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Evaluation System of College Educational Information Management System based on AHP

Qifu Dai[1] and Wenyuan Sun[2]
[1]Student, Department of Mathematics, Yanbian University, CHINA
[2]Lecturer, Department of Mathematics, Yanbian University, CHINA

[2]Corresponding Author: 112277188@qq.com

ABSTRACT

Aiming at evaluating the college educational information management system, in this paper, taking the YanBian University for example, we construct a three-level evaluation system of college educational information management system. Using AHP, through the hierarchical single rankings and total rankings, the weight of each index is obtained. Meanwhile, we prove that the evaluation system is scientific and reasonable. Finally, we get the conclusion and give some relevant suggestions to make the system more complete.

Keywords-- Educational Information Management System, AHP, weight

I. INTRODUCTION

In recent years, colleges all over China have introduced various educational information management systems to manage the information of students and teachers through the Internet. Through educational information management systems, students can choose courses online, check schedules, scores and apply for scholarships. Teachers can also use the educational information management system to browse the information published by school, consult for information, record the scores and so on. Although educational information management system is convenient to manage, there are many defects. For example, when students choosing their courses, many educational information management systems are on the brink of paralysis, leading to the failure. In general, the development and design of educational information management system has always been attached importance to, but the evaluation of it is also an important research content. Therefore, this paper combines the present situation of the system of Yanbian University, and constructs a reasonable three-level index evaluation system by AHP[1] to research it.

II. EVALUATION OF EDUCATIONAL INFORMATION MANAGEMENT SYSTEM

2.1 AHP

AHP is proposed by Saaty, a well-known US operations research scientist. It is a combination of qualitative and quantitative analysis of multi-level for multi-objective statistical decision-making methods. In recent years, AHP has a wide range of applications in satisfaction evaluation [2], teaching evaluation and traffic safety evaluation. The method mainly includes two parts: single hierarchical arrangement and total hierarchical ranking . In the process of level single order, according to the constructed index evaluation system, through the score of each expert and using it to judge the importance of each index, the judgment matrix is constructed and the consistency test is conducted. Finally, the overall level of ranking and portfolio consistency are tested to get the final sort results.

2.2 Single Hierarchical Arrangement

2.2.1 The division of hierarchical structure

This paper summarizes the main indexes that affect the educational information management system of Yanbian University through the relevant materials and literature [3~4] and the inquiry from the Dean of Academic Affairs Office of Yanbian University, and then constructs the evaluation system. First of all, the first target layer is a comprehensive evaluation of educational information management system of Yanbian University. The second layer is the standard layer, which mainly includes system user, system performance, system security and system

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function. The third layer is the indicator layer which is the further division of all standard layer, and select the most representative 15 indicators, as shown in Table 1.

Table 1 evaluation system

Target layer（A）	Rule layer（B）	Index layer（C）
Evaluation System of College Educational Information Management System	System user B_1	Interface friendliness C_1
		Ease of operation C_2
		Document completeness C_3
	System performance B_2	System maintainability C_4
		System portability C_5
		System reliability C_6
		System sharing C_7
		System scalability C_8
	System safety B_3	Safety of operation C_9
		User information confidentiality C_{10}
		System fault tolerance C_{11}
		Stability of data transmission C_{12}
	System function B_4	Functional integrity C_{13}
		Rationality of function module C_{14}
		Timeliness of information C_{15}

2.2.2 The construction of judgment matrix

The author invited five faculty members from the Dean of Academic Affairs of Yanbian University and five postgraduates of department of computing to pair each index according to the scale of 1 to 9 (Table 2).

Table 2 1~9 scale and its meaning

scale	meaning
1	Compared to the two factors, it is equally important
3	The former is a little more important than the latter.
5	Compared to the two factors, the former is more important
7	Compared to the two factors, the former is strongly important
9	Compared to the two factors, the former is extremely important
2,4,6,8	the intermediate values of the above adjacent judgments

Five pairs of judgment matrices were constructed from each of the two matrices. The maximum eigenvalue

and the corresponding eigenvector are obtained and the eigenvector normalized is the weight of each index. The criteria layer of the target layer of the judgment matrix is:

$$P=\begin{vmatrix} 1 & 3 & 1 & 2 \\ 1/3 & 1 & 1/4 & 1/2 \\ 1 & 4 & 1 & 2 \\ 1/2 & 2 & 1/2 & 1 \end{vmatrix}$$ The judgment matrices of the index layer to the criterion layer are respectively: $P_1=\begin{vmatrix} 1 & 5 & 1/2 \\ 1/5 & 1 & 1/5 \\ 2 & 5 & 1 \end{vmatrix}$,

$$P_2=\begin{vmatrix} 1 & 3 & 5 & 2 & 3 \\ 1/3 & 1 & 2 & 1/2 & 1 \\ 1/5 & 1/2 & 1 & 1/2 & 1/3 \\ 1/2 & 2 & 2 & 1 & 2 \\ 1/3 & 1 & 3 & 1/2 & 1 \end{vmatrix},\quad P_3=\begin{vmatrix} 1 & 1 & 5 & 4 \\ 1 & 1 & 2 & 1 \\ 1/5 & 1/2 & 1 & 1/3 \\ 1/4 & 1 & 3 & 1 \end{vmatrix},\quad P_4=\begin{vmatrix} 1 & 1/2 & 1/4 \\ 2 & 1 & 1/3 \\ 4 & 3 & 1 \end{vmatrix}$$

2.2.3 Consistency test of judgment matrix

In order to prevent the circumstance that L is more important than M , M is more important than N and N is more important than L ,the consistency test of the judgment matrix is necessary. The test formula is

$$CI=\frac{\lambda_{\max}-n}{n-1} \quad (1)$$

$$CR=\frac{CI}{RI} \quad (2)$$

CI is the consistency index of judgment matrix; RI is the Random consistency index（table3）, CR is consistency ratio. In general, when $CR<0.1$, it is considered that the judgment matrix passes the consistency check. Otherwise, we need to reconstruct the judgment matrix.

Table 3 Random consistency index

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

The results can be calculated as follows:

For P , $W=(W_1,W_2,W_3,W_4)=(0.3448,0.0995,0.3705,0.1852)$, $\lambda_{\max}=4.0074$ $CR=\frac{4.0074-4}{3\times0.90}=0.0027<0.1.$

For P_1 , $W=(W_1,W_2,W_3)=(0.3522,0.0887,0.5591)$, $\lambda_{\max}=3.0861$

$$CR=\frac{3.0861-3}{2\times0.58}=0.0742<0.1.$$

For P_2 , $W=(W_1,W_2,W_3,W_4,W_5)=(0.4173,0.1362,0.07480.2239,0.1477)$, $\lambda_{\max}=5.0939$

$$CR=\frac{5.0939-5}{4\times1.12}=0.0210<0.1.$$

For P_3 , $W=(W_1,W_2,W_3,W_4)=(0.4536,0.2551,0.0916,0.1996)$, $\lambda_{\max}=4.2339$

$$CR=\frac{4.2339-4}{3\times0.90}=0.0866<0.1$$

For P_4 , $W=(W_1,W_2,W_3)=(0.1365,0.2385,0.6250)$, $\lambda_{\max}=3.0814$

$$CR = \frac{3.0814 - 3}{2 \times 0.58} = 0.0702 < 0.1.$$

All the CR of judgment matrix is less than 0.1,so these judgment matrices can be regarded as consistent.

2.3 Total Hierarchical Ranking and Combination Consistency Test

After the completion of the single-level order, we also need to calculate the lowest indicator of the target layer for each combination of target weight, that is, the total hierarchy. The results of the total hierarchy are shown in Table 4. At the same time as completing the total level of sorting, the consistency of the combination has to be tested based on relevant formula, if the test is passed, then the total ranking of the hierarchy's result is reasonable. The formula is:

$CR = \dfrac{\sum_{j=1}^{m} CI_j b_j}{\sum_{j=1}^{m} RI_j b_j}$, $\sum_{j=1}^{m} CI_j b_j$ is the total ranking consistency index for hierarchy. $\sum_{j=1}^{m} RI_j b_j$ is Hierarchical ranking random consistency index.The CR can be calculated as follows :

$CR = \dfrac{0.0536}{0.7530} = 0.0712 < 0.1$,so the consistency of total hierarchical ranking can be accepted. It proves that the AHP is a proper way and hierarchical ranking results can be used for analyzing something useful.

Table 4 Total ranking of layers

	A				Total ranking
	B_1	B_2	B_3	B_4	
	0.3448	0.0995	0.3705	0.1852	
C_1	0.3522				0.1214
C_2	0.0887				0.0306
C_3	0.5591				0.1928
C_4		0.4173			0.0415
C_5		0.1362			0.0136
C_6		0.0748			0.0074
C_7		1.2239			0.0223
C_8		0.1477			0.0147
C_9			0.4536		0.1681
C_{10}			0.2551		0.0945
C_{11}			0.0916		0.0339
C_{12}			0.1996		0.0740
C_{13}				0.1365	0.0253
C_{14}				0.2385	0.0441
C_{15}				0.6250	0.1158

III. CONCLUSIONS AND RELEVANT SUGGESTIONS

According to Table 9, we can draw the following conclusions: Among the four criteria in the guideline layer, security system has the highest weight, followed by the user system, system's function and system's performance. In addition, in the index layer, the weight of C_1、C_3、C_9、C_{10}、C_{12}、C_{15} are all over 0.05, especially for C_3、C_9, they occupy a large proportion which are the two main factors that affect the evaluation of educational information management system of Yanbian University. In general, In general, the system of Yanbian University is good, but it still needs to be further improved.

According to conclusions above, the following suggestions are made:

1) Taking the user system attention to the user's experience of teachers and students and improve the satisfaction of the users. At the same time, we should pay attention to the protection of the user's personal information completely; so as to avoid the user's information is stolen by others, which may cause some irreparable errors.

2) Improving the function module to ensure the information's timely and accurate. The functional modules' pages of the educational information management system should be clear, so that the users can quickly find the corresponding modules. At the same time, we should also release some educational information timely and ensure that the information is reliable and accurate.

3) Improve the performance of the system and ensure the economic benefits. Only first-rate system performance can ensure the normal operation of the system. Only then will the system don't collapse when the students are choosing courses and the apply for scholarship and other circumstances of a large amount of flow.

The analytic hierarchy process (AHP) is a scientific and reasonable evaluation method for multi-objective and multi criteria statistical decision making. In this paper, we use AHP to set up an index system to evaluate the educational information system of Yanbian University. It is also applicable to the evaluation research of educational information management system in other universities in China.

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