Research on the Evaluation Model of Electronic Commerce Innovation Ability of College Students Based on Analytic Hierarchy Process

LuoLang
Beijing University of Posts and Telecommunications
BUPT
Beijing, China
luolang0111@163.com

LiuYao, HuTao
Beijing University of Posts and Telecommunications
BUPT
Beijing, China

Abstract—To solve the problems of index establishment and reasonable quantification in the evaluation model of electronic commerce innovation ability of college students, this paper makes a careful analysis of the existing problems of evaluation system of the traditional education, puts forward a more comprehensive index evaluation system including innovative foundation, innovative thinking, innovative skills and innovative potential, and establishes the evaluation model of the multi-level analysis of electronic commerce innovation ability of college students, comprehensive evaluation; this paper gives a multi-dimensional analysis and comprehensive evaluation from different angles, which are tested by living examples, and provides a more systematic, comprehensive, feasible approach for the comprehensive evaluation of electronic commerce innovation ability of college students.

Keywords—electronic commerce; innovation ability; Analytic Hierarchy Process; evaluation model

I. INTRODUCTION

The evaluation of the traditional education mainly focuses on the students’ examination results during the school, strengthens the role of examinations excessively, so that the evaluation form becomes rigid and single, and the contradiction of the employing units’ demand for the talent innovation ability becomes more and more prominent. Therefore, colleges and universities should take the evaluation of innovative ability with examination results as a complementary evaluation standard, in order to reflect the changes of concepts of modern education and the social demand [1].

The commonly used methods of the comprehensive evaluation on the electronic commerce innovation ability of college students include comprehensive grading method, fuzzy comprehensive judgment method, and comprehensive evaluation theory based on extension theory [2]. Because AHP is a decision-making method of multiple criteria and targets combined with the qualitative and quantitative analysis, it breaks a complex decision-making problem down into a number of factors, and makes these factors form the hierarchical structure according to the dominance relationship, so as to get the weight of each factor through the comparison of every two factors of the importance of various factors on the same level in the hierarchy, then the decision-maker can make a comprehensive evaluation to be mathematical, and the evaluation has the features of strong system performance, wide application and simplicity prominence. In particular, it plays an important role in the qualitative judgment [3]. In view of this, this paper adopts the analytic hierarchy process to make a comprehensive evaluation of electronic commerce innovation ability of college students, and to provide a new idea and method for solving the similar problems.

II. THE THOUGHT METHOD AND PROCEDURE OF AHP

A. The thought method and its production of AHP

The Analytical Hierarchy Process, referred to as AHP, is a systematic and hierarchical analysis method combined with qualitative and quantitative methods, which was proposed by the USA operational research expert, Professor A. L. Seaty in the 1970’s of the twentieth century. It is an analytical method of decision-making problems to deal with the complex social, political, economic and technological problems, especially with the decision-making of the multiple targets and multiple schemes. He organized the various factors which the complex system problem contained by means of defining the interrelated orderly hierarchies, and he also provided the quantitative description of the relative importance for the same hierarchical elements according to the qualitative judgment, and determined the relative importance weights of the elements of each hierarchy by using the mathematical method: finally, according to the numerical value and the weight of each index, make a comprehensive evaluation on the research questions.

B. The basic procedure of AHP

(1) The decision-making problem will be divided into several levels: the goal level, specific index level and criterion level. The bottom node is the specific index which influences the results, known as the “sub-index level”; the second level is “index class level”, which will organize a number of related indexes as a class (or known as a subsystem) to be reflected on a larger category performance; the top level is “target level”, which has only a node, and it indicates the final evaluation results. (2) Determine the weights of each criterion for the target weight and each solution for the criterion through the
inter-comparison. These weights in the process of human thinking are often qualitative, while the quantitative method of the weights should be given in the analytic hierarchy process. (3) Carry out a comprehensive analysis of the solution level on the weight of the criterion level and of the criterion level on the weight of the target level, and determine the weight of the final solution level on the target level. In the practical application, adopting a definite evaluation method can figure out the solution level on the target level. In the practical application, weight of the target level, and determine the weight of the final the weight of the criterion level and of the criterion level on the weights should be given in the analytic hierarchy process.

thinking are often qualitative, while the quantitative method of from the bottom level — namely the final evaluation results.

III. THE ESTABLISHMENT OF EVALUATION INDEX SYSTEM

Many factors affect the electronic commerce innovation abilities of college students, and some factors correlate with each other. In order to reflect the level of electronic commerce innovation ability of college students accurately, we need to construct an evaluation index system from various angles and levels. To determine the index composition of evaluation model of innovative ability of college students objectively, the author referred to a large number of documents based on[4]-[7], and followed the scientific, comprehensive and operational principles of the index system choice, through the questionnaire survey and interviews of the students, teachers and experts, and eventually established the evaluation index system of electronic commerce innovation ability of college students and the various evaluation criteria, see Table 1.

<table>
<thead>
<tr>
<th>First Grade Index</th>
<th>Second Grade Index</th>
<th>Criteria of Evaluation Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovative thinking</td>
<td>Intuitive thinking ability</td>
<td>Good at making judgments, guessing and reasoning for new things on the basis of perception</td>
</tr>
<tr>
<td>Deductive reasoning ability</td>
<td>Be able to make judgments, guess and reason for new things on the basis of perception</td>
<td></td>
</tr>
<tr>
<td>Critical thinking ability</td>
<td>Have the courage and be good at thinking critically, and thinking method is unique.</td>
<td></td>
</tr>
<tr>
<td>Creative thinking ability</td>
<td>Active thinking, good at proposing the model to break the conventional problem solving</td>
<td></td>
</tr>
<tr>
<td>Innovation skill</td>
<td>The ability to find problems</td>
<td>Thinking is sensitive, and good at discovering new problems</td>
</tr>
<tr>
<td>The ability to solve problems</td>
<td>Good at linking theory with practice and solve the problem creatively</td>
<td></td>
</tr>
<tr>
<td>The ability to implement programs</td>
<td>Good at putting the theory scheme into practice</td>
<td></td>
</tr>
<tr>
<td>Innovation potential</td>
<td>The ability to express and communicate</td>
<td>Good at expressing, and having the strong ability to communicate</td>
</tr>
<tr>
<td>Innovative and will power</td>
<td>The willpower is tough, and the innovative determination and confidence is strong.</td>
<td></td>
</tr>
</tbody>
</table>
IV. CONSTRUCTION OF THE EVALUATION MODEL BASED ON AHP

A. The hierarchical structure to form problems

According to Table 1, establish the hierarchy structure chart of comprehensive evaluation of electronic commerce innovative ability of college students, as shown in Table 2.

TABLE II. THE HIERARCHY STRUCTURE OF COMPREHENSIVE EVALUATION OF ELECTRONIC COMMERCE INNOVATIVE ABILITY OF COLLEGE STUDENTS

<table>
<thead>
<tr>
<th>First Grade Index</th>
<th>Second Grade Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1: Innovative Ability Evaluation</td>
<td>C1: Professional Knowledge and Ability</td>
</tr>
<tr>
<td></td>
<td>C2: Information retrieval Ability</td>
</tr>
<tr>
<td></td>
<td>C3: Cross Knowledge Ability</td>
</tr>
<tr>
<td></td>
<td>C4: Intuitive Thinking Ability</td>
</tr>
<tr>
<td></td>
<td>C5: Deductive Reasoning Ability</td>
</tr>
<tr>
<td></td>
<td>C6: Critical Thinking Ability</td>
</tr>
<tr>
<td></td>
<td>C7: Creative Thinking Ability</td>
</tr>
<tr>
<td>B1: Innovative Foundation</td>
<td>C8: The Ability to Find Problem</td>
</tr>
<tr>
<td></td>
<td>C9: The Ability to Solve Problem</td>
</tr>
<tr>
<td></td>
<td>C10: The Ability to Implement Programs</td>
</tr>
<tr>
<td>B2: Innovative Thinking</td>
<td>C11: The Ability to Implement Program</td>
</tr>
<tr>
<td></td>
<td>C12: Innovative and Will Power</td>
</tr>
<tr>
<td>B3: Innovative Skill</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>B4: Innovative Potential</td>
<td></td>
</tr>
</tbody>
</table>

B. Construction of the judgment matrix

In view of some factors on the above level, the relative importance of the factors on the same level in the hierarchical structure can be carried out by the comparison of every two factors. Suppose that the factor $A_k$ of Level A connects with $B_1, B_2, \ldots, B_n$ of the next level B, it can be constructed as the following judgment matrix:

$$A = \begin{pmatrix}
a_{11} & a_{12} & \cdots & a_{1n} \\
a_{21} & a_{22} & \cdots & a_{2n} \\
\vdots & \vdots & & \vdots \\
a_{n1} & a_{n2} & \cdots & a_{nn}
\end{pmatrix}$$  \hspace{1cm} (1)

In the formula (1):

$$a_{ij} \ (i = 1, 2, \ldots, m; j = 1, 2, \ldots, n)$$

is the scale value of the relative importance of the factors $B_i$ and $B_j$ against $A_k$, and the valuation method adopts the scaling method of Saaty.

C. The determination of the single sequence weight of each level

Solve the maximum eigenvalue and eigenvector of the judgment matrix. The eigenvector represents the weight of various factors on the same level which influence some factors of the above level. Generally the simplified calculation is carried out by using the summation method or the square root method. This is calculated by using the square root method.

D. Consistency test

When the various factors of the complex event are compared by every two factors, the subjective judgment matrix obtained usually need to carry out the consistency check. When the consistency ratio is $CR = CI / R < 0.1$, the consistency of the matrix is considered to be acceptable, or it needs to revise the judgment matrix. Among them, $CI$ is the consistency test index; $RI$ is the average random consistency index.

E. The determination of the total sequence weight of the level

The calculation of level by level should be carried out orderly along the hierarchical structure from top to bottom, and then the coefficient of the relative importance of the bottom level factors relative to the target level can be obtained, namely the weight $\omega_i$ of each evaluation index.

F. Comprehensive sequence

By using the weight $\omega_i$ of each evaluation index and the score $X_i$ of its corresponding index, the comprehensive score $S$ of each evaluation index can be obtained, and the comprehensive evaluation of the testing samples can be carried on according to the size of $S$ value.

$$S = \sum_{i=1}^{n} X_i \omega_i$$ \hspace{1cm} (2)

V. EXAMPLE ANALYSIS

Now take the evaluation of electronic commerce innovation ability of a student as an example, and select the relevant experts, leaders and teachers of the university to make every two comparison of various evaluation indexes. The judgment matrix is constructed as follows:

The judgment matrix is $A – B$

$$\begin{pmatrix}
A & B_1 & B_2 & B_3 & B_4 \\
B_1 & 1 & 2 & 3 & 4 \\
B_2 & 1/2 & 1 & 2 & 1 \\
B_3 & 1/3 & 1/2 & 1 & 1/2 \\
B_4 & 1/2 & 1 & 2 & 1
\end{pmatrix}$$

The judgment matrix is $B_1 – C$
The judgment matrix is $B_2 - C$

\[
B_2 = \begin{bmatrix}
C_4 & C_5 & C_6 & C_7 \\
1 & 1 & 1/2 & 1 \\
1 & 1 & 2 & 1 \\
2 & 1/2 & 1 & 1/2 \\
1 & 1 & 2 & 1 \\
\end{bmatrix}
\]

The judgment matrix is $B_3 - C$

\[
B_3 = \begin{bmatrix}
C_8 & C_9 & C_{10} \\
1 & 2 & 3 \\
1/2 & 1 & 2 \\
1/3 & 1/2 & 1 \\
\end{bmatrix}
\]

The judgment matrix is $B_4 - C$

\[
B_4 = \begin{bmatrix}
C_{11} & C_{12} \\
1 & 1/3 \\
3 & 1 \\
\end{bmatrix}
\]

The weight vector of each evaluation index can be obtained according to the calculation of AHP steps, and the consistency of each judgment matrix can pass the test.

\[\omega^{-1} = \{0.2283, 0.068, 0.126, 0.047, 0.067, 0.047, 0.067, 0.067, 0.036, 0.020, 0.057, 0.170\} \]

The scores in each evaluation index of the student for the evaluation are marked by the guidance teachers, course teachers, counselors, student representatives, and the respective scores:

\[x = \{82, 75, 90, 75, 85, 82, 78, 86, 79, 72, 78, 90\} \]

By the formula (2), the student can get $S = 83.253$, and the student's electronic commerce innovation ability is close to Grade I, which belongs to the grade II (good). In addition, judging from the weight vector $\omega$, the professional knowledge level, cross knowledge level and innovative will occupy an important position in the electronic commerce innovation ability evaluation. Therefore, we should strengthen the command of the students' professional knowledge in the process of teaching, broaden the students' knowledge and cultivate the students to possess the innovative confidence and perseverance.

VI. CONCLUSION

1. The weight value of each index determined by the AHP and the comprehensive use of quantitative and qualitative evaluation methods can avoid the subjectivity in the evaluation process effectively and reflect the objective situation of the evaluation object relatively accurately. 2. Compared with other evaluation methods, this method preserves the good flexibility, so that different universities can determine the corresponding evaluation index system according to their actual conditions in order to improve the comprehensiveness of evaluation. 3. When the previous evaluation methods constructed an evaluation index system, it is difficult give reasonable weight values because there are many indexes and the degree of distinction is not high[8]. The Analytical Hierarchy Process can make up for this deficiency effectively. In short, among the evaluations of comprehensive qualities of the students, the Analytic Hierarchy Process will meet the requirements of comprehensiveness of evaluation indexes and the scientificity of the weight of each index in the evaluation process, and the comprehensive application of the quantitative and qualitative evaluation method will improve the accuracy and feasibility of the evaluation results.

REFERENCES


