Evaluation of College Students' Learning Ability based on Fuzzy Clustering Analysis

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Keywords: Learning ability, Machine learning, Fuzzy clustering analysis, Evaluation model

Abstract: With the rapid development of science and technology, the cycle of knowledge renewal is shorter and shorter, and college students must have higher knowledge, deeper attainments and better adaptability. This requires them to have the ability to learn for life. In this paper we proposed a college students' learning ability model based on fuzzy clustering analysis. We analyze the existing problems in the evaluation of learning ability of college students and study the method to evaluate the college students' learning ability combining the theory of statistics learning with the practice of college students management. Then we construct an evaluation model to ananlyize the learning ability of the college students.

1. Introduction

More and more attention has been paid to the development of education and colleges, and the learning ability of college students is the key problem. However, as the number of enrollment increases, the scale of students is becoming more and larger. Students' learning ability has also been paid more and more attention by the vast number of scholars. Our school is energetically reforming the teaching mode and management mode to adapt to the new requirements, especially the learning ability of the students, which puts forward higher requirements for the college teaching quality. At the same time, how to evaluate the college students' learning ability scientifically and impartially is an urgent problem to be solved. However, there are many qualitative descriptions in college students' learning ability evaluation. Much content only give qualitative standards, and the standard flexibility is very large. Usually, the evaluators have certain deviations and subjective factors in the standard grasp, which leads to the greater difference between the results and the actual situation, and reduces the accuracy of the evaluation results.

Nowadays, there is no scientific evaluation system for the college students' learning ability. The research on the learning ability of college students is carried out by descriptive and investigation methods, which can not objectively evaluate the situation of college students' learning ability. Therefore, it is particularly important to study the evaluation system of college students' learning ability. In fact, the college students' learning ability is a vague concept, so the learning ability evaluation can be regarded as a fuzzy mathematical problem. In this paper, the theory and method of pattern recognition are used to evaluate the college students' learning ability, and the fuzzy clustering analysis method is used to construct the evaluation model of the college students' learning ability, which can ensure the objectivity and consistency of the evaluation.

2. Relation work

In recent years, with the rapid increase in the number of students in universities, the scale of the students is becoming more and larger, and the evaluation of students' learning ability has been paid more and more attention by the experts. The departments at all levels are actively exploring and

formulating scientific, effective and feasible evaluation and index system for students' learning ability, and constantly promote the healthy development of higher education. The evaluation process of students' learning ability includes the establishment of index system, sample collection, data preprocessing, and effective index information extraction and evaluation model construction. Nowadays, most people focus on the evaluation process and evaluation method of students' learning ability. So it is necessary to optimize the evaluation mechanism of students' learning ability [1-3].

With the changes of people's way of life, working methods and learning methods, the cultivation of college students' social practice ability has been continuously proposed and strengthened. However, in contrast, the cultivation of basic survivability of college students does not seem to attract the attention of scholars. We know that the shortage of talents has restricted the development of the economy, which have a profound impact on the education system and the personnel training system. Therefore, we must put forward higher requirements for the development of education [4-5].

Paper [6] propposed that the social competitiveness of college students depend on their learning ability, which including living ability, professional learning ability and practical ability. The cultivation of learning ability is mainly to train them to discover problems, scientifically analyze problems and solve problems in time. This ability can help college students acquire new knowledge and new skills. Paper [7] evaluated the learning ability of college students from the perspectives of professional knowledge, social identity and self-awareness, which make the healthy development of college students. Any unfair evaluation of any of these factors may make the development of college students' ability not perfect, which can affect the overall development of college students. Paper [8] established a college student evaluation system that is compatible with the needs of today's society, and then use this system for college students' quality assessment and self-evaluation, so we can effectively improve the learning ability of college students.

Paper [9] analysised the college students' ability, and summarized the index used for evaluation, which including innovation ability evaluation, social responsibility evaluation, organization management cooperation ability evaluation, competition stress resistance evaluation, language proficiency assessment ability. Based on the combination of qualitative and quantitative research, the methods related to the factor analysis, discriminative power analysis, reliability analysis and validity analysis. The evaluation system includes four first-level indicators and 25 secondary indicators [10]. Paper [11] proposed the AHP-fuzzy comprehensive evaluation method to evaluate of students' learning ability based on the combination of qualitative and quantitative, which can provide reference for the countermeasures to promote students' learning ability. By analyzing the main factors and sub-factors of learning ability, paper constructed the index system for evaluating learning ability. They established a self-assessment model using weighting strategies and maximum adherence principles [12].

There are some problems in the evaluation of the learning ability of college students. For example, the current colleges and universities mainly pay attention to the results of students' courses, but they are not paying enough attention to the learning ability of college students. At the same time, management and teachers participate in evaluations, while students and parents participate in evaluations less. A widely recognized evaluation indicator system has not yet been established. At present, most of the domestic research on clustering analysis is concentrated on the improvement of the algorithm, but the research in the field of education is very few. This project tries to solve the problem of students' learning ability by using the cluster analysis method, and finally constructs a fair evaluation model of the learning ability of college students.

3. Evaluation of students' learning ability

The evaluation process of students' learning ability includes the establishment of index system, sample collection, data preprocessing, and effective index information extraction and evaluation model construction. Among them, index system construction, effective index information extraction and evaluation model construction is the key to achieve the reasonable evaluation of learning ability. This project combines the knowledge of pattern recognition, artificial intelligence and management

science to study the elements of students' learning ability.

To build effective evaluation system of students' learning ability, the key is to design a scientific and reasonable evaluation index system. We can divide the indicator system into multiple functional modules, and then refine these modules to obtain evaluation indicators. The characteristics of the indicators are as follows

$$X = [x_1, x_2, ... x_n] \tag{1}$$

At present, weighted evaluation method are used in the evaluation of the college students' learning ability. The main shortcomings is that the weight setting of various factors mainly depends on human setting and the subjective factors are greatly influenced. The accuracy of the price result is not good. Actually, there are many factors involved in the evaluation of the students' learning ability, and it is a typical fuzzy problem that the evaluation level is difficult to determine the boundary. So we use a fuzzy clustering method in the field of pattern recognition to evaluate students' learning ability [13]. First we set up the similarity relation matrix between samples $R = (r_{ij})$. For the sample X_i and X_j determining a real number r_{ij} of values in the [0, 1] interval, the calculation process is as follows:

$$r_{ij} = \frac{\sum_{k=1}^{m} \min(X_{ik}, X_{jk})}{\frac{1}{2}\sum_{k=1}^{m}(X_{ik} + X_{jk})} \tag{2}$$

Then we judge whether the relation matrix is a fuzzy equivalence relation. If the transitive closure of the fuzzy relation matrix is not calculated, the transitive closure $t(R)$ is an approximate equivalent matrix R. We can calculate the transfer closure using the square method

$$R^2 = R \bullet R \tag{3}$$

We classify the equivalent matrix and draw fuzzy clustering graph by classification R_λ. From this, we can get the classification result of the whole sample, and divide the students' learning ability into several grades. In order to verify the classification effectiveness for the performance of the college students' learning ability, we gather the index information for different students, and the use the fuzzy clustering analysis method to evaluate the learning ability of students. For the sake of simplicity, we analyze only a few examples to illustrate the process of evaluation.

Table.1 Coefficient k=1.0000

1	0	0	0	0	0
0	1	0	0	0	0
0	0	1	0	0	0
0	0	0	1	0	0
0	0	0	0	1	0
0	0	0	0	0	1

Table.2 Coefficient k= 0.9207

1	0	0	1	0	0
0	1	0	0	0	0
0	0	1	0	0	0
1	0	0	1	0	0
0	0	0	0	1	0
0	0	0	0	0	1

Table.3 Coefficient k=0.8440

1	0	0	1	0	0
0	1	0	0	0	0
0	0	1	0	1	0
1	0	0	1	0	0
0	0	1	0	1	0
0	0	0	0	0	1

Table.4 Coefficient k= 0.8215

1	0	0	1	0	0
0	1	0	0	0	0
0	0	1	0	1	1
1	0	0	1	0	0
0	0	1	0	1	1
0	0	1	0	1	1

Table.5 Coefficient k=0.8102

1	0	1	1	1	1
0	1	0	0	0	0
1	0	1	1	1	1
1	0	1	1	1	1
1	0	1	1	1	1

Table.6 Coefficient k= 0.7835

1	1	1	1	1	1
1	1	1	1	1	1
1	1	1	1	1	1
1	1	1	1	1	1
1	1	1	1	1	1

1	0	1	1	1	1		1	1	1	1	1	1

Tables 1 to table 6, respectively, are the evaluation results of the college students' learning ability when the classification coefficients choose different values. From the results of dynamic clustering, we can see that the classification coefficient is the key to the evaluation of the college students' learning ability, so in practice we can determine the different grades according to the overall learning ability of all students. The results show that the system can gather students into classes according to the similarity of each student, and give the characteristic indexes of each class of students. According to the scores of students' various indicators, students can be integrated into different categories to ensure that each category has its own characteristics. This method can achieve an objective evaluation of the college students' learning ability.

4. Conclusion

A fair evaluation of the college students' learning ability is an important part of the whole process of education management. In this paper, a fuzzy clustering method is used to classify the college students' learning ability. By selecting appropriate similarity coefficient, the fuzzy similarity matrix is established. Finally, the dynamic clustering method is used to analyze. From the analysis result, the method is better to realize the combination of quantitative evaluation and comprehensive evaluation.

Acknowledgments

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