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The Application of Fuzzy Decision in the Management for Undergraduates

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Abstract. In this paper, the computer professional students trained under the 'embedded' training mode in Jiangsu province is selected as research subjects. By introducing fuzzy mathematics theory, a series of subjective and objective factors in the process of cultivating undergraduate students were studied. Through the corresponding analysis of various factors and sets of factors, levels as well as weights, the corresponding expert system is established to determine the fuzzy mathematical model that can comprehensively assess students. A feasible, objective, fair, comprehensive and quantifiable assessment method for college students has been put forward. To further improve the level of student management, effects, scientific, and ultimately achieve this goal that method of evaluation of students more accurate and objective.

Keywords: Expert System; Fuzzy Mathematics; Comprehensive Evaluation; Management.

1. Introduction

The world is entering an era of universal intelligence in which everything is interconnected and intellectualized. The "Internet+" is leading the deep integration of information technology and traditional industries in accordance with the changes in the technology situation to make the pace of development faster [1]. The undergraduate training of the 'embedded' training mode of computer related major is also facing these opportunities and challenges. However, the technical fields involved in this kind of related major are often characterized by strong application, rapid development and high innovation density. Therefore, the requirements for students of this kind of specialty are also all-round--to strengthen the cultivation of self-help ability, teamwork ability, innovation ability, social adaptability and communication ability, but also to enhance their personal culture, life habits and overall quality. Therefore, all-round, multi-factor evaluation of the comprehensive quality of students is particularly important, making the evaluation of students with feasibility, objectivity and scientificity.

However, the traditional assessment is mainly based on one or several indicators of students. There are several problems in this method. One is mainly to the students existing performance evaluation, which neglects the process and formative evaluation, lacks the development of the vision to judge the ability of students to adapt to the industry position; second, the assessment index is small, the process and the results of the examination of a mere formality, not a comprehensive evaluation of the overall situation of students; third, evaluation body is not comprehensive. The teacher of practice enterprise is the main body of evaluation, which ignores the guidance teachers' assessments, the evaluation of students and the evaluation of behavior among students; four is a single assessment, the implementation of the lack of unity, the existence of subjectivity and human shortcomings.

In recent years, with the development of teaching reform, some colleges and universities have put forward the method of combination of both bilateral evaluation method and grade evaluation to evaluate a certain task of students. For example, the evaluation of students' professional practice achievement is obtained by the direct scoring method or weighted summation method according to the evaluation grade of the unit of practice and the grade of the school. However, both direct scoring and weighted basis for objective assessment, and only the subjective qualitative method that schools and practice units make to students' daily performance and practice report.

For example, in terms of attendance, the vast majority of students are not very different, in the class is not necessarily in serious work, serious work is not necessarily a good internship effect. For

the internship works is that only results to be evaluated, lacking in the process and formative characteristics of the analysis. In addition to that each student assignment are different, and lacks a unified value criteria and evaluation criteria. Therefore, in the actual assessment work, it is incomplete to provide the basis for judgment mainly on the basis of the personal subjectivity of the trainees. In the final analysis, the criteria and criteria have the characteristics of "fuzziness" and are difficult to quantify from facts. Therefore, for the students of computer 'embedded' training mode, the reason why it is difficult to evaluate the comprehensive results is that the evaluation basis and standard are fuzzy and difficult to quantify. The study of many "fuzzy" phenomena in nature, society, economy and life is the main content of fuzzy mathematics. This paper mainly uses the fuzzy comprehensive evaluation method of fuzzy mathematics to discuss how to complete the quantitative evaluation of the quality and effect of computer-related undergraduate practice, and provides a certain reference for the scientific evaluation of computer-related undergraduate practice. At the same time, in the process of assessment and evaluation of these indicators, we can effectively manage students.

2. Steps for Fuzzy Decision Making

The fuzzy decision should first determine the target layer, the criterion layer and the index layer of the evaluated object. Then, the weight of the criterion layer on the target layer and the factors of the corresponding criterion layer is determined to obtain a fuzzy evaluation matrix. The matrix and the weight vector of the factors are fuzzy operation and the fuzzy comprehensive evaluation result is obtained finally. The purpose of the fuzzy decision is to sort the objects to be evaluated, according to the highest degree of membership selecting the relative optimal object from the object to be evaluated[2].

2.1. Determine the Layer of Criterion and the Layer of Index Factor Set for Comprehensive Evaluation

For example, the evaluation standard of students' comprehensive quality comes from teachers, classmate, company and student's achievements, and each aspect can be divided into several sub-factors (that is the indicator layer of factors), each sub- factors have the corresponding scoring criteria. The factors set out in the criteria layer and the indicator layer is as follows:

$$U = (U_1, U_2, U_3 \cdots U_n)$$
$$U_1 = (U_{11}, U_{12}, U_{13} \cdots U_{1n})$$
$$U_2 = (U_{21}, U_{22}, U_{23} \cdots U_{2n})$$
$$U_3 = (U_{31}, U_{32}, U_{33} \cdots U_{3n})$$

Determining the domain of student evaluation grade, assume that the grade of student evaluation has five levels: excellent, good, medium, passing and failed, the established ranking is: V = (excellent, good, medium, passing and failed).

2.2. Weight Set for Determining Evaluation Factors

In fuzzy decision-making, the weight set of evaluation factors is determined: $A = (a_1, a_2, a_3 \cdots a_n)$. The element a_i in weight set A is essentially the membership of the factor U_i to the target layer factor U , B_i is the degree to which the metrics layer factors are subordinate to the corresponding U_i. The common methods for determining the weight set are: Analytic Hierarchy Process, Delphi method and so on [3].

Analytic hierarchy process (AHP) is used to determine the order of relative importance among evaluation indicators. Thus, the weight coefficient is determined and normalized before synthesis. That is

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

The Delphi method, which uses a back-to-back approach to communicate with the members of the panel of experts, has been consulted for several rounds, which tends to focus the expert group's forecasts and finally makes a reasonable prediction. Delphi method is also known as expert opinion method. The method is based on systematic procedures, the use of anonymous expression of views, that is, experts should not discuss with each other, do not have horizontal contact, can only communicate with investigators, opinions of experts on the questions raised in the questionnaire through multiple rounds of surveys, after repeated consultation, induction, modification, the final meeting assembly experts basically consistent view as a result of the prediction. This method is widely representative and reliable.

2.3. Establishing the Fuzzy Relation Matrix R

After constructing the domain of student evaluation grade , we should evaluate the criteria layer from the index layer, which is the organization expert quantifying the evaluated factors $(U_1, U_2, U_3 \cdots U_n)$, that is, to determine the membership degree of the graded fuzzy subsets from the single factor, and then get the fuzzy relation vector Bi.

$B_i = A_i \circ R_i = (b_{i1}, b_{i2}, b_{i3}, b_{i4}, b_{i5})$, $i = 1,2,3,4$. That is the number of (U_1, U_2, U_3, U_4) . $A_i(i = 1,2,3,4)$ is the weight sets of $(U_{11}, U_{12}, U_{13}, U_{14})$ to U_1 , $(U_{21}, U_{22}, U_{23}, U_{24})$ to U_2 , $(U_{31}, U_{32}, U_{33}, U_{34})$ to U_3 , $(U_{41}, U_{42}, U_{43}, U_{44})$ to U_4 . $R_i(i = 1,2,3,4)$ is the evaluation matrix of each sub-factor in (U_1, U_2, U_3, U_4) to the evaluation of hierarchical domain V.

$$R_i = \begin{bmatrix} B_{i1} \\ B_{i2} \\ \vdots \\ B_{im} \end{bmatrix} = \begin{bmatrix} b_{i11} & b_{i12} & \cdots & b_{i1n} \\ b_{i21} & b_{i22} & \cdots & b_{i2n} \\ \vdots & \vdots & \vdots & \vdots \\ b_{im1} & b_{im2} & \cdots & b_{imn} \end{bmatrix}$$

Where m is the number of neutron factors (U_1, U_2, U_3, U_4).

After determining the fuzzy relation vector of each criterion layer subfactor, the target level fuzzy relation vector B can be obtained according to the following formula.

$B = A \circ R = (b_1, b_2, b_3, b_4, b_5)$, where A is the weight set of the criterion layer factor set to the target layer factor U , that is, $A = (a_1, a_2, a_3, a_4)$, R is the evaluation matrix of the criterion layer factor set for U .

$$R = \begin{bmatrix} B_1 \\ B_2 \\ B_3 \\ B_4 \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} & b_{13} & b_{14} & b_{15} \\ b_{21} & b_{22} & b_{23} & b_{24} & b_{25} \\ b_{31} & b_{32} & b_{33} & b_{34} & b_{35} \\ b_{41} & b_{42} & b_{43} & b_{44} & b_{45} \end{bmatrix}$$

$B = (b_1, b_2, b_3, b_4, b_5)$ is the subordinate degree of the fuzzy subset V = (excellent, good, medium, passing, failed) of the evaluation grade U of accounting practice. According to the principle of maximum membership, we can evaluate the grade of an intern.

3. An empirical Study on the Grade of Student Evaluation

Take the students in the 'embedded' training mode of computer science in Taizhou University as an example to analyze the above evaluation methods. This training model is characterized by 2.5 years of study at the university campus followed by 1.5 years of practice in the enterprise. The purpose is to train students' practical ability and innovative ability to participate in practical projects in order to achieve seamless connection between schools and enterprises. Therefore, in order to evaluate the performance of students comprehensively, in addition to the establishment of a system of students and teachers, it is also necessary to establish an expert database of corporate instructors and corresponding expert systems. The experts of this system are composed of project instructors, corporate class teachers, project engineers and project managers, and try to be fair, objective and comprehensive.

Considering the particularity of evaluation of such students, assuming the evaluation of students' comprehensive quality in Taizhou university, the specific target layer, the criteria layer, the factors of the index layer and the relationship are set up. Evaluation Set V = (excellent, good, medium, passing, failed). Take the student named Shen cheng as an example , using the Delphi method, the weights of the indicators are as follows [4], shown in Table 1.

Table 1. Application of Delphi method to the evaluation of each factor set weight of computer professional student

Target layer	**Assessment** A			
Criterion layer	Teacher's A_1 (0.22)	Classmate A_2 (0.17)	Company A_3 (0.30)	Honors and achievement A_4 (0.31)
Indicator layer	respect teachers A_{11} (0.40)	classmate relation A_{21} (0.20)	observe discipline A_{31} (0.32)	score ranking A_{41} (0.41)
	endeavor A_{12} (0.31)	offering help A_{22} (0.17)	project A_{32} (0.06)	honors and awards A_{42} (0.29)
	observe discipline A_{13} (0.19)	living habit A_{23} (0.33)	innovation capability A_{33} (0.18)	average honor A_{43} (0.13)
	keeping time A_{14} (0.1)	responsibility A_{33} (0.48)	communicational ability A_{34} (0.44)	project results A_{44} (0.17)

According to the table, each weight set is:

$$A = (0.22, 0.17, 0.30, 0.31)$$
$$A_1 = (0.40, 0.31, 0.19, 0.10)$$
$$A_2 = (0.20, 0.17, 0.33, 0.48)$$
$$A_3 = (0.32, 0.06, 0.18, 0.44)$$
$$A_4 = (0.41, 0.29, 0.13, 0.17)$$

Using the evaluation matrix of A_1、A_2、A_3、A_4: R_1、R_2、R_3、R_4, B_1、B_2、B_3、B_4 are separately calculated, as follows:

$$R_1=\begin{bmatrix}0.27 & 0.32 & 0.30 & 0.08 & 0.03\\ 0.22 & 0.35 & 0.28 & 0.08 & 0.07\\ 0.31 & 0.34 & 0.20 & 0.10 & 0.05\\ 0.40 & 0.30 & 0.15 & 0.10 & 0.05\end{bmatrix}$$

$$B_1=A_1^{\circ}R_1$$
$$=(0.4,0.31,0.19,0.10)$$
$$\begin{bmatrix}0.27 & 0.32 & 0.30 & 0.08 & 0.03\\ 0.22 & 0.35 & 0.28 & 0.08 & 0.07\\ 0.31 & 0.34 & 0.20 & 0.10 & 0.05\\ 0.40 & 0.30 & 0.15 & 0.10 & 0.05\end{bmatrix}$$
$$=(0.2751,0.3311,0.2598,0.0858,0.0428)$$

$$R_2=\begin{bmatrix}0.13 & 0.21 & 0.35 & 0.25 & 0.06\\ 0.15 & 0.27 & 0.34 & 0.21 & 0.03\\ 0.12 & 0.23 & 0.41 & 0.20 & 0.04\\ 0.11 & 0.25 & 0.40 & 0.20 & 0.04\end{bmatrix}$$

$$B_2=A_2^{\circ}R_2$$
$$=(0.20,0.17,0.33,0.48)$$
$$\begin{bmatrix}0.13 & 0.21 & 0.35 & 0.25 & 0.06\\ 0.15 & 0.27 & 0.34 & 0.21 & 0.03\\ 0.12 & 0.23 & 0.41 & 0.20 & 0.04\\ 0.11 & 0.25 & 0.40 & 0.20 & 0.04\end{bmatrix}$$
$$=(0.1439,0.2838,0.4551,0.2477,0.0495)$$

$$R_3=\begin{bmatrix}0.21 & 0.43 & 0.19 & 0.14 & 0.03\\ 0.20 & 0.37 & 0.23 & 0.18 & 0.02\\ 0.16 & 0.37 & 0.24 & 0.21 & 0.02\\ 0.35 & 0.34 & 0.17 & 0.11 & 0.03\end{bmatrix}$$

$$B_3=A_3^{\circ}R_3$$
$$=(0.32,0.06,0.18,0.44)$$
$$\begin{bmatrix}0.21 & 0.43 & 0.19 & 0.14 & 0.03\\ 0.20 & 0.37 & 0.23 & 0.18 & 0.02\\ 0.16 & 0.37 & 0.24 & 0.21 & 0.02\\ 0.35 & 0.34 & 0.17 & 0.11 & 0.03\end{bmatrix}$$
$$=(0.262,0.376,0.1926,0.1418,0.0276)$$

$$R_4=\begin{pmatrix}0.15 & 0.25 & 0.32 & 0.22 & 0.06\\ 0.17 & 0.27 & 0.32 & 0.20 & 0.04\\ 0.13 & 0.24 & 0.30 & 0.26 & 0.07\\ 0.14 & 0.28 & 0.35 & 0.18 & 0.05\end{pmatrix}$$

$$B_4=A_4^{\circ}R_4$$
$$=(0.41,0.29,0.31,0.17)$$
$$\begin{bmatrix}0.15 & 0.25 & 0.32 & 0.22 & 0.06\\ 0.17 & 0.27 & 0.32 & 0.20 & 0.04\\ 0.13 & 0.24 & 0.30 & 0.26 & 0.07\\ 0.14 & 0.28 & 0.35 & 0.18 & 0.05\end{bmatrix}$$
$$=(0.1749,0.3028,0.3765,0.2594,0.0664)$$

$$R=\begin{bmatrix}B_1\\ B_2\\ B_3\\ B_4\end{bmatrix}$$
$$=\begin{bmatrix}0.2751 & 0.3311 & 0.2598 & 0.0858 & 0.0428\\ 0.1439 & 0.2838 & 0.4551 & 0.2477 & 0.0495\\ 0.262 & 0.376 & 0.1926 & 0.1418 & 0.0276\\ 0.1749 & 0.3028 & 0.3765 & 0.2594 & 0.0664\end{bmatrix}$$

$$B=A^{\circ}R$$
$$=(0.22,0.17,0.30,0.31)$$
$$\begin{bmatrix}0.2751 & 0.3311 & 0.2598 & 0.0858 & 0.0428\\ 0.1439 & 0.2838 & 0.4551 & 0.2477 & 0.0495\\ 0.262 & 0.376 & 0.1926 & 0.1418 & 0.0276\\ 0.1749 & 0.3028 & 0.3765 & 0.2594 & 0.0664\end{bmatrix}$$
$$=(0.2178,0.32776,0.30902,0.18394,0.0467)$$

According to the principle of maximum membership, the comprehensive performance of Shen cheng is good.

4. Conclusion

The evaluation of students plays an important role in student management. An objective evaluation of students is both a kind of encouragement and a kind of spur. Therefore, it is necessary to establish an effective and scientific comprehensive evaluation system for student's management. The method of comprehensive evaluation of students has been established and the computer program for this method which is available in this paper comprehensive, where the results of evaluation can be calculated automatically. As long as you enter the information of the fuzzy level of the indicator level evaluated by the company, college teachers, and classmates, the results can be calculated automatically which will ensure the objectivity, scientificity and efficiency of the student evaluation work.It provides an effective and convenient evaluation method for the management of students.

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