Design of International Teaching Quality Evaluation System for Railway Locomotive Specialty Based on Mobile Terminal

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Abstract. Domestic railway locomotive colleges attach great importance to the supervision, evaluation and guidance of international teaching. It is necessary to build a set of teaching evaluation system suitable for the development of railway locomotive colleges. The current teaching quality evaluation system still has the problem of poor evaluation accuracy. Therefore, this paper designs an international teaching quality evaluation system for railway locomotive specialty based on mobile terminal. The system is divided into PC Web terminal and mobile terminal, and the appropriate chip and network equipment are selected to complete the selection of central integrated chip and the design process of network interface. According to the results of hardware optimization, a new evaluation index system is designed, and the teaching quality evaluation model is constructed by using analytic hierarchy process. By combining hardware with software, the design of international teaching quality evaluation system for railway locomotive specialty based on mobile terminal has been completed. The test shows that the application effect of the system is better than that of the current system, which has a certain role in promoting the international teaching of railway locomotive specialty.

Keywords: Mobile terminal · Teaching quality evaluation · Analytic hierarchy process · Scaling method

1 Introduction

The international teaching quality of railway locomotive specialty is not only the lifeline of the survival and development of railway locomotive specialty, but also the foundation of railway locomotive specialty. Continuously improving the teaching quality of railway locomotive specialty is the eternal theme of education and teaching. Teaching quality evaluation of railway locomotive professional teachers is one of the key links of teaching management, which plays a positive role in promoting and promoting the teaching quality of teachers [1, 2]. Research shows that good teaching qualities can not only improve students' academic performance in school, but also improve students' salaries after graduation. In recent years, important education documents at home and abroad reveal the important position of teaching quality evaluation in the whole higher education system, and indicate the transformation orientation of teaching quality evaluation in the

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aspects of content, mode and method. On the basis of the diversification of modern higher education, the education evaluation mode is facing the practical need of comprehensive transformation to informatization.

In reference [3], a series of teaching activities of "I ask you to answer" were designed to improve the deficiency of the homework form of students' self-made questions. The activity design included the design of roles and tasks, links and processes, evaluation mechanism and activity work page. The links of question writing, question answering, evaluation and discussion correction were integrated, and the quality blind evaluation was embedded in each key link. Through the practice of circuit course at Tianjin University, it shows that this method can make students fully integrate and deepen their knowledge, and the teaching effect is very significant while reducing the workload of teachers. In reference [4], a teaching evaluation system based on B/S mode is designed, in order to meet the needs of teaching quality evaluation of university teachers, UML technology designed and developed by MyEclipse and webstorm is used as the back-end tool and front-end tool. Taking tomcat 7.0.54 as the server and MySQL as the database, the system is standard, efficient, practical and easy to expand. Mobile Internet is regarded as the core and one of the most important trends of the future network development. The combination of education evaluation and the mobile Internet has become the inevitable trend of the development of education, and the informatization of education evaluation is the inevitable result of the development of the times and technology. Therefore, fully relying on the mobile Internet platform to achieve continuous, comprehensive and real evaluation results of teachers' teaching quality, and constantly using the evaluation results to improve the teaching quality of colleges and universities is the current trend [5].

According to the above analysis, the focus of international teaching quality evaluation of railway locomotive specialty should shift from infrastructure construction to application level. Therefore, a mobile terminal based international teaching quality evaluation system for railway locomotive specialty is designed, and a reasonable evaluation index is established in order to improve students' participation.

2 Hardware Design of International Teaching Quality Evaluation System for Railway Locomotive Specialty

Through the research and analysis of the shortcomings of the current international teaching quality evaluation system of railway locomotive specialty, the optimization design is based on the mobile terminal, in order to optimize the data processing speed and reliability of the current international teaching quality evaluation system of railway locomotive specialty more effectively. On the premise of optimizing the hardware and software of the whole system, the hardware structure of the system is designed. The hardware structure of the system after design is shown as follows.

According to the content in Fig. 1, the software part of the system is designed based on the construction of the hardware part of the system. The optimized hardware structure of the system is used as the basis of software development, and the system hardware structure in Fig. 1 is optimized to complete the selection of each device. In order to flexibly adapt to the integration of all kinds of terminals, this topic is based

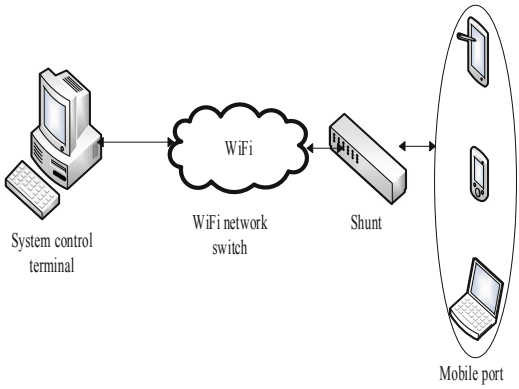

Fig. 1. Hardware structure of the system

on the theory of service computing, on the basis of in-depth study of service-oriented architecture (SOA), using web services technology, the interface of system integration is developed, so that the system can integrate all kinds of terminal programs, and achieve good scalability and cross terminal adaptability. Specifically, at the bottom of the system architecture, the web service is used to develop the system interface. On the basis of the web service interface, the mobile end and PC end of the system are developed. Therefore, the mobile end and PC end can adopt different programming technologies for development.

2.1 Central Integrated Chip Selection

The intelligent control of mobile terminal is the development trend of computer technology control. Using single chip microcomputer to control the mobile terminal is the most commonly used means to realize the intelligent control of mobile digital terminal. Through literature research, it can be seen that MCU integrates CPU, ram, ROM (EPROM or EEPROM), clock, timer/counter, serial and parallel I/O ports with multiple functions on one chip. In addition to the above basic functions, some also integrate A/D, D/A and other modules, such as Intel's 8098 series. It has the characteristics of processing capacity, low price, complete development environment and complete development tools. The system with single chip microcomputer as the digital control core not only has simple circuit, but also can realize more complex control with strong flexibility and adaptability. Therefore, this study will use a single-chip microcomputer as the main part of the central integrated controller. According to the system design requirements, inter series single-chip microcomputer is selected as the minimum control system. The schematic diagram of the chip and its peripheral circuit is shown in Fig. 2. The main frequency of the system is 8 m. There is no need to install additional program memory. The main components of the minimum system are described in detail as follows.

In order to ensure that the MCU can be effectively connected with other devices in the mobile terminal, the D/A conversion interface is set in it. D/A conversion is a typical interface technology of application measurement and control system. The main content of its design is the rotation of D/A integrated chip, configuration of peripheral circuits

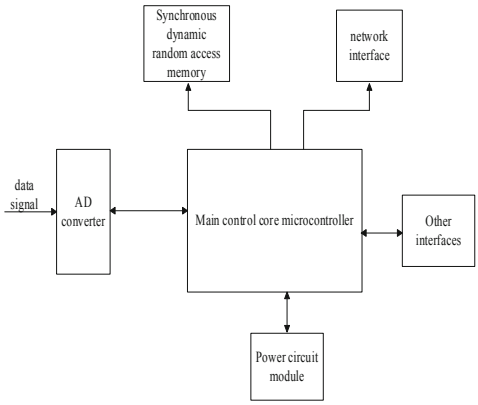

Fig. 2. Structure chart of central integrated control chip

and devices. Considering the performance, structure and application characteristics of the system, the D/A conversion chip selected in this study is set as multiple interfaces to meet the interface requirements of the system and reduce the development cost of the system.

2.2 Network Communication Interface Design

In this study, the wireless network terminal as the main platform of system design, to achieve the management of wireless network, must have the corresponding hardware support, in order to cooperate with the management end, to achieve the use process of the whole mobile terminal.

The hardware architecture is the bottom module of the whole network communication interface, and the hardware must support openway system [6, 7]. At the same time, the signal conversion chip is added in this interface to improve the communication ability of the system. At present, many companies in the market provide a variety of lUDs signal conversion chips. The obvious advantage of this design is that the form of front-end signal level is not limited. At the same time, there are many kinds of chips to choose from. According to the requirements, the chips with excellent performance can be selected in different transmission application fields, and different conversion chip characteristics can be used to meet different design requirements. This topic selects the lUDs signal conversion chip from Texas Instruments Company, which can not only meet the high-speed, multi-channel transmission characteristics, but also has strong anti electromagnetic interference ability, and improves the data transmission ability of the system to a certain extent.

The central integrated control chip and network communication interface designed in this study are introduced into the original hardware framework of the system. So far, the hardware design of international teaching quality evaluation system for railway locomotive specialty is completed.

3 Software Design of International Teaching Quality Evaluation System for Railway Locomotive Specialty

3.1 Construction of Evaluation Index System

This paper attempts to use the method of literature analysis to summarize the existing teaching quality evaluation related indicators, and systematically sort out, sort out the existing construction of the teaching quality evaluation index system, and sort out the key indicators. With the help of China Wanfang, CNKI and other paper websites, this paper collects journals, monographs and academic papers related to teaching quality, teaching quality evaluation, university evaluation index, education informatization, mobile teaching evaluation in five years, so as to screen, sort out and summarize the existing research on teaching quality evaluation index in China. 14 indicators are listed by exhaustive method, as shown in Table 1.

Table 1. Evaluation index system of international teaching quality of railway locomotive

Serial number	Index content	Direction
1	Excellent scientific research ability	Teachers' teaching direction
2	With noble sentiments	Teachers' teaching direction
3	Have the spirit of dedication	Teachers' teaching direction
4	Teachers' professional skills	Teachers' teaching direction
5	Teachers' professional conscience	Teachers' teaching direction
6	Teachers' professional style	Teachers' teaching direction
7	Professional honor of Teachers	Teachers' teaching direction
8	Internationalization of students' learning content	Students' learning direction
9	Students have international thinking	Students' learning direction
10	Students pay attention to international current affairs	Students' learning direction
11	Uphold academic spirit and abide by academic norms	Students' learning direction
12	To undertake social responsibility for national prosperity and national rejuvenation	Students' learning direction
13	Application of advanced technology	Students' learning direction
14	Good learning attitude	Students' learning direction

At present, most of the research uses the analytic hierarchy process, the Delphi method, the entropy weight method, the average method to determine the weight of indicators, and several methods have their own advantages and disadvantages [8–10]. In this study, AHP is used to assign the weight of indicators. AHP can determine the weight value of each indicator by comparing different indicators. It is a method of multiple

objectives decision-making combining qualitative analysis and quantitative analysis. It is systematic, easy to operate and needs less quantitative data. This method provides a good solution for multi index and multi solution [11]. In this study, AHP is used to deal with the index system, which provides the basis for the follow-up evaluation.

3.2 Building Evaluation Model

According to the evaluation index system, the scale method is used to build the evaluation model in this study. After comparing the evaluation indexes at the same level, the judgment matrix is obtained.

$$A = \begin{bmatrix} a_{11} & a_{12} & \ldots & a_{1n} \\ a_{21} & a_{22} & \ldots & a_{2n} \\ \ldots & \ldots & \ldots & \ldots \\ a_{m1} & a_{m2} & \ldots & a_{mn} \end{bmatrix} \tag{1}$$

The judgment matrix A should satisfy the following two conditions:

$$a_{ii} = 1(i = 1, 2, ..., n) \tag{2}$$

$$a_{ij} = a_{ji}(i, j = 1, 2, ..., n) \tag{3}$$

According to the above formula, the judgment matrix A is calculated to obtain the weight coefficient. A new matrix is obtained by column normalization of the judgment matrix.

$$B = (b_{ij})_{n*n} \tag{4}$$

$$b_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}} \tag{5}$$

The matrix C is obtained by summing the matrix B according to the row.

$$C = (c_i)_{n*1} \tag{6}$$

$$c_i = \sum_{j=1}^{n} a_{ij} \tag{7}$$

Once again, the matrix is normalized [12, 13], and the eigenvector is obtained.

$$D = (d_i)_{n*1} \tag{8}$$

$$d_{ij} = \frac{c_i}{\sum_{i=1}^{n} c_i} \tag{9}$$

According to the above formula, complete the evaluation process of international teaching. In order to ensure the reliability of the evaluation results, the consistency of the results is tested. Set the judgment matrix as order $m * m$ and the maximum eigenvalue as α_{max}. when $\alpha_{max} = m$, the matrix is said to have consistency, but in general case $\alpha_{max} \neq m$, then it is necessary to use the consistency ratio to test it

$$CR = \frac{CI}{RI} \tag{10}$$

CR is the consistency ratio; CI is the consistency test index, and:

$$CI = \frac{\alpha_{max} - 1}{n - 1} \tag{11}$$

$$\alpha_{max} = \frac{1}{n} \sum_{i=1}^{n} \frac{(R * C)_i}{c_i} \tag{12}$$

In the above formula, RI is the average random consistency index. Use the above formula to complete the evaluation process of international teaching quality, and output the evaluation results to the image system. So far, the design of railway locomotive professional international teaching quality evaluation system based on mobile terminal has been completed.

4 System Test Analysis

This test task is to find as many errors as possible before the software is put into operation. There are two goals of testing: the first is the process of executing a program to find errors in the program. The second point is that a good test plan is one that is likely to find errors that have not been found so far.

4.1 System Test Environment

In this study, the design process of the international teaching quality evaluation system for railway locomotive specialty based on mobile terminal is completed. In order to analyze the effect of its use, they built the system test link, compared it with the original system, and determined the difference between them. The test environment of the system is described in Table 2. The network environment is campus network, with a bandwidth of 100 m, the server used is Lenovo, and the database environment is SQL server2016.

Using the above system test environment as the comparison platform between the mobile terminal system and the original system, the differences between the two systems are studied.

Table 2. System test environment

Experimental network	Campus laboratory network		
The server	Lenovo architecture server		
Database	SQL Server2016		
Client	Model	ThinkPad X 1	
	Number	2	
	PC mobile terminal	Hardware configuration	Software configuration
		CPU: Intel(R)Core(TM)i5-2430 M 2.4 GHz	Operating system: Windows 10
		Memory: 16 GB	Internet Explorer 8
		Hard disk: 1 TB	–

4.2 System Testing Programme

Generally speaking, when the international teaching quality evaluation system of railway locomotive specialty is adopted, there are two kinds of errors: output error and data consistency error. The reason of output error is the defect of program design or the slow network speed. The so-called consistency error is caused by the user's error when uploading information. The above two different errors can be tested respectively. In the process of system testing, six basic principles are strictly observed to ensure the smooth completion of system testing. The specific function test contents and results are shown in Table 3.

Table 3. System function test results

Function test content	Test results	Is this correct
Sign in	Login successful	1
User query	Information query successful	2
Increase in evaluation content	Success	3
Modification of evaluation content	Success	4
Deletion of evaluation content	Success	5
User information correction	User information corrected	6

From the above experimental results, it can be seen that the function of mobile terminal system meets the current functional requirements, and the subsequent performance test can be carried out. In this test, the system indicators are set as follows: teaching quality evaluation accuracy, teaching quality grade division error value and teaching quality

evaluation running time. According to the above indicators, the application effects of the two systems are compared and analyzed.

4.3 System Test Results

As can be seen from Fig. 3, in the process of multi system simultaneous testing, the accuracy of teaching quality evaluation of mobile terminal system is significantly better than that of existing systems, and the highest accuracy rate can reach 87.5%. After many system tests, the accuracy of teaching quality evaluation of mobile terminal system is relatively stable, there are few problems of large fluctuations in the accuracy of evaluation, and it has a high and stable evaluation ability. Compared with the mobile terminal system, the evaluation accuracy of the comparison system is relatively low, the evaluation accuracy changes greatly and is unstable. Using the existing system to analyze the international teaching quality will lead to the teaching design and the current situation is not consistent. According to the above experimental results, the mobile terminal system is better than the current system.

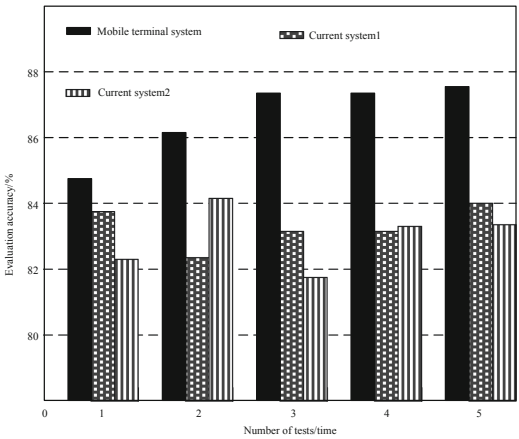

Fig. 3. Accuracy of teaching quality evaluation

In the process of this experiment, the accuracy of risk classification results is reflected as the data difference between each level after risk classification. In order to improve the representativeness of this test index, the above images are used to display and analyze it. As can be seen from Fig. 4, the result of teaching quality grading is more accurate and accurate, with lower error value and in line with the current teaching evaluation requirements. The results of risk assessment are divided into four levels according to the classification of teaching quality, and there are obvious differences between each level. The current system divides the teaching quality into three levels, and the differences between the levels are small, so it is unable to carry out a comprehensive analysis and timely teaching optimization on the international teaching quality.

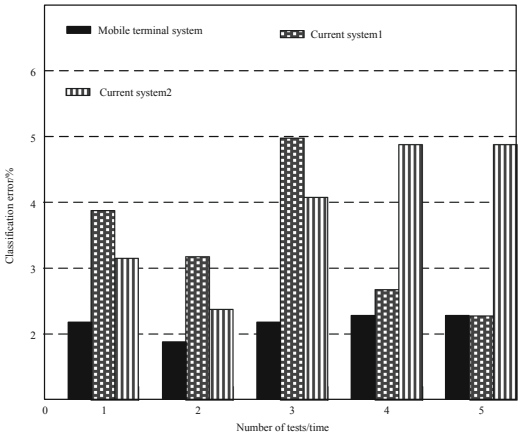

Fig. 4. Error value of teaching quality grading

Table 4. Length of evaluation of teaching quality

Test object	Test index	Test result/s
Mobile terminal system	Maximum running time	3.15
	Minimum running time	2.27
	Average running time	2.74
Original system 1	Maximum running time	4.13
	Minimum running time	3.85
	Average running time	4.06
Original system 2	Maximum running time	4.37
	Minimum running time	4.20
	Average running time	4.33

According to the test results in Table 4, the evaluation speed of the mobile terminal system is fast and stable. Although the current system also has high evaluation efficiency, it is still different from the mobile terminal system. In the follow-up research, this performance should be optimized in order to improve the use effect of the system. According to the above test results, the use effect of the mobile terminal system is better than the current system.

5 Conclusion

This paper studies and discusses the evaluation of international teaching quality of railway locomotive specialty under the network environment, and brings teachers into the overall environment of the teaching platform. Through the intelligent interaction among students, teachers, students and teachers, students and systems, teachers and systems,

through the multi-user interaction mode and multi-agent cooperation mechanism, an all-round teaching quality evaluation under the network environment is realized Intelligent education services. The research on international teaching quality evaluation of railway locomotive specialty has always been concerned by China, and the field of thesis and creation is constantly emerging. However, in the development of Internet technology, how to combine technology with research theory in-depth research. As countries, schools and parents pay more and more attention to education, people from all walks of life are paying more and more attention to teachers' teaching qualities. Due to the limited ability and knowledge of the author, the author only makes an in-depth analysis on the teaching quality of a single railway locomotive major, and does not explore the education problems in a wider range of majors. But it is these problems that can be further studied that have become a new starting point for my future research. There is no end to finding problems and constantly summarizing and exploring them.

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