Design and Application of Comprehensive Evaluation System for Teaching Quality of Computer Specialty Under the Background of Engineering Education Professional Certification

Qingliang Jiao, Kuiliang Xia, and Baomin Zheng(✉)

Heihe University, Heihe, Heilongjiang, China
35407045@qq.com

Abstract. In the computer major, comprehensive evaluation of teaching quality by engineering education certification is an important standard to measure teaching work, and it is also a means to test teaching quality. It plays an important role in training computer professionals and achieving teaching objectives in China. Therefore, this paper studies the design and application of comprehensive evaluation system for teaching quality of computer major under the background of engineering education certification. The application is designed based on Javaweb technology, and the server uses Apache Tomcat8.0. The front-end development language of the system is HTML + CSS + JavaScript, the development tool is Layui combined with JQuery, and the back-end development framework of the system is currently the mainstream SSH framework of Struts2 + spring + hibernate. In this paper, the construction of the system is described, and the implementation method is explained in detail. Analytic hierarchy process (AHP) with multi-level index model is adopted when establishing the evaluation system.

Keywords: engineering education professional certification · Evaluation of teaching quality · javaweb · application design

1 Introduction

With China becoming the 18th official member of "Washington Accord" in 2016, China's higher education has made great progress in the cause of opening to the outside world, so the certification of engineering education in China has entered a substantive stage. Engineering education quality assurance system is an internationally recognized professional evaluation system. Engineering professional certification requires that education should have professional teachers and curriculum system, and it needs to focus on students' learning ability to achieve this standard. Therefore, we should compare the certification standards of engineering education and combine the characteristics of computer science, study the teaching quality evaluation system of computer science, and use the most reasonable quality evaluation system to test the teaching results of computer science [1].

X. Yuan et al. (Eds.): ICEKIM 2023, AHCS 13, pp. 828–835, 2023.
https://doi.org/10.2991/978-94-6463-172-2_87

With the rapid increase of the number of computer majors, the existing evaluation management system scheme has been difficult to meet the demand, so we should design and develop a more practical and targeted comprehensive evaluation system for the teaching quality of computer majors under the background of engineering education certification. Reasonable use of a stable and good education quality evaluation system can promote the scientific and standardized teaching management. In this paper, javaweb technology is used to design the system structure according to the three-tier model of B/S structure, and a scientific evaluation system composed of students, teachers and leaders is established, and the evaluation data are reasonably classified and integrated. Combined with J2EE technology and MySQL database technology, the system is developed, and finally the comprehensive evaluation system of teaching quality of computer major is realized.

2 Key Technologies

2.1 JSP Technology

JSP is a widely used application development language, which is similar to Microsoft's ASP. ASP technology and JSP technology are both implemented by inserting scripts or program codes into static pages. They are both technologies that are responsible for interactive processing between web pages and clients, and then complete related operations in response to user requests. The application program designed with JSP technology as its core mainly uses the technology of JSP + JavaBean combination [2].

2.2 Database Technology

In order to ensure the stable performance and complete functions of the comprehensive evaluation system of computer teaching quality, database technology is an indispensable link. In the process of quality evaluation, the system will produce a large amount of temporary data and persistent city bureau, so it is necessary to use database technology to standardize the management of these data. The basic principle of database technology is to make a one-to-one correspondence between the physical database connection and the Connection Object of the client to establish a connection. When the data object loses its connection, the system can't return the data information requested by the client through the database server, so the client's access will also be disconnected, making it difficult to do related operations again. The technology responsible for solving the problem of resource consumption in data storage in database is Connection Pool technology, and the schematic diagram of connection pool is shown in Fig. 1. Connection Pool builds the database connection through the caching function of the system, so that when multiple users request, they only need to use the same data connection. Pool technology can improve the performance of database operation, especially in the three-tier network environment with few physical connections. First, the application uses DataSourceAPI interface function to access the back-end server. After the server receives the request, it uses Connection Pool DataSourceAPI and JDBC to establish a connection to Mysql database. JDBC driver uses the physical connection pool object to read the corresponding

object in the database and then returns it to the server. The server caches the data object through connection pool [3].

The database technology of this paper adopts Hibernate framework in ORM (Object Relational Mapping) technology and MySQL database, and uses DAO mode to finish the object persistence of data layer. The operation principle of Hibernate is shown in Fig. 2. By establishing JAVA objects and then using the called methods to process data, the operation time of data conversion is saved, and the development efficiency and maintainability are greatly improved. Hibernate combined with DAO layer makes use of the technology of mapping files to interact persistently with the data of implementation objects in the database, and provides connection objects for database connection pool.

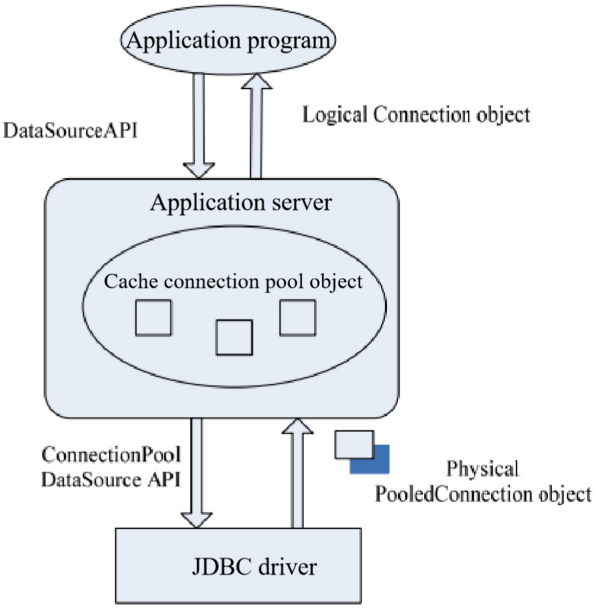

Fig. 1. Operation principle of the connection pool

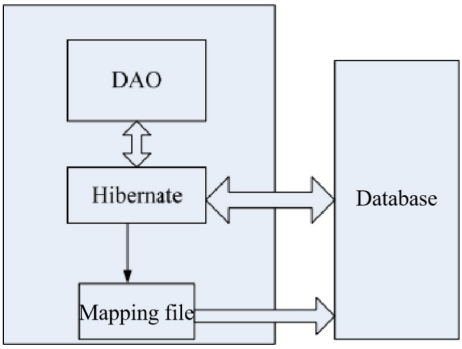

Fig. 2. Hibernate combined with DAO to realize object persistence

2.3 Development Environment

The comprehensive evaluation system of computer teaching quality is designed based on Javaweb technology. The development language is JAVA 8, the development tools are IDEA and Eclipse, and the server uses Apache Tomcat8.0. The front-end development language of the system is HTML + CSS + JavaScript, the development tool is Layui combined with JQuery, and the back-end development framework of the system is currently the mainstream SSH framework of Struts2 + spring + hibernate. Hibernate is the persistence layer framework. The operating environment is Windows10 operating system, JDK is 1.8, and MySQL8.0 is selected as the database. Through the construction of the above environment and the introduction of the technology, the feasibility of the system design is made clear. According to the application requirements of the above related application technologies, the construction and deployment of the development environment of the comprehensive evaluation system for the teaching quality of logarithmic computer specialty can be completed [4].

3 Requirements Analysis

3.1 Functional Requirements

The comprehensive evaluation system of computer teaching quality has three user ports: teachers, students and leaders. Users can log in to evaluate related courses and teachers of computer major. Teachers log in to evaluate other teachers' courses, check the grading results, opinions of students and other teachers, and evaluate the curriculum. The leader port evaluates the teachers from the aspect of teaching supervision, and evaluates the teaching achievements. In terms of the performance requirements of the system, it is required that the average transaction response time of the system should be kept between the expected value of 4 ms and 8 ms. The user capacity of the system is greater than 1000, and the maximum number of concurrent users is not less than 400. The stability of the system needs to reach the level of 600 users and 400 concurrent users accessing continuously for 24 h. The system requires that the update processing time should reach 2.6 s/form, and the system conversion and transmission time should be less than 3 s. The specific requirements are shown in Table 1 [5].

Table 1. System Performance Requirements Table

Performance	Demand item	Expectation value
System response efficiency	Average transaction response time	4 ms–8 ms
	Maximum system response time	Less than 2.5s
	Update processing time	No form for up to 4 s
	Data transfer time	3.5 s
System capacity	Number of system users	More than 1000
	Maximum number of concurrent users	400

3.2 Overall Design

The comprehensive evaluation system of computer teaching quality is developed by J2EE framework combined with B/S mode, and the overall design framework of the system is shown in Fig. 3. J2EE architecture can be based on components and use the components in it. The application multi-layer model system is divided from the software architecture, and the multi-layer distributed application model is adopted, which is divided into three layers.

The first layer is the JSP layer, which is also the client layer. It is responsible for the related design of the interaction between the front-end page and the server. It can provide a Web browser access channel for system management, and at the same time, it can provide APLWeb Service calling function for different business systems. The second layer is the page layer, which uses Struts to establish basic configuration files for the forms and operations of the page, and mainly serves the presentation layer logic of accessing the system client through the Web. The third layer is the server layer, also called the business layer, which centralizes the logic and data processing of the system business. This layer uses spring to interface with pages, and implements related logical functions, while hibernate is responsible for the interface between DAO layer and database. The business layer mainly realizes functions through management modules, including user management, access control, teaching evaluation management and other functions. The fourth layer is the database layer, which uses MySQL to store the relevant data of the application system, and realize the operations such as calling, deleting and modifying the data. The data layer also needs to continue to classify and integrate the data in the application system. The database realizes the relational database and LDAP directory server, and supports the J2EE architecture through the database to fulfill the online evaluation requirements of a large number of users at the same time, and ensures the security and integrity of data [6].

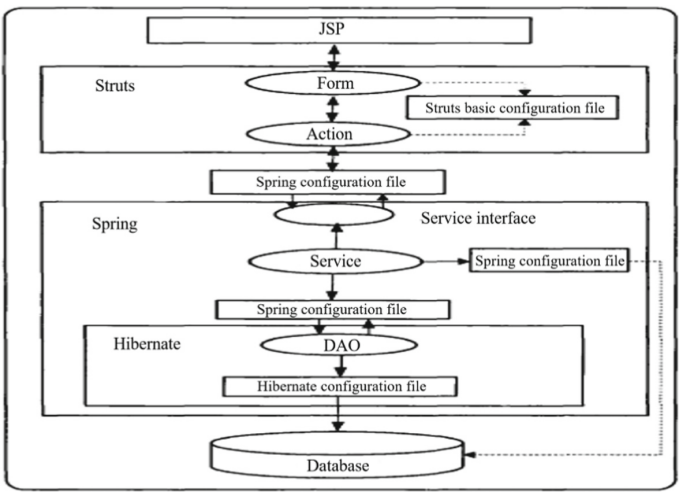

Fig. 3. Overall design technical diagram of the system

4 Functional Implementation

The user ports of the system are divided into three categories: teachers, students and leaders. Therefore, the system needs to authenticate the user's identity separately, and then the system displays the corresponding page according to the user type [7]. When logging in, users should choose their own identity to log in, submit their userid and password, and then the system will call the access class according to the database verification information. The system authentication user function code is shown in Fig. 4.

Users need to use hibernate.cfg.xml to configure the relational database MySQL, and create persistent object mapping definitions, such as user.hbm.xml. The configuration source code of this part is shown in Fig. 5.

Take student users as an example. When evaluating teachers, we should first show the list of courses and use < logic:empty > and < logic:iterate > to judge the contents of the list. After that, students click on the course list to evaluate the teaching quality relative to the teachers, fill in the rating and submit the results. At this time, the system page needs to send a request to save the evaluation results, and the request instruction is "studentOperate.do?" method=saveEvalute". SaveEvaluate () is the key to the method of processing the page request, and it belongs to the content of StudentAction. Teachers can check the grading results of students. The view request is "teacherOperate.do?" method=goViewEvaluate". After the teacher port sends this instruction, he can check the latest student evaluation results [8].

```
Determine whether the login user exists in the data table student/teacher/expert, and
execute the SQL statement:
"select*from myuser where username=""++username+" anduserpswd="+userpswd+";
ResultSet rs=stmt executeQuery(sqlstr);
//Decide to turn according to judgment
if(!rs.next()}
<script language="ja}ascript">
window.alert(" error message");
</script>
<span class="STYLEI">Wrong user name or password<</span><br/>
<a href--"login.jsp">Return login<</a>
response.sendRedirect( "main.] sp");/Turn to the corresponding home page
}
```

Fig. 4. System Validate user function code

```
<hibernate -mapping package = " com.cgnu.postgraduate.model" >
<class name="User" table=" user" >
<id name=" username"type=”java.lang.String""><id>
<property name=" password" not-null=" true"type="java.lang.String>
</property>
</class>
<hibernate-mapping>
```

Fig. 5. Hibernate creates persistent objects

Table 2. Average random consistency index RI

n	1	2	3	4	5	6	7	8	9
RI	0	0	0.43	0.92	1.11	1.26	1.31	1.39	1.54

The establishment of the evaluation index system needs to design multi-level evaluation indexes, and each first-level index should be set up with a second-level index. When establishing the system, we should pay attention to the analytic hierarchy process (AHP) of multi-level index model. Firstly, the hierarchical structure model is established, and then the data is classified into multiple levels, and the elements of each level are kept subordinate, and each data element will change with the changes of the upper level elements [9]. Then a comparison matrix is established for each layer of elements, and finally the coefficients of the comparison matrix are determined to complete the construction of the evaluation system. After obtaining the comparison matrix, the necessary work is the consistency test. The step of consistency check is to calculate the eigenvectors of paired matrices at first, and then check the consistency index of the eigenvectors, and normalize the qualified eigenvectors. Get the weight vector of the final matrix. After calculating the weight vector, we can get the consistency index CI through formula (1):

$$C1 = \frac{-1}{n-1}\sum_{i=2}^{n}\lambda_i = \frac{\lambda_{max}-n}{n-1} \tag{1}$$

For n =…9, Saaty gives the value of RI, as shown in Table 2. In the table, the random consistency index is RI, and the order of matrix is N. After calculating CI and RI, the consistency ratio CR = CI/RI can be calculated. Finally, the consistency can be judged according to the value of CR. When CR is less than 0.1, the consistency of paired comparison matrix is the best.

5 Conclusions

Establishing a set of scientific and reasonable teaching quality evaluation of computer major is the key to the education management of computer major in China, so this paper studies the teaching quality evaluation system developed by javaweb technology in computer technology. The experiment proves that it can effectively improve the comprehensive quality of college students majoring in computer science, and has strong practicability and popularization value. However, due to the limited time, there are many shortcomings in this research, which will be further strengthened in the future research. At present, the teaching quality evaluation system can only assist analysis, but can't make intelligent decisions. In the future research, we should consider adding intelligent evaluation modules and decision-making modules [10].

Acknowledgments. 1. The General Project of Higher Education and Teaching Reform of HeiLong Jiang in 2021(SJGY20210596).

2. Higher Education and Teaching Reform project of HeiHe university in 2020 (XJGZ202002).

References

1. Luo Zhen. (2022) New Development of Teaching Quality Evaluation in Colleges and Universities from the Perspective of Engineering Professional Certification. Digital Printing. 04.
2. Liu Long, Shen Hua, Han Xue. (2021) Research on Evaluation Method of Graduation Requirements and Course Objectives Based on Engineering Education Professional Certification. Computer Education. 08.
3. Wei Lu, Wu Deyi, Tao Mingxia. (2020) Research on the Construction of Teaching Quality Monitoring System under the Background of Engineering Education Certification. Journal of Hefei University. 12.
4. Zhao Ling. (2015) Research on Undergraduate Teaching Quality Management System in Colleges and Universities under the Background of Engineering Professional Certification. College Construction. 12.
5. Zhang Yutong. (2014) Design and Implementation of Diversified Teaching Quality Evaluation System Based on J2EE. Shandong University. 04.
6. Wang Yongwang. (2019) Development of Teaching Quality Evaluation System in Colleges and Universities Based on Rete Algorithm. Shenyang Ligong University. 05.
7. Wang Xiaolin, Jiang Aihua, Chen Jie, Qin Haiou. (2018) Taking Engineering Education Professional Certification as an Opportunity to Improve the Management Mechanism of Continuous Improvement of Teaching Quality. University Academic. 02.
8. Ren Yanan.Design and Implementation of Teaching Quality Evaluation System in Higher Vocational Colleges. Xidian University. 2017.12.
9. Wen Hu.Design and Implementation of Teaching Effect Evaluation System Based on SSH. Jilin University. 2012.06.
10. Zeng Shaohua, Yuan Li.Design and Implementation of Evaluation System for Postgraduates' Scientific Research Ability Based on SSH2 Framework. Research on Computer Application Teaching. 2016.03.