The Construction of the Remote Interactive Platform of the Practical Training Teaching in the Employment Domain of Colleges and Universities Under the 1 + X Certificate System

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Abstract. In view of the problems of poor interaction and non-reservation in the existing college employment training teaching platform, which leads to the decline of students' interest in learning, therefore, under the influence of the 1 + X certificate system, a new college employment work domain training teaching remote interaction platform is constructed. The platform takes the 1 + X certificate system as the goal, establishes the appointment mechanism of training teaching, designs the long-distance interactive mode of training teaching platform by setting the way of video and audio playing in the platform, and realizes the construction of the long-distance interactive platform of training teaching in the field of employment in colleges and universities. The experimental results show that the long-distance interactive platform for training teaching is highly interactive. Students can improve the performance of training teaching through using the platform, and the application effect is better.

Keywords: 1 + X certificate system · University employment domain · Practical teaching · Remote interactive platform

1 Introduction

In order to improve the employment rate and expand the employment direction of college students, many colleges and universities have constructed practical teaching platform. By setting up a training teaching resource management platform, the training content will be uploaded to a page, so that students can query at any time in their spare time, and learn training related courses [1]. Some scholars have proposed the construction of training platform based on distance education, which uses face recognition to realize the process control of distance education. Take the knowledge block as the construction unit, take the professional skill promotion as the goal, reconstruct the distance education teaching resources [2]. Some scholars also put forward the framework of network-based

modular interactive hybrid laboratory, and discussed the efficiency of practical teaching platform [3].

In order to further improve the training platform and improve the test results of students. Therefore, based on the $1 + X$ certificate system, a new long-distance interactive platform for practical teaching in the field of employment in Colleges and universities is constructed. The platform has appointment module, and the audio and video playing mode is more flexible, and the interaction between students and teachers is better. It can enhance students' interest in learning, provide more reliable teaching support for graduates' employment.

2 Appointment Mechanism of Establishing Practical Teaching Platform Under $1 + X$ Certificate System

According to the implementation plan of national vocational education reform, the state will launch the pilot project of "diploma+several vocational skill level certificates" in vocational colleges and application-oriented undergraduate schools, i.e. $1 + X$ certificate system. It is used to encourage students to actively take multiple vocational skill level certificates while learning textbook knowledge and theory. Therefore, taking the $1 + X$ certificate system as the construction goal, the platform reservation mechanism is established. The purpose of the platform is to let students interact with teachers face to face actively by appointment, and to strengthen the learning of practical training content in the field of employment. The platform is linked with teaching activities to realize the automatic practical teaching in the field of employment in colleges and universities.

With the development of cloud technology, students can easily access cloud services, storage resources, computing resources, software and hardware resources through terminal devices. The reservation platform consists of user service platform, teaching reservation platform, authorization platform and control service platform. The structure is shown in Fig. 1:
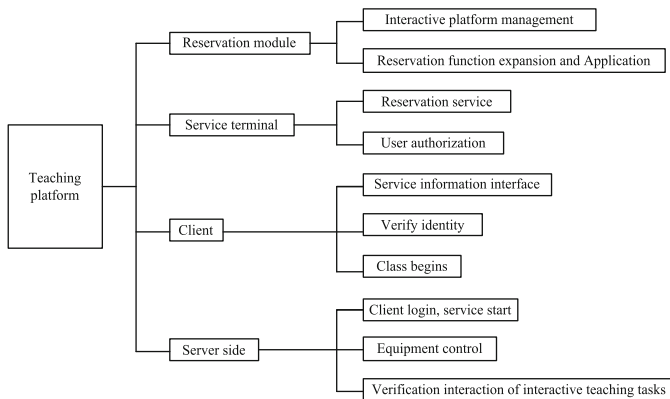

Fig. 1. Reservation module of remote interaction platform for practical teaching

According to Fig. 1, the use of page display can reflect the advantages of the reservation platform and emphasize the concept of time. At the same time, it can inform people through various media in time, with simple and practical functions. Formula (1) is the reservation algorithm set according to the reservation mechanism:

$$\sigma = \frac{\Delta k}{q} = \frac{\varphi \omega_i - s}{q} \tag{1}$$

In formula (1): σ represents the reservation control parameter; Δk represents the reservation usage; q represents the average reservation item; φ represents the total amount of reservation after temporary increase; ω_i represents the weight; s represents the asynchronous reservation data. Set the reservation mode of the platform according to the above algorithm.

For teaching activity reservation, you can make a corresponding reservation activity plan through the visual calendar presentation, and reserve teaching activities through the corresponding arrangement of the timetable. Select an interactive classroom, interact with participants, make an appointment to start the corresponding classroom equipment at the same time, and inform people of the appointment information through SMS and email in time. The calendar management module displays the calendar information, the daily booking activity record is displayed in the log, the day, week and month functions are reserved, and the schedule can be synchronized to realize the automatic call; the booking information entry of the booking module, the entry personnel can be selected, and the time and notification media can be selected; the equipment management module notifies the equipment to start according to the time, and controls the terminal and relevant through the start-up equipment Start of equipment in activity room.

The user management module adjusts the appointments reasonably, supports multiple teachers to participate in interactive [4] simultaneously, and the communication module adopts multiple classrooms or multiple display terminals. The classroom reminds the reservation classroom reminder, calls the appointment information through the intelligent terminal, and compares the time of the call before the start of the activity and the start of the activity, so as to remind the teacher to enter the activity in time. The reservation mode can select the schedule synchronization mode, adapt to the fixed reservation mode of the schedule, and realize the automatic reservation activity; regularly synchronize the schedule information, and achieve the intelligent interactive teaching remote mode; open the remote interaction through the public network, Cross School interactive mode interactive screen; customize the interactive reservation playing mode through the interactive screen, and automatically save the recording and broadcasting resources.

According to the above content, the appointment mechanism of the training teaching platform is established to ensure that under the guidance of the $1 + X$ certificate system, students can improve their employment competitiveness and increase the professional skills to obtain various certificates through the appointment of employment training teaching content.

3 Interactive Mechanism of Establishing Practical Teaching Platform Under 1 + X Certificate System

Video and audio are the most important media in the network learning platform. Only by establishing a real-time, clear and stable video and audio system, can we ensure the information exchange between teachers and students in the network environment [5]. The user interface of e-learning platform consists of four parts: user information control, audio and video display, information sharing and text exchange, as shown in Fig. 2:
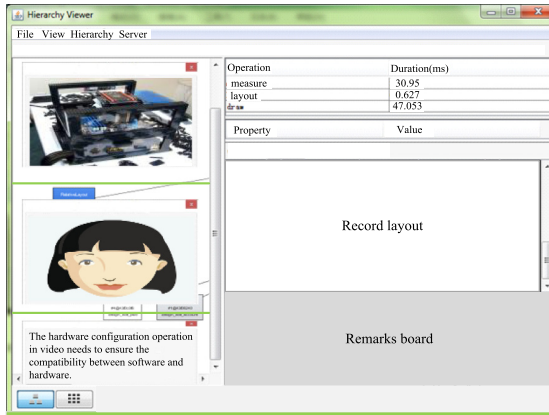

Fig. 2. User interface of e-learning platform

According to the user interface in Fig. 2, the user information control area displays the current classroom name, the names of online teachers and students, member status and other information, so as to realize the functions of role assignment and authority control; the audio and video display area mainly displays the video windows of current online teachers and students, as well as the voice volume fluctuation of speakers; the information sharing area mainly displays Teachers and students share teaching information to achieve the function of whiteboard writing in the teaching process, while the text exchange area realizes the function of text exchange between teachers and students, students and students. Audio and video are important modules for interaction between teachers and students, which are realized by streaming media technology [6]. The following two modules are designed.

3.1 Audio Module Design

(1) Audio on demand function

According to the control center, the server transmits the directory and files of the audio files that can be on-demand to the terminal, and the terminal requests the files on demand from the server. The server is responsible for delivering the directory content to the terminal, so that the terminal can select the files that it wants to play on demand. After the terminal determines the selected file, the server transmits the content of the file to

the terminal in the mode of "request transfer" for the terminal to play freely. The whole process improves two main steps: the transmission of directory and the transmission and reception of audio data stream. The processing mode of the directory is shown in Fig. 3.
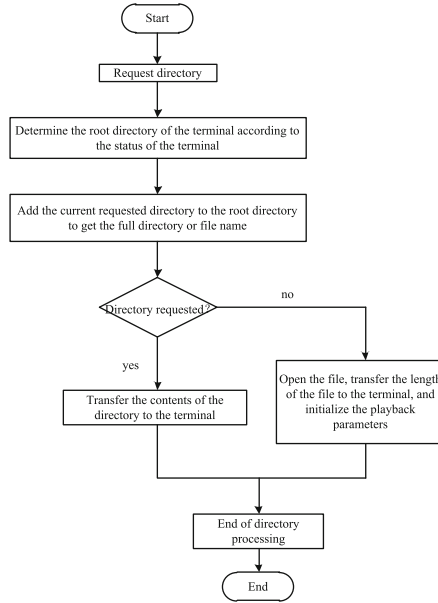

Fig. 3. Directory processing flow

In order to make the audio stream play continuously in real time, the system adopts the "preprocessing double buffer queue mechanism". Because the speed of network receiving stream is much faster than that of stream playing, if we play by the way of "receiving, playing, receiving and playing", there must be a gap, which shows that there is an intermittent pause in playing. The way to solve this problem is to adopt the mechanism of pre receive double buffer queue, whose main idea is "receive and send at the same time, double buffer is used alternately".

Suppose that the two buffer queues are W_1 and W_2 respectively. After the receiving thread is started, the data will be received into W_1 queue. When W_1 is full, on the one hand, the data will continue to be received and placed into W_2 queue, on the other hand, the data in W_1 buffer will be played. Because the receiving process is far faster than the playing process, when W_2 receives the full data, it is likely that W_1's data hasn't played out, so the receiving thread will be suspended; when W_1's data plays out, it will turn to W_2's data, then resume the receiving thread, and put the received data in W_1 buffer queue, and when W_1 is full, it will be suspended until y plays out. To control this alternate process, the following formula can be used to obtain the control parameters:

$$\begin{cases} W_1 = \mu_1 \sin \beta tn \cdot x \\ W_2 = \mu_2 \sin \beta tn \cdot x \\ g(w) = m\lambda - b_i \end{cases} \tag{2}$$

In formula (2), μ_1 and μ_2 respectively represent the constraints of two queues; β represents the buffered data; t represents the buffering time; n represents the load completed amount of playing content; x represents the control parameters of necessary conditions; $g(w)$ represents the identification function for the alternation of two queues; m represents the identification parameters; λ represents the progress indicators of two queues; b_i represents the alternation offset of the ith stage. According to the above control process alternation, the playback thread is guaranteed to execute all the time, so as to make the playback real-time and smooth.

(2) Voice live broadcast design

Voice live broadcast is mainly to collect voice data from microphone through sound card, and then broadcast it through network, so that students can hear the teacher's voice [7]. This function is the basis of the whole system, the quality of voice directly determines the success of the whole system. Voice live broadcast is implemented by windows low-level audio functions, because they can operate on each voice data block. Low level audio services include querying audio devices, turning device drivers on and off, allocating and preparing audio data blocks, managing audio data blocks, applying MMTIME structures, and handling errors. The reason why low-level audio functions can operate on each sound data block is attributed to the message mapping of windows, which will send relevant messages after collecting and playing a data block. The important messages and trigger conditions involved in playing sound are shown in Fig. 4 below.
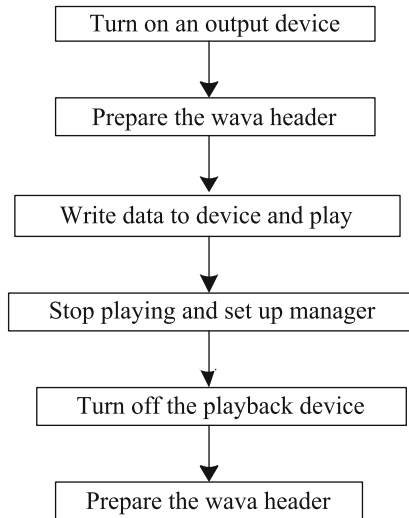

Fig. 4. Voice live broadcast process

The audio and video module also has a function. On the teacher's computer, it can record and broadcast the content. The teacher has the right to record the content in the classroom, and then play it to the students selectively at a certain time.

3.2 Video Design

(1) VOD design

Users can choose to watch video courses according to their own wishes, which fundamentally changes the shortcomings of passive watching teaching content, does not need to comply with the traditional schedule, and fully realizes the initiative of users to obtain information [8]. After the request acceptance, the server prepares the accessible course types in the storage subsystem and displays the course on demand list on the user screen. After the user selects the teaching category, the server takes the course content from the storage subroutine and synthesizes one video data stream, which is transmitted to the client through the network.

(2) Live video design

The live video uses a video camera to collect video in real time and send it to the students through the network, so that students can see the head and shoulders of teachers, just like sitting in a real classroom [9]. Moreover, it has a great auxiliary effect on teaching, especially when teaching practical manual courses, students can see the teacher's design actions through live video, which plays a very important role in training students' actual operation [10]. At the same time, the video and audio are shared, and the synchronization of video and audio is realized by FMS.

4 Design the Remote Interactive Mode of Practical Teaching Platform

Through the design of teaching audio and video broadcast mode, the distance interaction mode of training teaching platform is designed. Figure 5 is the structure diagram of the interaction mode of the platform.
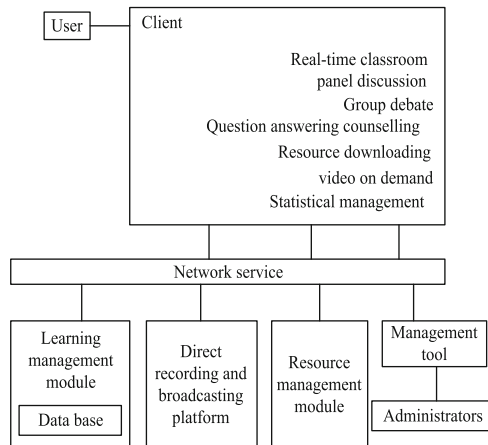

Fig. 5. Structure diagram of remote interaction mode of practical teaching platform

Based on the existing teaching resource management system and the simple learning management system, the remote interactive platform shown in this paper realizes the

functions of real-time classroom, group discussion, group debate, question answering guidance, resource download, video on demand and management on the client side in the way of network service. In order to deal with the problems in a unified way, the types and categories of training teaching resources are integrated. The types of resources provided are text, audio and video. Each type of resource should control the size, format and category settings of the uploaded resources, so as to facilitate the management of resources. The resource management function will provide user upload (teacher user) and resource download (student user). Table 1 is the standard design table of shared resources upload.

Table 1. Upload standard of shared resources

Resource type	Format	Size restriction	Remarks
Text	.xps	<10 m	Office document printing format
Audio frequency	wina	<10 m	Time less than hours, bit rate < 320 kbs
Video	Mp4 wmv	<15 m	Resolving power 640*480 No longer than 30 min

In order to control the smooth operation of the interactive program of the remote interactive platform for practical teaching, the evaluation index of the platform is set, and the calculation equation of the interactive index is as follows:

$$\gamma = \sum_{i=2}^{n} \varphi_i - f_{\max} \tag{3}$$

In formula (3): γ represents the interaction index; $f_{\max}$ represents the maximum interaction deviation; φ_i represents the ith interaction result; n represents the number of iterations. The data in Table 2 is the evaluation elements and index system.

Table 2. Evaluation elements and index system

First level index	Two level index	Three level index
Learning behavior	Online record	Online duration and login frequency
	Question answering	Number of questions and answers
	Participate in discussion	Discussion frequency
Learning process	Learning plan	Number of completed plans of the course webpage visited
	Learning tasks	Whether the course webpage you browse has completed the established learning task and learning goal
	Learning log	Records of students in the course of learning

According to the above parameters, the interaction index is set up. Through the improved remote interaction mode of the training teaching platform, the construction of the remote interaction platform of the training teaching in the employment domain of colleges and Universities under the $1 + X$ certificate system is realized.

5   Experimental Results and Analysis

In this paper, a comparative experiment is proposed to compare the distance interaction platform of high-efficiency employment work area training teaching with the training platform (traditional platform) based on configuration and multimedia software. Analyze the differences between the two platforms. In the experiment, the proposed construction method was used as the experimental group and the traditional platform as the control

Table 3. Basic information of test objects

Name code	Examination results	
	Written examination	Practical training
01	94.5	84.5
02	92.5	80.5
03	92	80.5
04	96.5	88
05	94	84
06	90.5	78.5
07	91	79
08	92.5	79.5
09	98.5	89.5
010	97.5	84.5
011	95	85.5
012	95	83.5
013	95	80
014	97	82
015	96.5	90.5
016	96.5	90
017	94	91.5
018	94.5	86.5
019	92.5	87
020	93	89.5

group. In a university with a large number of specialties, 20 students with different specialties are randomly selected as the experimental test objects, and the basic information of the experimental objects is shown in Table 3.

According to Table 3, students' performance in culture class is normal and above the excellent level, but the training test results are not ideal. Most of the students are 90 points away from the excellent file, which is a certain distance away. The results of the two training platforms were compared. Figure 6 shows the comparison results of this experiment.
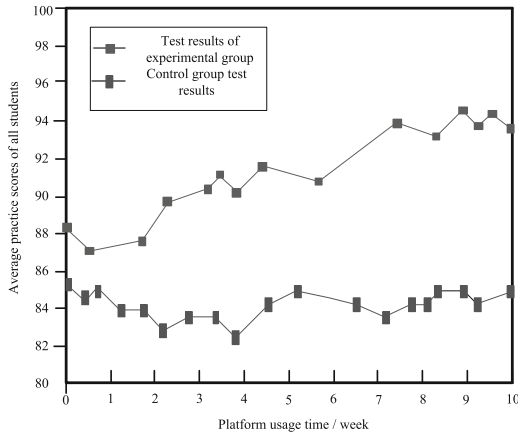

Fig. 6. Comparison of students' performance after learning in different systems

According to the experimental results in Fig. 6, taking 10 weeks as the experimental test cycle, there are great differences between the two training teaching platforms, which are embodied in the students' scores. According to the curve trend, the design of the remote interactive training teaching platform, due to its superior video and audio display, teacher-student interaction, as well as the function of appointment, deepens students' interest in learning, makes students increase the enthusiasm of self-help training, so improves the training test results. The traditional training teaching platform, because of its weak function, can not meet the students' understanding of the training content, and there is no online interaction, which reduces the enthusiasm of students, leading to the training performance has been below the excellent level. Based on the above experimental results, it can be seen that this platform can improve the practical training level of students and enhance their employment competitiveness.

6   Conclusion

Under the condition of considering the $1 + X$ certificate system, the platform designed in this paper can enhance the video and audio teaching effect of the platform, and set up the program and interactive mode that can be reserved. At the same time of improving the enthusiasm of students, we should strengthen the training ability of students, so as

to provide guarantee for the graduates' employment choice in the future. But this design is designed for students and teachers. In the future, other hardware facilities can be optimized to further improve the real-time feedback of the platform.

7 Fund Projects

(1) 2019 research project of college level teaching reform of Chongqing Tourism Vocational College, key project, project name: research and practice of automobile inspection and maintenance technology construction based on 1 + X certificate system, Project No: yjg2019002.

(2) 2019 college level teaching achievement cultivation project of Chongqing Tourism Vocational College, project name: Exploration and practice of "post rotation" practical teaching based on work station under 1 + X certificate system, Project No: yjcg2019006.

References

1. Tian, K.Y., Shang, F.F., Tian, Y.Y., et al.: Apprenticeship system of American NCCAOM Certification of acupuncture and oriental medicine. Zhongguo Zhen Jiu=Chin. Acupunct. Moxibustion **39**(4), 429–432 (2019)
2. Wu, L.D., Huang, W.Q., Xiao, L.W.: Construction of teaching and training platform of distance vocational education based on VR. J. Ningbo Radio TV University **16**(2), 96–101 (2018)
3. Lei, Z., Zhou, H., Hu, W., et al.: Modular web-based interactive hybrid laboratory framework for research and education. IEEE Access **17**(6), 20152–20163 (2018)
4. Cheshire, M.H., Strickland, H.P.: Distance learning teaching strategies in registered nurse to baccalaureate nurse programs: advancing cultural competence of registered nurses in providing end-of-life care. Teach. Learn. Nurs. **13**(3), 153–155 (2018)
5. Achilleos, A.P., Mettouris, C., Yeratziotis, A., et al.: SciChallenge: a social media aware platform for contest-based STEM education and motivation of young students. IEEE Trans. Learn. Technol. **12**(1), 98–111 (2018)
6. Li, G., Wang, F.: Research on art innovation teaching platform based on data mining algorithm. Cluster Comput. **22**(6), 13867–13872 (2019)
7. Rodríguez-Prieto, A., Camacho, A.M., Merayo, D., et al.: An educational software to reinforce the comprehensive learning of materials selection. Comput. Appl. Eng. Educ. **26**(1), 125–140 (2018)
8. Fan, Y., Zhang, J., Yu, H., et al.: Research on digital and analog electronic experiment teaching course management based on UltraLab network experiment platform. Int. J. Plant Eng. Manage. **32**(4), 206–215 (2018)
9. Bai, Y., Huang, F., Wang, Q., et al.: Development of practical teaching model based on intelligent comprehensive nursing practice platform. Stud. Health Technol. Inform. **250**(5), 240 (2018)
10. Ranga, J.S.: Multipurpose use of explain everything iPad app for teaching chemistry courses. J. Chem. Educ. **95**(5), 895–898 (2018)