

# Development and Application of the Network Training System for College Students' Professional Core Literacy under the Concept of "Three-wide Education"

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**Abstract.** With the deepening of China's industrial transformation and upgrading process, the social demand for high-quality compound professionals is increasingly strong. When colleges and universities respond to the change of personnel training objectives, they are often not fully prepared, and still adopt the educational concept of "technical skills first", ignoring the cultivation of students' professional core literacy. In this regard, based on the problems of low attention, insufficient teachers and imperfect training platform in the current situation of professional core literacy training in colleges and universities, this paper puts forward a development plan of professional core literacy network training system, aiming at completing the construction of professional literacy training system under the framework of integration of production and education with the help of the practical advantages of digital education technology. The whole network training system adopts Javaweb technology to complete the design and development, and separates the front-end interactive interface from the back-end server according to MVC mode, so as to facilitate teachers and students to complete the education and training tasks of professional core literacy courses through simple and convenient operation. Practice has proved that the network training system effectively integrates many functional modules, such as remote login, online teaching, resource sharing, communication and consultation, and data analysis. It not only reshapes the teaching process, but also promotes the application of "double-qualified" teaching mode under the framework of integration of production and education, and sets a new paradigm for the cultivation of college students' professional core literacy.

**Keywords:** professional core literacy; network remote training; integration of industry and education; Javaweb; computer application

## 1 Introduction

At present, China's social and economic development has entered a new normal, and industrial transformation and upgrading have been promoted at a high speed. The emergence of a series of new technologies, new models and new formats has triggered changes in the post level and talent demand structure, and compound professionals with high professional quality, excellent technology and strong skills are favored. [1] Faced with the dual pressures of college students' employment form and the reform and development of modern education, the talent training mode of some colleges and universities still follows the educational concept of "knowledge

and skills first", unilaterally attaching importance to the teaching of theoretical knowledge and practical skills, while ignoring the cultivation of college students' professional core literacy. At the same time, the problems such as outdated teaching content, weak professional teachers and imperfect professional quality training platform have led to the lack of professional cognition, irregular professional behavior and difficulties in career development of college students. [2] In view of this, referring to the current situation of professional literacy education and training for college students at home and abroad, combined with the formation mechanism of professional literacy under the condition of social transformation proposed by Viacheslav I. Berkus[3] and others, the research on solutions to improve the quality of college students' professional ethics by Nguyen Binh [4], and the training system of professional core literacy under the concept of "three-round education" advocated by Lou Yun [5], this paper holds that colleges and universities should base themselves on the present situation of cultivating the professional core literacy of contemporary college students, gather strong educational synergy with the educational concept of "three-round education", fully explore the application advantages of digital information technology in modern educational methods and paths, and comprehensively promote the construction of the professional core literacy training system under the framework of integration of production and education. The network training system of professional core literacy can apply the "internet plus Open Education" model to educational practice, solve the problem of building a "double-qualified" teaching team, and realize the innovation of educational concept, teaching technology and teaching mode, thus improving the effectiveness of professional literacy education and providing feasible measures and schemes for the full implementation of information construction of higher education.

## 2 Development process

According to the actual requirements of system development, complete the configuration and deployment of the development environment of college students' professional core literacy network training system. The design and development of the system will be divided into two parts, one is the construction of the overall operation architecture, and the other is the design and implementation of functional modules and application services.

First of all, the whole system is B/S architecture, which consists of three parts: client, server and database. Figure 1 shows the system operation architecture diagram. Among them, the server is further divided into Web server and application server to realize the decoupling of business logic and improve the efficiency of the system in handling user requests. [6]

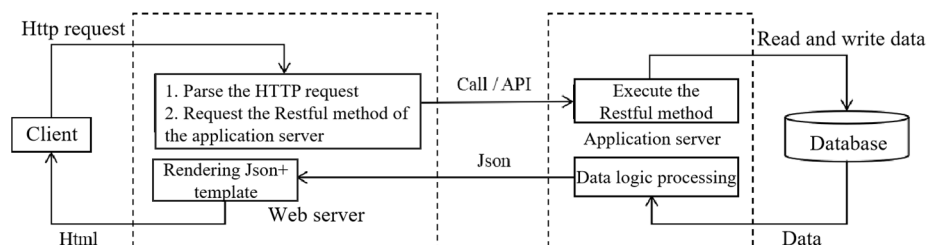
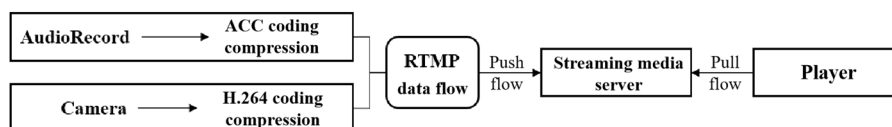


Fig. 1. System operation architecture diagram

On the client side, there are usually four kinds of HTTP requests sent by users to the server side: Get, Post, Put and Delete. The request is divided into Request-url and Request-body through the parameter transfer of WebAPI, and the Restful interface is called through the Web server to execute the corresponding exposure method. [7] When the application server completes the database interaction, it returns the target data to the Web server in Json form, and at the same time completes the HTML rendering by combining with the corresponding template, and returns it to the client to complete the presentation.

Secondly, the functional modules and application services of the system mainly include remote login, online teaching, resource sharing, communication and consultation, and data analysis. Each part will be developed, adapted and integrated in turn, and deployed on the application server, and the response of user requests will be realized through the call and control of the Web server. Among them, the online teaching module can not only provide a large number of online teaching resources for students to learn independently, but also integrate streaming media technology to realize live teaching. Under the framework of streaming media technology, teacher users belong to push stream client and student user data pull stream client. The push stream client collects, encodes, compresses and encapsulates the digital signals of microphone and camera to form RTMP data stream. After caching, scheduling and transmission by the streaming media server, it finishes decoding and playing through the pull stream client. Figure 2 shows the basic operation flow of streaming media technology.



**Fig. 2.** Streaming media technology framework

Finally, for the overall development environment configuration of the system, Linux CentOS 7.0 is selected as the bottom operating system, Nginx as the Web server, Nginx-Rtmp-Module as the streaming media server, and MySQL 5.7 as the database server. In the Java language environment, after importing JSP page and Spring framework with Eclipse Version 2020 integrated development tool, MVC creation and single entry file configuration are completed in turn, and the corresponding functional modules are finally selected to realize specific functions. [8] Through the introduction of the above key technical theories, the overall environment of system development, the configuration of related software and tools are determined, and the technical feasibility of the network training system for professional core literacy is also clarified.

### 3 Functional implementation

#### 3.1 Student side

##### A. Login and home page

The system has a unified initial login interface, which is convenient for student users to complete account registration and identity verification by submitting materials, and complete

the login and use of the system with unique identification information. After students enter their account and password, the system will call PBE password encryption algorithm to ensure the security of user account password information. PBE algorithm introduces "Salt" random information, and forms a key with password information under the digest algorithm. The running code is as follows. [9]

```
public class PBECoder {
    public static final String ALGORITHM="PBEWITHMD5andDES";
    public static final int ITERATION_COUNT=100;
    public static byte[] initSalt() throws Exception{
        SecureRandom random=new SecureRandom();
        return random.generateSeed(8);    }
    private static Key toKey(String password) throws
Exception{
        PBEKeySpec                    keySpec=new
PBEKeySpec(password.toCharArray());
        SecretKeyFactory
keyFactory=SecretKeyFactory.getInstance(ALGORITHM);
        SecretKey
secretKey=keyFactory.generateSecret(keySpec);
        return secretKey;    }
```

After the user logs in successfully, the system will automatically jump to the homepage interface, which mainly includes the centralized display of function navigation, Banner dynamic picture news, course information announcement and related hot topics.

#### B. Online learning

Compared with the previous classroom teaching mode, the system can provide students with long-term and expanded education and training services. Under this function module, student users can rely on a large number of digital learning resources for autonomous and personalized learning. Digital learning resources include ppt courseware materials, micro-courses and comprehensive graphics and texts. Based on the logical structure of professional core literacy and the development order of students' cognition, the system combines with each other to form multiple teaching units to complete the disassembly of traditional teaching materials, emphasizing the connection and application of knowledge points, and helping students to accelerate their understanding and mastery of theoretical knowledge.

#### C. Live training

The system takes live courses as the main form, invites many professional "double-qualified" teachers to carry out long-distance training for students, and issues training course notices in the system in advance, so as to facilitate student users to choose to study according to their own schedules. The training content will be subdivided into three dimensions: professional

role, job competence and career development according to the actual training goal of professional core literacy. The content setting can ensure innovation and pertinence at the same time. Table 1 shows some live training course information.

**Table 1.** Live training course information

No.	Live time	Live title	Lecturer	Duration
Z1001	23.02.01	Let the ideal into the reality	Teacher Liu	100 Minutes
Z1002	23.02.07	Live out the meaning	Teacher Dong	90 Minutes
Z1003	23.02.10	Professional ethics	Teacher Fang	120 Minutes
Z1004	23.02.16	Structural thinking-effective communication	Teacher Zhao	120 Minutes

In the process of live training, student users interact with teachers through the "barrage" function under the viewing interface. At the entrance of the barrage, students and users can directly enter their own words in the text box and send them out in time. The barrage mainly includes the evaluation of courses and teachers, the proposal of some questions and the discussion of related topics. The barrage will appear on the teacher side simultaneously. When the teacher sees the barrage, he can answer the questions raised by the student users in a targeted manner and launch educational services in the field of professional core literacy.

Live training runs according to a one-to-many mechanism, that is, one teacher port corresponds to multiple student ports, so that the streaming media server in the system is heavily loaded and easily fluctuated by factors such as code rate, congestion and time delay, which further affects the students' viewing experience. Therefore, the system incorporates the adaptive rate algorithm (ABR) to improve the transmission performance and concurrency control ability of the system. In order to verify the practical application effect of ABR algorithm, Qoe utility model will be used to complete the comparative evaluation. In the Qoe utility model, code rate, jam, time delay and switching frequency are taken as indicators, and the calculation is made according to the video block calculation rule. Formula 1 shows the calculation formula of Qoe utility model under MPC algorithm, where  $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$  are the weight values of the four indicators respectively. [10]

$$Qoe = \alpha \sum_{n=1}^N q(R_n) - \beta \sum_{n=1}^N T_n - \gamma \sum_{n=1}^N |q(R_n) - q(R_{n-1})| - \delta \sum_{n=1}^N L_n \quad (1)$$

In the simulation test experiment, Festive, BBA and MPC algorithms are compared in four network states, namely, strong, medium, weak and mixed, and the linear Qoe results are displayed in the form of graphs, as shown in Figure 3. The test results show that the strong network environment is the key to affect the live viewing experience. In the same network environment, the performance of MPC algorithm is obviously due to the other two, which can effectively improve the actual efficiency of the system.

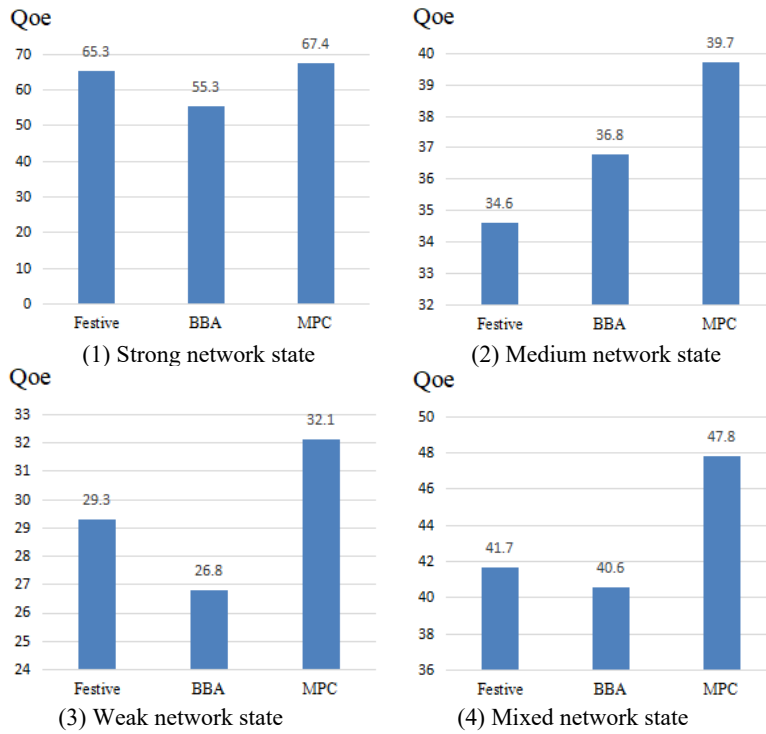


Fig. 3. Comparison of the test results in the three network states

### 3.2 Teacher side

#### A. Resource management

Faced with numerous digital learning resources, teacher users can initiate many operations such as adding, viewing, modifying and deleting online. On the teacher side, teacher users can use the interactive characteristics between the system and the database to transfer the data information input by users in the form of parameters, and combine with function design to speed up the construction and execution of SQL statements, thus improving the user's operation efficiency.

#### B. Learning evaluation

The system supports automatic evaluation of students' learning effect with fuzzy comprehensive evaluation model. When teachers and users initiate learning evaluation online, the system will extract data from the database and operation log library, and build a multi-level learning evaluation system in combination with the teaching objectives of professional core literacy courses, as shown in Table 3. The index values of the learning behavior characteristics reflected by the measures layer in the table will be constructed according to the AHP analysis algorithm, as shown in Formula 2. Then, each row of the judgment matrix is normalized, and the row vector is normalized twice to get the ranking weight vector  $W$ , and the corresponding maximum weight is calculated by the sum-product method, as shown in

Formula 3. [11] After the weight of each index value is determined, the system automatically calculates the teaching effect score, and some test results are also shown in Table 2.

$$A = \begin{bmatrix} A_{11} & A_{12} & A_{13} \\ A_{21} & A_{22} & A_{23} \\ A_{31} & A_{32} & A_{33} \end{bmatrix} \quad (2) \quad \lambda_{\max} = \sum_{i=1}^n \frac{(AW)_i}{nW_i} \quad (3)$$

**Table 2.** Network learning evaluation system

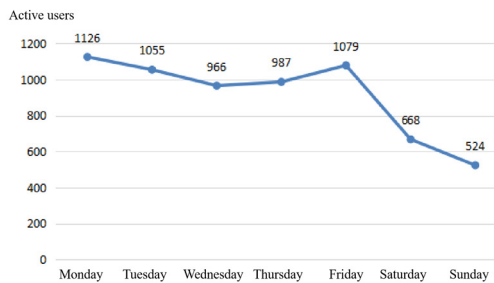
Target layer	Standard layer	Measures layer	Weighted value	Item score	Score
Teaching evaluation	Learning attitude A <sub>1</sub>	Login frequency A <sub>11</sub>	λ=0.092	85	7.641
		Average study duration A <sub>12</sub>	λ=0.133	77	10.217
	Learning process A <sub>2</sub>	Resource utilization A <sub>21</sub>	λ=0.156	69	0.934
		Training participation times A <sub>22</sub>	λ=0.077	71	2.577
	Learning outcome A <sub>3</sub>	Homework completion result A <sub>31</sub>	λ=0.134	84	5.186
		Training interaction frequency A <sub>32</sub>	λ=0.051	70	4.180
	...	...	...		

### C. Data statistics

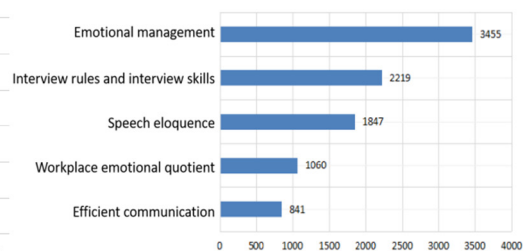
Based on the application and processing ability of professional core literacy network training system to data information, teachers and users can make statistical analysis of various data in the system. Table 3 shows the statistical results of live training course data. In addition, the system will use Echarts.js to process the related data for the second time, so as to form a more intuitive data chart, which is convenient for teachers to check and use. Figure 4 shows the statistical results of the data of active users of the platform in a week, and Figure 5 shows the frequency of micro-course resources used this month.

**Table 3.** Data statistics of live training courses

No.	Live time	Live title	Viewer number (peak)	Viewing duration (average)	Barrage number
Z1001	23.02.01	Let the ideal into the reality	10416	23.3min	19866
Z1002	23.02.07	Live out the meaning	4314	18.3min	8126
Z1003	23.02.10	Professional ethics	5153	16.6min	7437
Z1004	23.02.16	Structural thinking-effective communication	3047	17.7min	6155



**Fig. 4.** Daily active users



**Fig. 5.** Frequency of the micro-course resources used

## 4 Conclusions

In order to improve the effectiveness of vocational core literacy training education in colleges and universities, this paper aims at many shortcomings in current teaching practice, and builds a vocational core literacy network training system with the help of the application advantages of streaming media technology, network information technology and computer application technology. The system focuses on four aspects: course form, course content, teaching staff and evaluation, which promotes the construction of professional core literacy education system and sets up a new paradigm of professional core literacy education in colleges and universities. In the follow-up research, it is necessary to further enhance the expansibility and adaptability of the system application and increase the abundance of comprehensive resources, which provides reference for the current digital education reform in colleges and universities.

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