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## Analysis of the application of fuzzy integrated evaluation method in the university entrepreneurship education and training system

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### ABSTRACT

China College pay more attention to venture training system construction work, but for inputs of resources whether made has expected of effect, operation of training system whether effective, has been lacking evaluation mechanism and method, this paper based on establishing effectiveness evaluation indicators system of college venture training system, using fuzzy integrated evaluation method, from factors set, and weight set, and evaluation set, these several aspects to build effectiveness evaluation model of college venture training system, to make intuitive assessment and evaluation on college venture training system construction and run situation. The model can be used to evaluate the University's entrepreneurship training system, can also be used for other comparative study on training system of the University. These articles also make further explanations and clarifications on evaluation model and its application.

### KEYWORDS

Training system; Evaluation model; Fuzzy comprehensive evaluation; Effectiveness.



## INTRODUCTION

In recent years, with the increasing number of college graduates in China, employment pressure of college students is more and more serious, start own businesses has become one of the important way to solve the employment problems of college students. Although the Government has issued many preferential policies to encourage and guide students to start their own businesses, and college students' entrepreneurship is growing, but still not very many students choose self-employment after graduation, and entrepreneurial success rates are low. There are many reasons, such as weak sense of entrepreneurship, unclear objectives, lack of skills and experience, lack of capital and the entrepreneurial environment is not ripe<sup>[1]</sup>. How to improve university graduates' entrepreneurship and success rates is a challenging task that the nation, community, and university must face. Except support of the Government and all sectors of society, as well as efforts of entrepreneurs, colleges should assume more responsibility for enterprise education, to develop the entrepreneurship training of students, improve students' entrepreneurship<sup>[2]</sup>. So, a set of scientific and rational method for evaluating the effectiveness of the training system in colleges and universities will an important standard to judge enterprise education in colleges and universities.

## RESEARCH BACKGROUND

Fuzzy comprehensive evaluation using fuzzy mathematics and fuzzy statistics method<sup>[3, 4]</sup>, through integrated consideration of all factors that affect something, to make scientific evaluation of pros and cons of the matter. Fuzzy comprehensive evaluation method founded by United States Cybernetics expert professor LA. Zadeh, at present, the fuzzy comprehensive evaluation (Fuzzy comprehensive evaluation, FCE for short) is a very widely used and effective method of fuzzy math.

Fuzzy comprehensive evaluation has a wide range of applications and fields, from an initial evaluation of economic benefit evaluation to the quality of life, environment quality evaluation and evaluation of comprehensive national strength, and in recent years, such as sustainable development, science and technology innovation capacity evaluation, we can say comprehensive evaluation questions are everywhere. The significance of application of fuzzy comprehensive evaluation is that make blurry moderately accurately and quantitative, provides theoretical and practical tools for us to grasp and understand the ambiguity, in order to solve many theoretical and practical issues to provide a practical and effective ways and means. To evaluate the effectiveness of university entrepreneurship training system, which involves a large number of comprehensive evaluation of subjective factors, due to the vagueness of subjective factors is large, using fuzzy comprehensive evaluation can take advantage of fuzzy methods, evaluating effort is better than other methods.

### **Establish evaluation index system**

To evaluate the effectiveness of the training system is based on the evaluation index system, through to evaluate which factors to measure effectiveness of the training system. Evaluation index system is an indicator that reflects the effectiveness of the training system, there are a lot of index reflect the effectiveness of the training system in colleges, these indicators from different angles, in different forms, reflecting the construction and operation of training system. Training management system is a complete set of training, implementation, assessment, integrated support system, is a multi-level and multi-factor system, constituted by many subsystems, such as the system of training and training for operational implementation system, training system, teacher training system, training management system, training system<sup>[5,6]</sup>. Paper according to college venture training system's connotation and features according to principles of indicators system building, preliminary building the college venture training system effectiveness evaluation indicators system, then used Delphi method, selected scholars that engaged in human resources management research, and expert engaged in human resources management in training institutions, and 15staff have rich experience in venture training institutions work practice, after 3 rounds expert survey and questionnaire survey, those are college venture training system effectiveness evaluation indicators system structure integrity and rationality questionnaire survey, importance of evaluation indicators questionnaire survey, and indicators determines rationality questionnaire survey, eventually determines college venture training system effectiveness evaluation

indicators system composited by 6 items level1 evaluation indicators, and 19 items level2 evaluation indicators, and 56 items level3 evaluation indicators<sup>[7]</sup>, see TABLE 1 College venture training system effectiveness evaluation indicators system table:

**TABLE 1 : College venture training system effectiveness evaluation indicators system**

| First level index          | Second level index      | Third level index                | First level index           | Second level index            | Third level index              |                             |
|----------------------------|-------------------------|----------------------------------|-----------------------------|-------------------------------|--------------------------------|-----------------------------|
| Organization system        | Agency personnel        | incumbent institution            | Training resource system    | Internal trainer              | Internal trainer construction  |                             |
|                            |                         | Supporting countermeasures       |                             |                               | Teacher participate            |                             |
|                            | Level of IT application | Clear responsibility             |                             | External training institution | Lecturers inspired             |                             |
|                            |                         | Information technology support   |                             |                               | External agencies selection    |                             |
|                            |                         | Coverage degree                  |                             |                               | External agencies assessment   |                             |
|                            |                         | Software level                   |                             |                               | Resource sharing platform      |                             |
|                            | Strategy and operation  | strategic orientation            |                             | Resource sharing              | Resource sharing degree        |                             |
|                            |                         | strategic alignment              |                             |                               | Training demand analysis       | Market orientation          |
|                            |                         | operation of system              |                             |                               |                                | Entrepreneurial orientation |
|                            | Training course system  | Curricula quality                |                             | Hierarchical classification   | Organizational. process system | Make training plan          |
| Feature significant        |                         |                                  | Plan development process    |                               |                                |                             |
| direction                  |                         | Training projects implementation | Businesses requirement      |                               |                                |                             |
| Class schedule             |                         |                                  | Implement process           |                               |                                |                             |
| Curriculum Requirements    |                         |                                  | curriculum development rate | Train method                  |                                |                             |
|                            |                         |                                  | Curriculum innovation       | Satisfaction degree           |                                |                             |
| Reaction assessment        | Curriculum output       | Content relevance                | Training effect appraisal   | training archives             |                                |                             |
|                            |                         | Appropriate method               |                             | Assessment level              |                                |                             |
|                            | Knowledge Acquirement   | Assessment strategy              |                             |                               |                                |                             |
| Training evaluation system | Study assessment        | Usage intention                  | Support security system     | University support            | Assessment method              |                             |
|                            |                         | Learning efficiency              |                             |                               | Assessment feedback            |                             |
|                            | Behavior assessment     | Learning skill                   |                             | Student support               | University support             |                             |
|                            |                         | Learning attitude                |                             |                               | School culture construction    |                             |
|                            | Result assessment       | Entrepreneurial performance      |                             | System support                | Budget support                 |                             |
| Students response          |                         | Student's attention              |                             |                               |                                |                             |
| Student development        |                         | Career management                |                             |                               |                                |                             |
|                            | Follow measures         |                                  |                             | Active learning               |                                |                             |
|                            |                         |                                  |                             | System perfecting             |                                |                             |
|                            |                         |                                  |                             | Institution of stimulation    |                                |                             |
|                            |                         |                                  |                             | Implementation of conditions  |                                |                             |

## ESTABLISH EVALUATION MODEL

Based on the final college venture training system effectiveness evaluation indicators systems, using fuzzy comprehensive evaluation method to establish the evaluation model, steps are as follows:

### Establish factor set

As college venture training system effectiveness evaluation indicators are constituted by object layer, first evaluation indicators, second evaluation indicators, third evaluation indicators, so factor set can be divided into three part.

First layer factor set

$U = \{A1, A2, A3, A4, A5, A6\} = \{\text{Organization system, training resource system, training course system, organizational process system, training evaluation system, support security system}\}$

Second layer factor set

$A1 = \{B1, B2, B3\} = \{\text{Agency personnel, Level of IT application, Strategy and operation}\}$   
 $A2 = \{B4, B5, B6\} = \{\text{Internal trainer, External training institution, Resource sharing}\}$  ...  $A6 = \{B17, B18, B19\} = \{\text{University support, Student support, System support}\}$

Third layer factor set

$B1 = \{C1, C2, C3\} = \{\text{incumbent institution, Supporting countermeasures, Clear responsibility}\}$ ;  
 $B2 = \{C4, C5, C6\} = \{\text{Information technology support, Coverage degree, Software level}\}$  ...  $B19 = \{C54, C55, C56\} = \{\text{System perfecting, institution of stimulation, implementation of conditions}\}$

### Establish weighted sets

Using  $A_i, B_i, C_i \{i=1,2,3 \dots N\}$  respectively represent a, b, and c each layer's weight of elements, arrange expert for fourth round questionnaire survey, compare each layer's indicators importance, using levels analysis method calculate each indicator's weight, for through consistency test of expert judge results for weighted average, can get each indicators corresponding of eventually weight, each layer weight coefficient reflect all factor's importance in integrated evaluation, thus we can established every evaluation indicator's weight set, weight set can represent by right vector, and each layer weight meet the normalization and non-negativity conditions, that is:

$$\sum_{i=1}^p a_i = 1, a_i \geq 0, i = 1, 2, \dots, n \tag{1}$$

Calculation results obtained from the analytic hierarchy process, this paper weight set can be expressed as:

First layer indicator eight sets

$U = \{A1, A2, A3, A4, A5, A6\} = \{0.2314, 0.1806, 0.1578, 0.1424, 0.1275, 0.1603\}$

Second layer indicator weight sets

$A1 = \{B1, B2, B3\} = \{0.3912, 0.3646, 0.2442\}$ ;  $A2 = \{B4, B5, B6\} = \{0.4661, 0.1742, 0.3597\}$

.....

Third layer indicator weight sets

$B1 = \{C1, C2, C3\} = \{0.4624, 0.3164, 0.2212\}$ ;  $B2 = \{C4, C5, C6\} = \{0.4981, 0.2452, 0.2567\}$

.....

$B19 = \{C54, C55, C56\} = \{0.3626, 0.2353, 0.4024\}$

### Determined evaluation sets

In general, comment grade number usually greater than 4 and no more than 10, combined the characteristics of university entrepreneurship training system effectiveness evaluation, evaluation set will be classified as good, better, general, poor, worse five grades, expressed as:

$V = \{\text{good, better, general, poor, worse}\}$

It is because of the determination of the evaluation sets, the fuzzy comprehensive evaluation obtain a fuzzy evaluation vector, information of evaluated objects for each evaluation grade degree represented by the fuzzy vector, reflecting the fuzzy characteristics of evaluation.

Determine the membership vector degree of each evaluation index, get a fuzzy evaluation matrix. Before fuzzy comprehensive evaluation, we need to get the fuzzy evaluation matrix, to quantify the each evaluation index, that is determined from single factor the membership degree of evaluation index to level fuzzy subsets, and get fuzzy relation matrix.

$$R = \begin{bmatrix} R | u_1 \\ R | u_2 \\ \dots \\ R | u_p \end{bmatrix} = \begin{bmatrix} r_{11}, r_{12}, \dots, r_{1m} \\ r_{21}, r_{22}, \dots, r_{2m} \\ \dots & \dots & \dots \\ r_{p1}, r_{p2}, \dots, r_{pm} \end{bmatrix} \quad (2)$$

As entrepreneurship training system effectiveness evaluation system in colleges and universities, the evaluation index has obvious fuzziness characteristics, more qualitative indexes, and entrepreneurship training's situation is more complex, branch is different, so the membership degree of every index obtained by the questionnaire survey, number of evaluation for each index in proportion to the number of total evaluation is the membership degree of various factors, namely the corresponding indicators of membership degree of collection constitutes the fuzzy evaluation matrix. Higher layer evaluation index membership degree and the judgment matrix can be calculated from low level index membership degree, judgment matrix and weight vector.

### Fuzzy comprehensive evaluation

After determined factor set, weight set, evaluation set, and the membership degree of each evaluation index vector and get fuzzy evaluation matrix, fuzzy comprehensive evaluation method can be used to do a comprehensive assessment of colleges and universities entrepreneurship training system, due to the index will be divided into four levels, so the fuzzy comprehensive evaluation is divided into 3, firstly, to do the third level fuzzy comprehensive evaluation, secondly, to do the second level fuzzy comprehensive evaluation, finally, to do synthesis evaluation, then get the fuzzy comprehensive evaluation results vector of evaluated colleges and universities entrepreneurship training system, that is:

$$A \circ R = (a_1, a_2, \dots, a_p) \begin{bmatrix} r_{11}, r_{12}, \dots, r_{1m} \\ r_{21}, r_{22}, \dots, r_{2m} \\ \dots & \dots & \dots \\ r_{p1}, r_{p2}, \dots, r_{pm} \end{bmatrix} = (b_1, b_2, \dots, b_m) = B \quad (3)$$

B vector contains all the information that standard collection's evaluation to the target layer U. The represent membership degree of first layer evaluation index. By the above methods respectively calculate vector of the target enterprise evaluation, according to the maximum membership degree principle, we can get corresponding evaluation results of target colleges and universities in the effectiveness of entrepreneurship training system.

In order to make further evaluation and sorting to target college entrepreneurship training system effectiveness, comment set  $V = \{\text{good, better, general, poor, worse}\}$ , give the evaluation score respectively  $\{10, 8, 6, 4, 2\}$ , using the formula:

$$W = \sum_{K=1}^n b_{pm} y_m \quad (4)$$

The  $P = a, b, c, m = 5, y_m = \{10, 8, 6, 4, 2\}$  to calculate the evaluation score of target colleges and universities, the goal colleges and universities entrepreneurship training system effectiveness can be intuitive comparison and sorting.

### THE APPLICATION AND CONCLUSION OF EVALUATION MODEL

Application of the model is simple, uses the questionnaire method can obtain the evaluation data. In target universities entrepreneurship training system construction and the operation condition of questionnaire survey, questionnaire survey has total of 56 issues, corresponding reflecting the operation situation of the 56th layer 3 index, to correspond final evaluation set, and questionnaire survey index evaluation comments results are divided into good, better, general, poor, worse five grades, according to the reviewers for the proportion evaluation index statistics, membership degree of each index to evaluate people for each of the index number of evaluation in proportion to all the number of evaluation, that is the membership degree of various factors, corresponding indicators of membership degree of collection form the fuzzy evaluation matrix, it can be directly fuzzy comprehensive evaluation and get conclusion<sup>[8]</sup>.

The model can be used for multiple comparison research of effectiveness of the training system in colleges and universities, adopting questionnaire survey data respectively to calculate evaluation score of the target training system's effectiveness in colleges and universities can compare the effectiveness of multiple training systems in colleges and universities. For evaluation vector of all levels fuzzy comprehensive evaluation, corresponding to the evaluation set {good, better, general, poor, worse}, given scores {10, 8, 6, 4, and 2} respectively, using the formula:

$$W_1 = \sum_{m=1}^5 b_m y_m \quad (5)$$

Let  $n=5, y_m = \{10, 8, 6, 4, 2\}$ ,  $b_m$  represent evaluation membership degree of index

Calculated evaluation scores of each index of each layer respectively, the evaluation indexes of all the colleges and universities can be intuitive comparison and sorting, facilitate comparative analysis was carried out on the evaluation index, find the gap between advantage and the existing of the training system in colleges and universities and beneficial complement each other, better take measures to improve the effectiveness of the training system.

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