationship with strong interaction. When formulating teaching objectives, we should pay attention to openness and diversity, update the teaching content that meets the background of the times and teaching requirements, and explore the teaching mode of combining traditional and online; We should create a high-quality and efficient information technology teaching environment and build a multi-dimensional teaching comprehensive evaluation system, so as to enhance the effectiveness of preschool education teaching and promote the comprehensive, coordinated and sustainable development of preschool education teaching ecosystem.

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