

An Teaching Quality Evaluation System Based on Java EE

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Abstract: The teaching quality evaluation system is always the significant part in teachers' examination management. With the require of higher talents quality in society, the conventional teaching quality evaluation is in the soup. This essay present a program which is basic on teaching quality evaluation system of Java EE to solve the problem .Including the instability operation ,hard maintain of teaching quality system now and the defect in confirming value of AHP in comprehensive evaluation. The system includes JSF(Java Server Faces) EJB(Enterprise Java Bean) and JPA(Java Persistence API), uses mode of MVC to develop and build PSO_AHP model to solve the problem of the unavailability in improving value and indicator uniformity when judgement matrix is certain in AHP. The essay's results of data comparison chart reveal the solution proposed in the paper is desired. Meanwhile the performance that how to improve teaching quality evaluation proposed in the paper is more likely to have a valuable implication in company or related field.

Keywords: JSF/EJB/JPA, Teaching Quality Evaluation, AHP, PSO, PSO_AHP Model

1. Introduction

Teaching quality evaluation system is the crucial tool to make comprehensive assessment which is basic on a number of indicator of teachers for school. While most of schools in China is using teaching quality evaluation system, there still has many problems in much more using process. Such as the increase of using system load, hardly maintain and the evaluation results have uncertainty and unconvincing subjectivity. Especially, the lack of scientific nature and reliability in comprehensive evaluation weights is particularly acute. This essay proposes a program named Java EE teaching quality evaluation system which is using for the trouble listed before. The system choose the open-source framework: JSF, EJB3.0, JPA, develop with MVC mode and masterly take frame skill into system operation to solve the issue: the big load rises and the difficult maintain. Teaching quality evaluation system is the core. This paper improve AHP and build PSO_AHP model to solve the problem of the unavailability in improving value and indicator uniformity when judgement matrix is certain. Meanwhile the performance that how to improve teaching quality evaluation

on basis of Java EE proposed in the paper is more likely to have a valuable implication in company or related field in the future.

2. Selection and Analysis of System Development Environment

2.1. Java EE Selection

The full name of Java Platform Java EE English, Enterprise Edition, Sun launched the enterprise platform portability, safety and standards for multiple users, in order to achieve cross J2SE/WEB/EJB micro container company, protect the core business component (Middleware), continue its vitality, rather than relying on the J2SE/J2EE version. So JDK5.0 from the beginning, will be renamed J2EE Java EE. Java EE application is composed of components, the system structure is divided into the presentation layer, middle layer and data layer, this structure has the advantages of shared by the three components of the code, to reduce the development time, said at the same time layer and data layer are independent of each other, so that the system has good scalability that provides

good division and cooperation for the project development, play to their strengths.

2.2. Introduction to the Development of Related Technologies

JPA (Java persistence API) is based on the Java persistence solutions, mainly in order to solve the current problems not compatible between the various object relational mapping (ORM) framework. The role is to on the real operation, the conversion paired database operation [1]. JPA is in the full absorption on the basis of the existing ORM framework, presents a unified standard norms, with support for advanced features of the object oriented, with comparable to the JDBC query capabilities, JPA as a persistent, can easily with other frameworks or container integrated, so the choice of JPA, is to choose the standard [2].

JSF (Java Service Face) Java Web MVC is completely follow the pattern design presentation layer framework [3]. Has the authenticator and converter can automatically complete the verification and data type conversion, reusable UI components as the core of JSF technology, improve the efficiency of software development, increase the maintainability, event driven development model based on the introduction of JSF, the UI component can be operated smoothly, at the same time the page navigation JSF avoids the shortcomings of centralized decentralized page navigation. Because the JSF is through Java Communication Process (JCP) is a standard Java development, so the development tool vendors can provide easy to use for the Java Service Face, efficient visualization development environment [4].

EJB (Enterprise Java Bean) is used for developing and deploying multi-tier structure, distributed application system, Java object-oriented cross platform component architecture [5]. from Java EE 5 to EJB3.0 on the use of annotation tools and O/R mapping model based on Hibernate, is now more a step forward, let a mark the POJO session Bean. EJB types are divided into entity Bean (Entity Bean), message driven Bean (MDB), Bean (Session Bean) session, there are two types of persistent entity Bean: BMP (Bean management persistent) and CMP (container managed persistence), BMP is a persistent Bean to realize by oneself CMP, is the persistence of Bean is realized by the container, do not need to write the operation database in the Bean code.

2.3. GlassFish Server

GlassFish is based on the open source community Java application server project, it in addition to have and support various characteristics of Java EE with many unique characteristics, GlassFish server has its own lazy loading technology, the server will be the first start some essential core services, such as JNDI and JMX service such as service time being less than the first not to be loaded, need GlassFish will automatically load. Compared with the tomcat, GlassFish hot deployment ability is stronger, at the same time, it is able to provide the required EJB container EJB Technology, and can provide JBoss EJB container compared to GlassFish not only

open source, hot deployment capability is strong, the OSGi support, and the kernel is small, fast startup.

3. System Architecture Design

3.1. System Architecture

Responsible for the representation of EJB in the design work carried out to develop a good web application program, how to make different frameworks in different application levels between mutual and close integration, at the same time, the low coupling way to complete a application function, is our concern. So the choice of excellent system framework can not only improve the system flexibility, scalability, portability, easy maintenance, but also improve system reusability, so that the system has good expansion function. Therefore the system the JSF JPA system architecture model, the JSF complete system function layer, EJB system logic control, JPA is complete system data persistence.

Teaching quality evaluation system based on this architecture, using the principle of MVC design pattern of the system is divided into the following three layers: presentation layer, business logic layer, persistence layer, thus making each layer in the application has a clear division of labor, not with other layers aliasing, between layer and layer through the interface communication, so as to achieve the purpose of expected system decoupling. Each layer between the functions of the system description is divided into:

Presentation layer: the presentation layer is mainly responsible for the user to send the request to display information to the user control page navigation and transfer the user input to the business logic layer. JSF as the framework, it contains the following: API said UI components, state management, event handling mechanism, server-side validation, data conversion, definition of page navigation, international support JSP, the tag library as well as for these characteristics provide a scalable [6] function, introducing the event handling mechanism which is a modified request-response processing mechanism of traditional Java Web applications, can be directly to the HTTP request for specific mapping processing component of the event. Under the management of Managed bean to create the JSF package for application layer data and events in response, the event processing is completed by calling the EJB Bean business class container management, EJB management of the business object can search through dependency injection, Managed Bean configuration reference EJB or JNDI to achieve, so as to achieve the complete separation of the presentation layer and business logic layer [7].

Persistence layer: persistence layer is responsible for data persistence, invoke the business logic layer, through ORM (object relational mapping tool will relational database mapping data into objects, achieve the object-oriented way of operating the database. This layer using JPA technology to realize the persistence operation of the data, mapping an entity class into data in a database table, the entity attributes are mapped into fields in the data table, entity User.java as

follows:

```
package com.jee6learning.jpa.entity;
import java.io.Serializable;
...
@Entity
@Table(name = "users")
@NamedQueries({
    @NamedQuery(name="findAllUsers", query="select u
from User u"),
...
})
public class User implements Serializable {
    private static final long serialVersionUID = 1L;
    @Id
    @Column(name="userid",length=20)
    private Integer userid;
    ...
    public User() {
    }
    ....
    public Integer getUserid() {
    return userid;
    }
    public void setUserid(Integer userid) {
    this.userid = userid;
    }
    ....
}
```

through the JPA configuration persistence.xml file is configured to connect to the database connection pool, user name and password information, part of the persistence.xml configuration code are as follows:

```
<persistence-unitname="jpaentity0"
transaction-type="RESOURCE_LOCAL">
    <provider>org.hibernate.ejb.HibernatePersistence</provid
er>
    <class>com.jee6learning.jpa.entity.User</class>
    ....
    <Properties>
    <property name="hibernate.dialect"
        value="org.hibernate.dialect.MySQL5Dialect"/>
    <property name="hibernate.connection.driver_class"
```

```
value="com.mysql.jdbc.Driver"/>
    <property name="hibernate.connection.username"
value="root"/>
    <property name="hibernate.connection.password"
value="root"/>
    <property name="hibernate.connection.url"
value="jdbc:mysql://localhost:3306/jee6learning"/>
    <property name="hibernate.hbm2ddl.auto"
value="update"/></properties>
</persistence-unit>
```

Overall, at the same time to realize the concept of the EJB implementation of the formulation of the business logic layer is the system architecture of the core part, mainly responsible for business rules and business process and business needs related system design is based on IOC framework in the business logic layer the choice of EJB, it provides "dependency injection", JNDI, "inversion of control (IOC)" can be easily implemented on two layer interface service EJB container also provides distributed transaction management, database connection, the component life cycle management services, so that they do not directly communications, business layer from the presentation layer provides the service and management from the business logic to the persistence layer implementation, the system architecture is shown in Figure 1 below.

3.2. System Architecture

Participants in the evaluation system of teaching quality evaluation, administrators, teachers and important cases have modify personal information, evaluation and scoring, query evaluation results, evaluation management, teaching information management, data calculation, evaluation content management. Teachers use system can view to participate in the evaluation of the comprehensive results, modify personal information, evaluation using system of teacher evaluation, modify personal information, query evaluation results, administrators use the system to the user evaluation in relation to the management, maintenance user information and teacher's teaching information, management evaluation contents, set index weight calculated data. As shown in Figure 2.

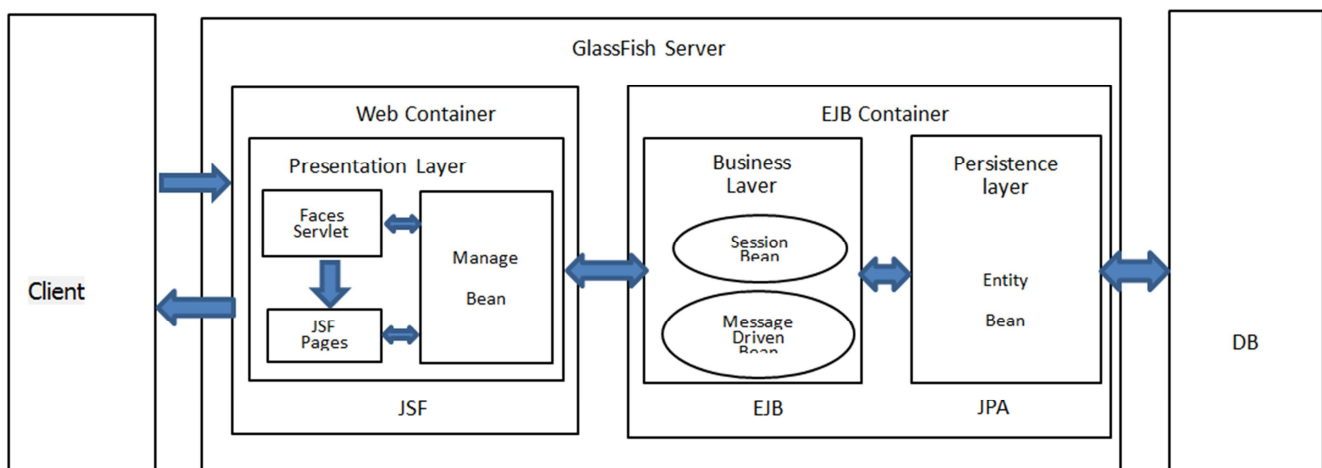


Fig. 1. Teaching quality evaluation system architecture diagram.

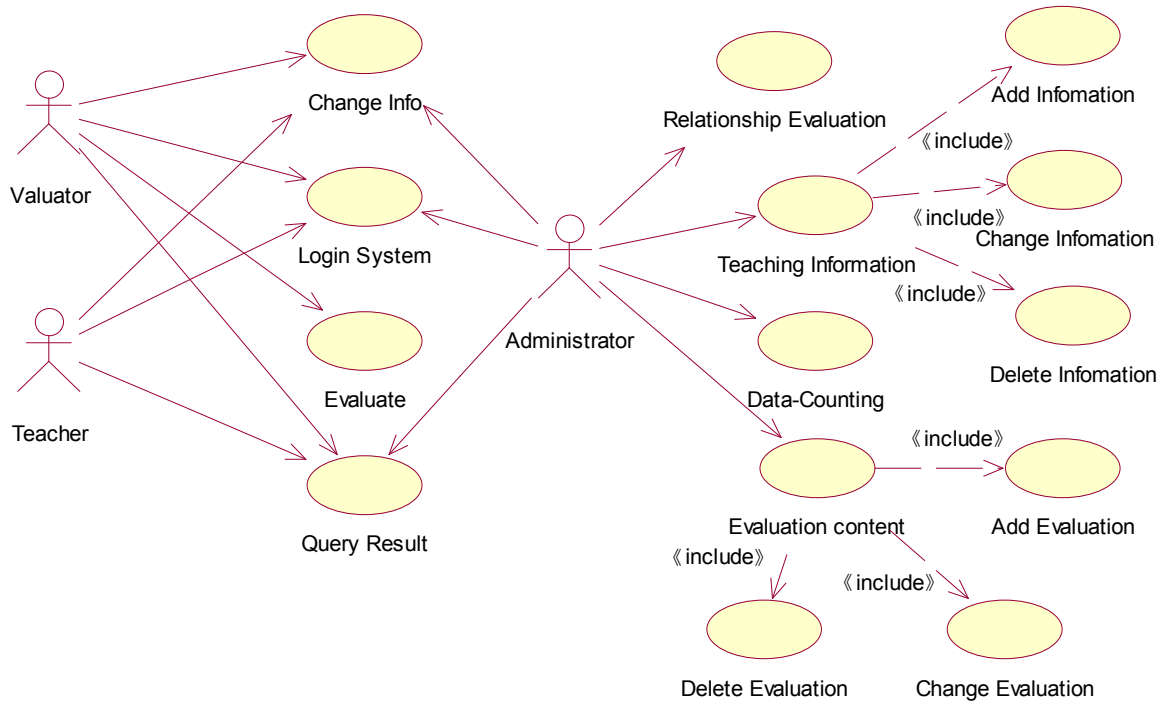


Fig. 2. Teaching quality evaluation system use case.

4. The Evaluation of Teaching Quality

With the rapid development of information technology, analytic hierarchy process, fuzzy algorithm, multiple linear regression and comprehensive evaluation method, a variety of techniques in the teaching quality evaluation has been widely used. But the use of a single method in the actual operation efficiency is relatively low, the defects of the algorithm with some limitations. Therefore, this paper on the status quo of teaching quality evaluation were in-depth analysis, put forward a kind of based on PSO AHP evaluation of teaching quality weight method. By means of the SPO algorithm of weight optimization model is solved, and outputs a globally optimal location and the corresponding weight values, consistent index function value MinCIF.

4.1. Level Analysis Method

The analytic hierarchy process (Analytic Hierarchy Process AHP) the basic principle is a complicated multi-objective decision making problem as a big system, and then a detailed analysis of each target in the system, determine the level of the relationship, then the objective comparison of several layers of the same level of elements, establish judgment matrix analysis of the relative importance between elements and quantitatively expressed, so as to get the level to get between the layers and the weight ratio of all the elements of each level in the coefficient, finally according to the weight ratio between the various factors to plan hierarchy system. The methods of qualitative analysis and quantitative analysis combined with system and logic very strong is the effective method to solve the multi-level, multi-objective decision-making problem [8].

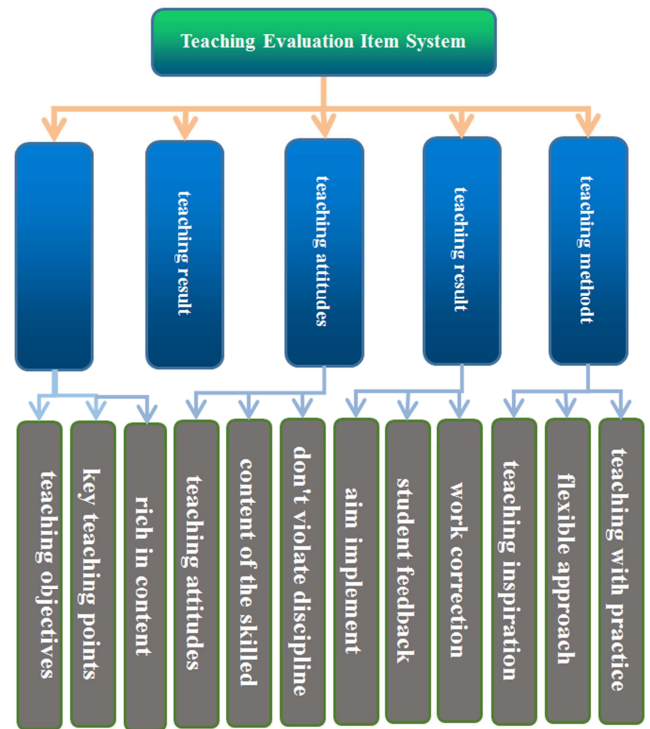


Fig. 3. Teaching quality evaluation index system.

4.1.1. To Construct the Hierarchical Structure Model

In this paper, the factors which have influence on the teaching quality evaluation were in-depth analysis, using analytic hierarchy process, will influence the teaching quality evaluation of all factors are divided into several layers with different properties, by reference to the teaching and administrative staff, superintendents, teachers and other

authoritative teaching staff, after comprehensive consideration of the teaching quality evaluation system is divided into three levels, the top for teaching quality evaluation index system, intermediate layer includes four elements: teaching content, teaching methods, teaching attitude, teaching effect, the lower subordinate middle 12 secondary indicators. Specific hierarchy as shown in Figure 3.

4.1.2. Determine the Weight Value

Through establishing the hierarchy model and found the importance index factors affect each other but they are not the same. Through repeated comparisons between the same level for each target level on comparing two factors affect the degree of structure judgment matrix, the different values to illustrate the importance of the different, resulting in the corresponding weight ratio [9].

To improve the scientific weight value division, constructs the judgment matrix A, will be divided into the middle tier 4 elements of the $V_i (i=1, 2, 3, 4)$, its elements corresponding weight coefficient into the omega $\omega_i (i=1, 2, 3, 4, 5)$, if the quality of teaching evaluation decision goal for U, have $U = \omega_1 V_1 + \omega_2 V_2 + \omega_3 V_3 + \omega_4 V_4 + \omega_5 V_5$. Each element of the target U V_i proportion is different, the target U weight coefficients of the four elements of two comparison between the two [10], if the comparison results for $a_{ij} (i, j=1, 2, 3, 4, 5)$, so, $a_{ij} = \omega_i / \omega_j$,

$$\text{Equates } A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} \end{bmatrix} \quad \text{If A satisfies the}$$

consistency condition, then the characteristic value λ of the A is obtained, and the obtained normalized difference is the value of the U weight coefficient of the first grade index of the decision target V, and the two level index is determined by the same method..

4.2. Particle Swarm Optimization

PSO is a kind of optimization calculation technology, PSO algorithm and genetic algorithm is similar, is also based on the optimization of the iterative tool. When the system is initialized, a set of random solutions is generated, and the optimal value is searched through the iteration.

Hypothesis vector:

$X_i = (x_{i1}, x_{i2}, \dots, x_{im})$ Represents the current position of the particle i;

$V_i = (v_{i1}, v_{i2}, \dots, v_{in})$ Represents the current flight velocity of a particle i;

$P_i = (p_{i1}, p_{i2}, \dots, p_{in})$ Said the best position of particles (also known as the local minimum), the best position of particle and the maximization of the objective function formula is as follows:

$$P_i(t+1) = \begin{cases} P_i(t); & \text{if } f(X_i(t+1)) \leq f(P_i(t)) \\ X_i(t+1); & \text{if } f(X_i(t+1)) > f(P_i(t)) \end{cases}$$

A group of particle number is N, experience the best position for the global best position. Equates:

$$P_g(t) \in \{P_0(t), P_1(t), \dots, P_N(t)\} \mid f(P_g(t)) = \max\{f(P_0(t)), f(P_1(t)), \dots, f(P_N(t))\}$$

the evolution equations proposed by kennedy and eberhart who are working in pso algorithm are as follows:

$$v_{ij}(t+1) = v_{ij}(t) + c_1 * r_{1j}(t) * (P_{ij}(t) - x_{ij}(t)) + c_2 * r_{2j}(t) * (P_{gj}(t) - x_{ij}(t)) \quad (1)$$

$$x_{ij}(t+1) = x_{ij}(t) + v_{ij}(t+1) \quad (2)$$

Among them: "i" means the i-th particle, "J", said for the i-th particle j-dimensional component and t denotes the for the T generation. Therefore, C_1, C_2 is a non negative constant, C_1 is responsible for adjusting particulate to its best flight position step, C_2 is responsible for adjusting the particles into groups, the best location of the flight of steps, C_1, C_2 usually value in $[0, 2]$. Both R_{1j} and R_{2j} are random numbers which are subject to uniform distribution in $[0, 1]$. In order to reduce in the optimization process, the particles flying out of the search space, usually $V_{ij}(T)$ within a limited range, i.e.

$v_{ij} \in [v_{\min}, v_{\max}]$, V_{\min}, V_{\max} is set according to the actual situation, but also can be set according to the need to limit the search space $x_{ij} \in [x_{\min}, x_{\max}]$ Usually, the optimal position of the maximum number of iterations or particle swarm optimization is set as the iteration termination condition, so as to achieve the preset accuracy.

4.3. The Establishment of PSO_AHP Model

Particle swarm optimization algorithm (PSO) based on the analytic hierarchy process model (PSO-AHP) for the establishment of the process [11] as follows:

A hierarchical structure model of PSO_AHP system is established.

The actual establishment based on PSO AHP system hierarchy structure model of ditto section 4.1.1 mentioned used AHP to establish a hierarchy structure model is the same, the system is divided into a, B, C three layer, a layer for top is the overall goal of the system, the B and C layer in the element denoted as N_b, N_c .

- (1) Create Optimal weighting model. In B layer of judgment matrix, suppose that single layer B each element of the sort has a weight of $\omega_k, k \in (1, n_b)$, If Judgment matrix of A_k satisfy $a_{ij} = \omega_i / \omega_j (i, j = 1 \sim n_b)$, equates, The A_k satisfy completely consistent:

- (2) Constructing judgment matrix

The same as the above section 4.1.2 to build a judgment matrix A the same, usually will use the 1-9 level standard to describe the importance of the same layer elements.

- (3) Establish optimization weight model

Take the judgment matrix of B layer as an example, assuming that the weight of each element of the B layer is a single sort. ω_k , $k \in (1, n_b)$. If the judgment matrix A_k meet $a_{ij} = \omega_i / \omega_j$ ($i, j = 1 \sim n_b$), There are A_k to meet the complete consistency, there is

$$\sum_{i=1}^{n_b} \left| \sum_{k=1}^{n_b} (a_{ij} \omega_k - n_b \omega_i) \right| = 0 \quad (3)$$

Obviously, the smaller the value of the formula is A_k , the more close to the complete consistency, if the formula is A_k , satisfying consistency. Therefore, the calculation and optimization of the weight value of each element in the B layer can sum up the following problems, namely, the objective function is:

$$\text{MinCIF}(n_b) = \sum_{i=1}^{n_b} - \sum_{k=1}^{n_b} (a_{ik} \omega_k) - n_b \omega_i - / n_b \quad (4)$$

The constraint conditions:

$$\begin{cases} \sum_{k=1}^{n_b} \omega_k = 1 \\ \omega_k > 0 (k = 1 \sim n_b) \end{cases} \quad (5)$$

The $\text{CIF}(n_b)$ is the consistency of the objective function, which is difficult to deal with the nonlinear optimization problem. so, $\text{CIF}(n_b)$ The solution to the minimum value of the corresponding weight value is the matrix A_k corresponding to the most weight

(4) Weight optimization model for PSO

PSO can solve the level of total sorting and test its consistency. That is to determine the same level of elements for the ranking of the most high-level elements and to test the consistency of the judgment matrix, the process is from the highest level to the lowest level layer by layer. The rank weight of each element in the B layer is the sum of all the elements in the C layer. $\omega_c^A = \sum_{k=1}^{n_b} \omega_k \omega_c^k$ ($i = 1 \sim n_c$),

Consistency index function is $\text{CIF}^A(n_c) = \sum_{k=1}^{n_b} \omega_k \text{CIF}^K(n_c)$,

if $\text{CIF}^A(n_c)$. To meet a certain standard, it can be considered that C layers of various elements of the total ordering results with satisfactory consistency, calculated according to the elements of the weight of total order is acceptable; otherwise, you will need to use the direction of the maximum improvement method and interval number improved method for adjusting judgment matrix [12] until they meet appropriate standards.

4.4. PSO_AHP Model Solution

According to the PSO-AHP model proposed in this paper, the PSO algorithm is used to construct the fitness function, which is used to solve the weight and optimize the weight.

(1) the preparation stage of the model solution.

It will affect the level of comprehensive evaluation of the factors, the establishment of a comprehensive evaluation system hierarchy model. According to the relative importance of each layer, the judgment matrix of each layer is constructed. To determine the parameters for the PSO algorithm, namely particle swarm number n , the maximum number of iterations is n , two factor C_1 , C_2 of the inertia coefficient change range of. In this paper, $n = 10$, $N = 3000$, $c_1 = c_2 = 2$ and $\omega_{in} [-0.3, 0.3]$.

(2) using the PSO algorithm to solve the weight optimization model.

The initial solution of the particle is generated in the solution space (0, 1), and the generated random number is normalized to make it a feasible solution. ② The initial particle fitness calculation the feasible solutions in the objective function of people, and select the global best particle

from. $\text{MinCIF}(n_b) = \sum_{i=1}^{n_b} - \sum_{k=1}^{n_b} (a_{ik} \omega_k) - n_b \omega_i - / n_b$, ③ using

formula (1) and (2) the particle is updated iteratively. The first iteration of the initial particle, the individual optimal value is the particle particle itself, after the individual optimal iteration value is used in the solution space of mobile is the best point.

④ judge updated particle meets the constraint conditions, whether meet the formula (5), if it does not satisfy the response to particles are normalized. ⑤ The fitness calculation and update of the particle, compare and select the optimal location and the optimal position of global particle.

⑥ The judge found the optimal solution to the convergence condition, this paper is to determine whether the number of iterations to reach 3000. If meet the condition for the termination of iteration, iteration is terminated, model output, the optimal solution and turn the; if it does not satisfy the condition for the termination of iteration, skip to the third, continue to process execution cycle. Seventhly, for the optimal value model, with the objective function, for a judge matrix corresponding to the consistency ratio value, if it satisfies the requirement of consistency, executing (3); otherwise use use the direction of the maximum improvement method and interval number improved method for adjusting judgment matrix, then jumped to 1 re execution of the loop.

(3) The weight and consistency index of output function of global optimal location and the corresponding value of MinCIF.

(4) In the model construction based on the success, combined with the teaching quality evaluation index system, the middle layer, for example, input corresponding expert evaluation data figure 4 after optimization PSO AHP model and AHP model consistency function value contrast, graphical display the calculation results of stationarity, and the judgement matrix consistency function values were less than 0.1, with satisfactory consistency. To achieve the desired purpose. matrix function values are less than 0.1, with a satisfactory consistency. The desired purpose is complete.

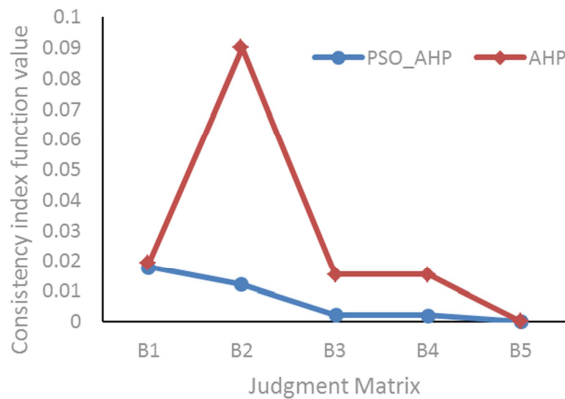


Fig. 4. PSO_AHP and AHP Contrast figure.

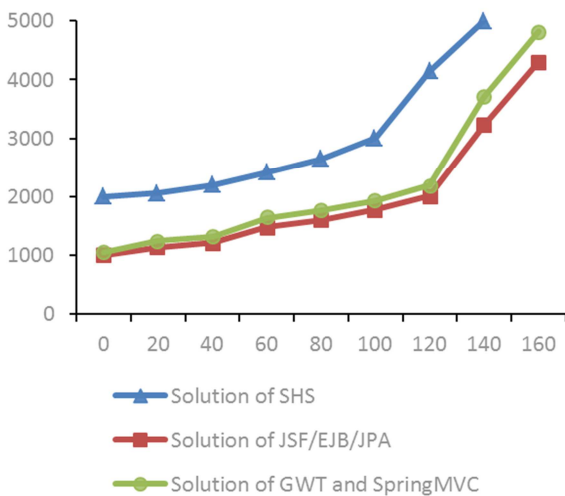


Fig. 5. AART curve.

5. Conclusion

Teaching quality evaluation system is mainly using to settle comprehensively the assessment to the teachers' teaching. This essay utilizes open-source framework of JSF/EJB/JPA to develop the teaching quality evaluation system. Chart 5 reveal the system average reponse time of Struts/Spring/Hibernate, JSF/EJB/JPA, GWT/SpringMVC, taking client Information query system as test environment [13]. Through the analysis of AART curve in diagram 5 JSF/EJB/JPA solution, it discovers that AART curve will increase with the increase of the number of users when the numbers are below 100. If it is more than 100, rising curve becomes more intense. AART curve rises gradually when the numbers increase. The system reponse time of JSF/EJB/JPA solution increases more linearly and steadily when the numbers are less than 100 compairing with other projects [14]. It meets the needs of users' maximum limit in quality test through analysis of AART curve variation tendency. Therefore the teaching quality evaluation system basis on Java EE proposed in this paper meet the needs of application service. The project of teaching quality evaluation system basis on Java EE has its unique characters and efficient

development. It can manage and maintain at the same time. Eventually, performance that how to improve teaching quality evaluation proposed in the paper has certain guiding signifiante in the application of teaching quality evaluation system and the field of development of digital campus.

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