

Application and research of fuzzy clustering analysis algorithm under “micro-lecture” English teaching mode

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ABSTRACT: The fuzzy clustering algorithm is to classify the data or indicators with a greater degree of similarity based on the principle of the same type of individuals possessing a greater similarity, and different types of individuals possessing differences, establish clear category boundaries, form any shape of relationship clusters in the solving process, and input the research indicators at random, in order to accurately analyze the significance of the indicators in the algorithm. The evaluation value of the clustering analysis can be obtained by the establishment of the fuzzy factor set based on the membership analysis, and the evaluation result can be analyzed through reference to the evaluation indicators of the fuzzy clustering analysis. The “micro-lecture” English teaching mode can be estimated and the analysis indicators can be rationally established based on the fuzzy clustering analysis algorithm, with better algorithm applicability.

Keywords: micro-lecture; fuzzy clustering; teaching mode; flipped learning

1 INTRODUCTION

“Micro-lecture” is a new teaching mode. For the understanding of “micro-lecture”, it mainly has the following viewpoints. Some scholars believe that the “micro-lecture” mode is a basic course, which serves for blended learning, flipped learning and a variety of learning styles; Hu Tiesheng and other scholars believe that “micro-lecture” teaching can be viewed as a kind of network video course, and become a part of teaching design; Jiao Jianli and other scholars believe that, as a kind of English teaching resource, the online education is subject to dapper online video, and aims at realizing the course scenario, digitization and interest. Based on the above analysis, the “micro-lecture” English teaching is based on the video as the main teaching medium. Each micro lecture is a complete teaching based on a knowledge point or a concept. “Micro-lecture” video can be from the network resources, and can also be produced or recorded by the English teachers. It is mainly subject to the platform of network, so that the students can implement free leaning through mobile devices. Of course, the micro-lecture video can be added in the ordinary classroom teaching, in order to improve the teaching quality.

2 FUZZY CLUSTERING ANALYSIS UNDER “MICRO-LECTURE” ENGLISH TEACHING MODE

The main form of micro-lecture applied in college English teaching based on the establishment of the factor set is U_1 ; the scope of content selection of college English micro-lecture is U_2 ; the development strategy of micro-lecture in college English teaching is U_3 ; the characteristic of micro-lecture in college English teaching is U_4 ; the path analysis of micro-lecture and college English teaching is U_5 :

$$U = (U_1, U_2, U_3, U_4, U_5)$$

The fuzzy clustering analysis indicators are established according to five main factor sets, as shown in Table 1.

3 FUZZY CLUSTERING ANALYSIS ALGORITHM UNDER “MICRO-LECTURE” ENGLISH TEACHING MODE

(1) To determine the factor domain in the process of modeling:

Table 1. Fuzzy clustering analysis indicators

Main form of micro-lecture applied in college English teaching U_1	Scope of content selection of college English micro-lecture U_2	Development strategy of micro-lecture in college English teaching U_3	Characteristic of micro-lecture in college English teaching U_4	Path analysis of micro-lecture and college English teaching U_5
Micro-lecture teaching in general English classroom u_{11}	Phonological knowledge u_{21}	Integration and convergence of micro-lecture and traditional English classroom teaching u_{31}	Enhancement of students interest in English learning u_{41}	English micro-lecture resources u_{51}
Students independent learning environment outside the classroom u_{12}	Syntax, semantic knowledge u_{22}	Professional business level of English teachers u_{32}	Freedom and flexible learning time of micro-lecture u_{42}	Change of educational concept and attempt of flipped classroom u_{52}
Listening and speaking practices or "English corner" and other related practical activities u_{13}	Text structure knowledge u_{23}	Media Network operating skills u_{33}	Dapper micro-lecture u_{43}	Introduction of supporting policies and encouragement of the teachers and students to make micro-lecture u_{53}
	English micro-lecture skills u_{24}	Facilities, platforms and resources applied in micro-lecture u_{34}	Targeted and topic-focused micro-lecture u_{44}	
	Non-language knowledge u_{25}			

$$U = \{u_1, u_2, \dots, u_n\}$$

(2) To determine the evaluation domain:

$$V = \{v_1, v_2, \dots, v_m\};$$

(3) To determine the fuzzy evaluation matrix

$$R = (r_{ij})_{n \times m};$$

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \vdots & \vdots & & \vdots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix}$$

The evaluation $f(u_i)(i=1,2,\dots,n)$ can be made for each factor u_i , so as to obtain a fuzzy mapping f from the factor domain U to the evaluation domain V , namely:

$$f: U \rightarrow F(U)$$

$$u_i \mapsto f(u_i) = (r_{i1}, r_{i2}, \dots, r_{im}) \in F(V)$$

Then, to find out the fuzzy relation $R_f \in F(U \times V)$ from the fuzzy mapping f , namely:

$$R_f(u_i, v_j) = f(u_i)(v_j) = r_{ij} (i=1, 2, \dots, n; j=1, 2, \dots, m)$$

(4) To establish a weight set, $A=(a_1, a_2, \dots, a_n) \in F(U)$, boundary conditions:

$$\sum_{i=1}^n a_i = 1 \quad a_i \geq 0$$

$$B = A \cdot R$$

$$= (a_1, a_2, a_3, \dots, a_n) \cdot \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \vdots & \vdots & & \vdots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix}$$

$$= (b_1, b_2, b_3, \dots, b_n)$$

(5) To evaluate the fuzzy clustering

For the weight $A=(a_1, a_2, \dots, a_n) \in F(U)$, the model $M(\wedge, \vee)$ can be used for maximum - minimum compositional operation, thus obtaining comprehensive evaluation:

$$B = A \circ R \quad (\Leftrightarrow b_j = \bigvee_{i=1}^n (a_i \wedge r_{ij}), j=1, 2, \dots, m)$$

The determination of the weight $A=(a_1, a_2, \dots, a_n)$ of the evaluation set V is an important part in the process of modeling. The main reason is that, in the evaluation process, the determination is made through the establishment of the fuzzy relation from reality. The fuzzy comprehensive evaluation model selected in the process of modeling is (U, V, R) . For the weight $A=(a_1, a_2, \dots, a_n) \in F(U)$, the fuzzy evaluation matrix is $R = (r_{ij})_{n \times m}$. The model $M(\wedge, \vee)$ can be used to obtain the comprehensive evaluation process:

$$B = A \circ R = (b_1, b_2, \dots, b_m) \in F(V),$$

where: $b_j = \bigvee_{i=1}^n (a_i \wedge r_{ij}) \quad (j=1, 2, \dots, m)$.

$$b_j = \bigvee_{i=1}^n (a_i \wedge r_{ij}) \quad (j=1,2,\dots,m)$$

The evaluation set can be obtained by the above fuzzy clustering algorithm.

$$U_1 = \{u_{11}, u_{12}\};$$

$$U_2 = \{u_{21}, u_{22}, u_{23}, u_{24}\};$$

$$U_3 = \{u_{31}, u_{32}, u_{33}, u_{34}, u_{35}\};$$

$$U_4 = \{u_{41}, u_{42}, u_{43}, u_{44}\};$$

$$U_5 = \{u_{51}, u_{52}, u_{53}\};$$

In the process of modeling, the following five ranking matrixes can be obtained: the main form of micro-lecture applied in college English teaching U_1 , the scope of content selection of college English micro-lecture U_2 , the development strategy of micro-lecture in college English teaching U_3 , the characteristic of micro-lecture in college English teaching U_4 , the path analysis of micro-lecture and college English teaching U_5 .

In this paper, the weight factor fuzzy set of a single-layer indicator is:

$$U_1^* = \{U_{11}, U_{12}, U_{13}\} = \{0.25, 0.55, 0.2\};$$

$$U_2^* = \{U_{21}, U_{22}, U_{23}, U_{24}, U_{25}\} = \{0.25, 0.55, 0.2\};$$

$$U_3^* = \{U_{31}, U_{32}, U_{33}, U_{34}\} = \{0.54, 0.1, 0.24, 0.14\};$$

$$U_4^* = \{U_{41}, U_{42}, U_{43}, U_{44}\} = \{0.24, 0.31, 0.22, 0.23\};$$

$$U_5^* = \{U_{51}, U_{52}, U_{53}\} = \{0.3, 0.43, 0.27\}$$

The weight vector obtained from the evaluation process:

$$\beta = \{\beta_1, \beta_2, \beta_3, \beta_4, \beta_5\} = \{0.3, 0.3, 0.2, 0.1, 0.1\}$$

$$U_i^* = U_i \cdot \beta^T$$

$$U_1^* = 10, U_2^* = 9.4, U_3^* = 5.6, U_4^* = 4, U_5^* = 4$$

After normalization,

$$U_1^* = 0.303, U_2^* = 0.285, U_3^* = 0.170, U_4^* = 0.121, U_5^* = 0.121$$

Thus

$$\bar{A} = (0.28 \quad 0.25 \quad 0.21 \quad 0.13 \quad 0.13)$$

Based on $\bar{A} = (0.28 \quad 0.25 \quad 0.21 \quad 0.13 \quad 0.13)$, five clustering factor sets under the micro-lecture English teaching mode can be analyzed: the main form of micro-lecture applied in college English teaching, the scope of content selection of college English micro-lecture, the development strategy of micro-lecture in college English teaching, the characteristic of micro-lecture in college English teaching, proportion of path analysis of micro-lecture and college English teaching, and the corresponding weight value. The weight value and impact of the main form of micro-lecture applied in college English teaching is the maximum.

This paper establishes the evaluation membership, as shown in Table 2.

Table 2. Fuzzy clustering analysis evaluation indicators

Evaluation method	Score range			
	0-60	60-80	80-90	90-100
Very good	0	0	0.05	0.95
Good	0	0.05	0.9	0.05
General	0.05	0.9	0.05	0
Bad	0.95	0.05	0	0

For the establishment of secondary indicators, the process is complex. The experience-based judgment is made for the micro-lecture English teaching according to the research data and literature and cases, and the importance degree of the secondary indicators is reflected based on the size of the score. In this model, the secondary indicators are determined by reference to the domestic and foreign literatures, thus obtaining the clustering evaluation value of the micro-lecture English teaching.

The above analysis indicators can be used to obtain Table 3.

The evaluation sets of five main factors are obtained from application of micro-lecture in college English teaching:

Main form of micro-lecture applied in college English teaching:

$$U_1 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0.05 & 0.9 & 0.05 \\ 0 & 0.05 & 0.9 & 0.05 \end{pmatrix}$$

Scope of content selection of college English micro-lecture:

$$U_2 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0 & 0.05 & 0.95 \\ 0 & 0.05 & 0.9 & 0.05 \\ 0 & 0 & 0.05 & 0.95 \\ 0 & 0.05 & 0.9 & 0.05 \end{pmatrix}$$

Development strategy of micro-lecture in college

Table 3. Fuzzy clustering evaluation value under “micro-lecture” English teaching mode

Each indicator,	Value	Each indicator	Value
Micro-lecture teaching in general English classroom u_{11}	Very good	Media network operating skills u_{33}	Good
Students independent learning environment outside the classroom u_{12}	General	Facilities, platforms and resources applied in micro-lecture u_{34}	Good
Listening and speaking practices or “English corner” and other related practical activities u_{13}	Very good	Enhancement of students interest in English learning u_{41}	Good
Phonological knowledge u_{21}	Very good	Freedom and flexible learning time of micro-lecture u_{42}	General
Syntax, semantic knowledge u_{22}	General	Dapper micro-lecture u_{43}	Good
Text structure knowledge u_{23}	Very good	Targeted and topic-focused micro-lecture u_{44}	General
English micro-lecture skills u_{24}	General	English micro-lecture resources u_{51}	General
Non-language knowledge u_{25}	Good	Change of educational concept and attempt of flipped classroom u_{52}	Good
Integration and convergence of micro-lecture and traditional English classroom teaching u_{31}	General	Introduction of supporting policies and encouragement of the teachers and students to make micro-lecture u_{53}	Good
Professional business level of English teachers u_{32}	General		

English teaching:

$$U_3 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0 & 0.05 & 0.95 \\ 0 & 0 & 0.05 & 0.95 \\ 0 & 0.05 & 0.9 & 0.05 \end{pmatrix}$$

Characteristic of micro-lecture in college English teaching:

$$U_4 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0 & 0.05 & 0.95 \\ 0 & 0 & 0.05 & 0.95 \\ 0 & 0.05 & 0.9 & 0.05 \end{pmatrix}$$

Path analysis of micro-lecture and college English teaching:

$$U_5 = \begin{pmatrix} 0 & 0 & 0.05 & 0.95 \\ 0 & 0.05 & 0.9 & 0.05 \\ 0 & 0.05 & 0.9 & 0.05 \end{pmatrix}$$

According to the formula

$$B_i = A_i \cdot R_i$$

The fuzzy evaluation matrix can be obtained by the normalization processing of B_i .

$$\bar{B} = \begin{pmatrix} B_1 \\ B_2 \\ B_3 \\ B_4 \\ B_5 \end{pmatrix} = \begin{pmatrix} 0.07 & 0.26 & 0.14 & 0.41 \\ 0 & 0.16 & 0.74 & 0.54 \\ 0.14 & 0.14 & 0.31 & 0.17 \\ 0.16 & 0.21 & 0.31 & 0.34 \\ 0.11 & 0.32 & 0.26 & 0.31 \end{pmatrix}$$

The evaluation value is obtained based on the fuzzy clustering analysis algorithm:

$$Z = U^* \cdot B = (0.38 \quad 0.33 \quad 0.10 \quad 0.19)$$

In the evaluation value Z , $0.38 > 0.33 > 0.1 > 0.19$. By reference to the evaluation indicators of the fuzzy clustering analysis, the maximum values in Z is corresponding to the evaluation indicators of 90-100. The result shows that the “micro-lecture” obtains a better evaluation in English teaching mode, and its application prospects and improved teaching effect are also obvious.

4 CONCLUSION

With the continuous deepening of the micro-lecture education, the educational pattern can increase the students’ interest in English learning, and enhance students’ independent learning ability. This paper carious out the fuzzy clustering based on the similarity of indicators, and form any shape of relationship clusters, and input the research indicators at random, in order to accurately analyze the applicability of the micro-lecture English teaching mode.

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