An Applicable Way of Teaching Quality Evaluation Based on MOOC Platform

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Abstract—The MOOC-based education is an important means to improve the quality of education as the increasing development of internet; meanwhile, the assessment of teaching quality is an indispensable aspect in teaching management, and it has been more and more important as the scale of the students' expansion. In order to deal with the challenges of big data processing effectively in the field of education, we designed a teaching quality assessment model for the MOOC platform based on comprehensive fuzzy evaluation. To verify the effectiveness of our method, a control experiment was adopted to explore the significance of our evaluation method; the results show that it can help teachers to prepare their teaching contents and students to improve their learning efficiency.

Keywords—MOOC-based education, fuzzy, teaching quality, assessment

1 Introduction

The MOOC-based education mode has developed rapidly in recent years, which is featured by abundant course resources, easy operation and extensive audiences. Students can engage in independent study according to their interests, so as to achieve the objective of cross-school and cross-region education. The major advantages of The MOOC-based education lie in its flexible form to conveniently expand teaching scale and reduce teaching cost [1-2]. It has been an obvious problem that how to select the right teacher's course for student' learning, so teaching quality assessment has been one of the most important aspects in education mode based on MOOC, and it has come to the attention of most university[3-5]. However, video resources are difficult to be evaluated in the current MOOC platform, affecting students' learning efficiency seriously. The traditional methods of teaching quality assessment mainly include linear regression, partial least squares, multivariate statistical analysis, grey relational analysis and analytic hierarchy process [6-9]. These methods assume that there is a linear connection between the teaching quality and assessment indicators. In fact, the

relationship between the assessment indicators and teaching quality are nonlinear. It is difficult to accurately describe the problem by using the linear model, which leads to the unignorable difference between the assessment results and the actual value, so it is significant to design an effective way to evaluate the quality of teaching videos. Evaluation of teaching quality is the process of determining the performance levels of individual in relation to educational objectives. A high quality evaluation system provides grounds for individual improvement, thus, the system should regularly be reviewed and improved to ensure that it is precise [10-12]. Hence, the evaluation system needs the transparency, objectivity, logical reasoning, and easy implementation which could be provided by the fuzzy logic comprehensive evaluation. To solve the problem above, this paper proposed a method based on fuzzy comprehensive evaluation to evaluate the teaching quality of the video resource. The proposed evaluation system considered the importance weights of various teaching skills in the teaching process. The paper is organized as follows. In section 2, we constructed a MOOC platform for reliable teaching content provision, in section 3, a fuzzy comprehensive evaluation model was proposed integrating with the distinguished teaching skills, which considers about all aspects in teaching management, so it is effective to evaluate the teaching video quality for the students' learning. The model consists of such process as fuzzification, inference, and defuzzification. In Section 4, through an example, the procedure of the proposed system is implemented and its result is explained with diagraphs and tables. In Section 5, Conclusions are drawn.

2 The Architecture of MOOC Platform

The MOOC platform was constructed with the integration of the software platform and the hardware platform. The hardware platform is set up based on cloud computing, which is shown as Figure 1. Services or data are hosted on remote infrastructure, and the cloud computing provides safe and reliable data storage [13, 14] as well as convenient and quick web service with supercomputing ability. If the new technology can be applied in educational fields, service based on cloud computing can be taken to assist instruction that will drive the process of the educational information.

The software platform is composed by such things as videos recorded by teachers, courseware, case studies and other teaching resources. Teachers can log in the platform to update content, publish information and arrange assignment [15]. Meanwhile, Students can achieve independent study with the platform. The most important feature of the platform is ubiquitous: teaching resources are available from anywhere. This platform is convenient and can provide quick web service with supercomputing ability.

Due to the strong openness of the MOOC platform, students can gain relevant course resources after registration. Teachers can guarantee the teaching system integrity through continuously adjusting teaching contents and enrich students' practical ability with the latest cases.

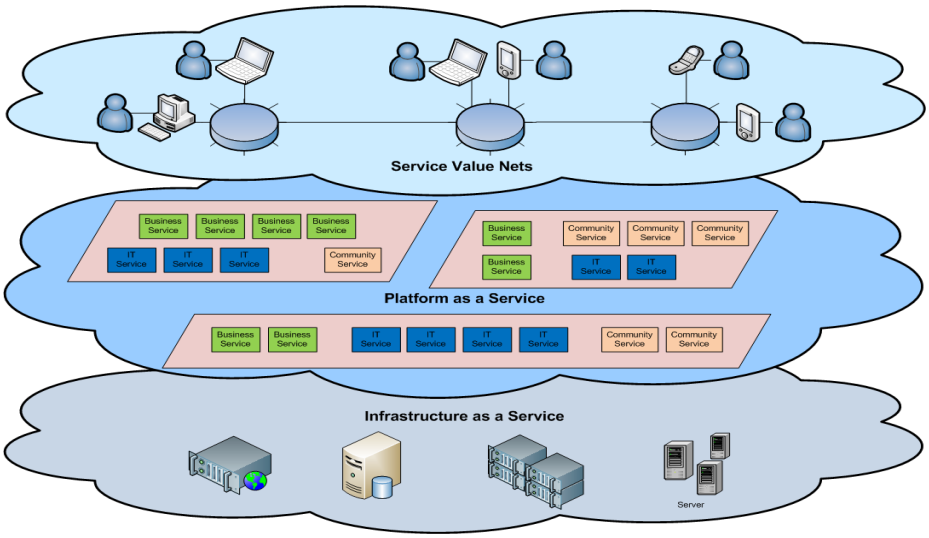

Fig. 1. The architecture of the cloud computing platform

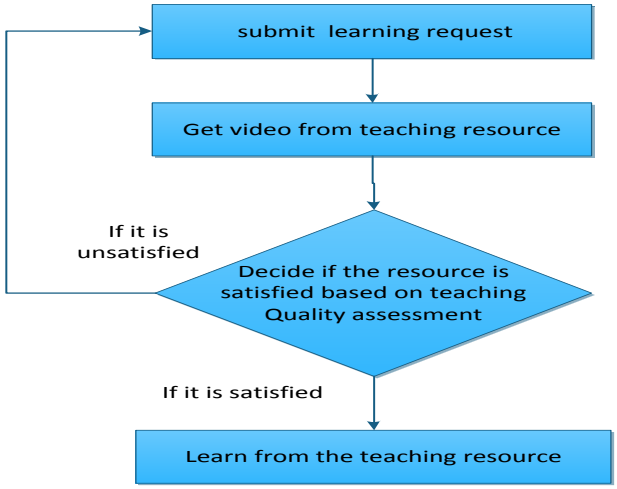

Fig. 2. The students' selection process based on MOOC platform

It is shown in Figure 2 that the students select the appropriate course to learn on the MOOC platform. The process can be classified as follows: Firstly, students should set up their learning plan and offer their request to the platform.

Secondly, the teaching resource would be given based on the request of the students, and then students can select the most appropriate course to learn according to the teaching assessment. Finally, if students are not satisfied with the course they have selected, they can select another teacher's teaching resource for their own objects. In summary, an excellent approach of teaching quality assessment is important, and we had designed the method in the next section.

3 Design of Teaching Quality Assessment

The global teaching quality is the final target in the teaching quality model, which is affected by many aspects of teaching skills. The various teaching skills can be quantified as distinguished system indicators. Considering that the main indicators include many sub-indicators, our design analyzes the whole teaching process is divided into the teaching skills as shown in Figure 3.

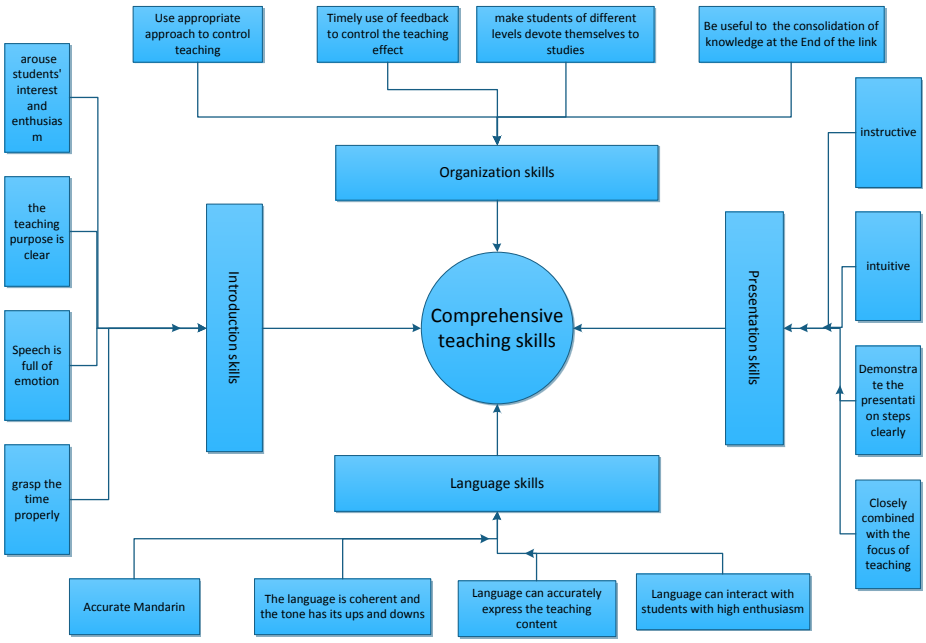

Fig. 3. The various factors contributing to the teaching quality

The whole target is located in the center as the figure shows, which is the evaluation of the comprehensive teaching skills. It can be decomposed into four main factors, which is also called the first level indicator. The four main factors are surrounding the main target as the figure shows, which are "Introduction skills", "Language skills", "Presentation skills" and "Organization skills" respectively. In order to evaluate the quality more delicate, we decompose every first level indicator into four sub-factors, which is also called the second level indicator. The sub-factor are surrounding with the first level factors, which are shown in the outermost periphery of Figure 3. Every indicator has the corresponding weight because it has different impact to the teaching quality, and each indicator has its own evaluation result which is called comment set.

The concrete establishment of indicator set, weight index set and comment set is presented as follows:

- the first level indicator set is defined as U = {U1, U2, U3, U4} = {"Introduction skills", "Language skills ", "Presentation skills", "Organization skills"}, and the corresponding weight index set is A= (a1, a2...an);
- the second level indicator set is U_i= {u_{i1}, u_{i2}, u_{i3}, u_{i4} }, (I = 1, 2, 3,4), and the corresponding weight index set is A_i={ a_{i1}, a_{i2}, a_{i3},a_{i4} },it is often obtained by the comment of the related domain experts.
- the comment index set is V={ V1,V2,V3,V4} ,which represents { Excellent ,good, middle, poor}

The whole evaluation procedure includes three steps, which is shown as follows:

- The first step is fuzzifization: the crisp comment value should be exchanged to the fuzzy member function. The fuzzy member function can be determined from the evaluation of the students for the distinguished indicator. For example, if there are 50 students thinking the second indicator U11 is "excellent" and the total number of the students is 100, the indicator U11 belongs to "excellent" would be 50/100=0.5 .
- The second step is fuzzy inference: the value of the first level indicators can be calculated according to the value of the second level evaluation, and this can be implemented by the fuzzy compound calculation between the membership degree of second level indicators and the weighted vectors given by the domain experts.
- The third step is defuzzification: the result of the global evaluation can be calculated from the first level evaluation, and this can be implemented through the fuzzy compound calculation between the first level indicator membership and the global weighted vector.

4 Result Analysis and Discussion

We designed an experiment to show the effectiveness of this evaluation method, the course content includes Theory explanation, case analysis, complete process demonstration, a questionnaire was applied to investigate the various teaching skills which is shown in Table 1.

4.1 Objects and design of the experiment

The Objects of the experiment were to evaluate the teaching quality based on the MOOC platform. Teaching assessment contents included theory and practice, and 100 students were chosen to present their comments on the teaching effectiveness. The weights of different teaching skills were given by ten experts in education domain.

Moreover, there is no significant difference in the gender of teachers, as well as the age, physical quality.

SPSS13.0 statistical software and Microsoft Excel 2010 software were used to gather and analyze the experimental data. Besides, the fuzzy Comprehensive evaluation was applied to implement the final teaching quality assessment.

Table 1. The evaluation of the various teaching skills

First level indicator	First level weight	Evaluation project	Second level weight	Evaluation grade			
				Excellent	***Good***	***Middle***	***Poor***
U1:Introduction skills	0.3	U11	0.3	0.5	0.3	0.1	0.1
		U12	0.3	0.6	0.2	0.1	0.1
		U13	0.2	0.4	0.3	0.1	0.2
		U14	0.2	0.6	0.2	0.1	0.1
U2:Language skills	0.2	U21	0.2	0.7	0.1	0.1	0.1
		U22	0.3	0.5	0.1	0.2	0.2
		U23	0.3	0.4	0.2	0.3	0.1
		U24	0.2	0.3	0.1	0.4	0.2
U3:Presentation skills	0.2	U31	0.2	0.5	0.1	0.2	0.2
		U32	0.2	0.4	0.1	0.4	0.1
		U33	0.3	0.2	0.1	0.6	0.1
		U34	0.3	0.3	0.1	0.5	0.1
U4:Organization skills	0.3	U41	0.3	0.6	0.2	0.1	0.1
		U42	0.3	0.5	0.2	0.1	0.2
		U43	0.2	0.4	0.3	0.1	0.2
		U44	0.2	0.3	0.2	0.3	0.2

4.2 Results of the experiment

Statistical results of the questionnaire survey about the teaching effectiveness are shown in TABLE 1. According to the model we have set up, the global evaluation set is {V1,V2,V3,V4}={ Excellent ,good, middle, poor}, corresponding to the first level indicator Ui(i=1,2,3,4)={"Introduction skills", "Language skills", "Presentation skills", "Organization skills"}, and the second level weight is also listed in Table 1. Each first level indicator is decomposed into the four second level indicators. For example: the first level U1 "instruction skills" are decomposed into four second level indicators {u11, u12, u13, u14}, The result of the first level evaluation can be calculated from the second level indicators, and the value of the second level indicators are set according to the comments of one hundred students, which is shown as Table 1.the results of the four first level indicators are shown in Figure 4-7.

The evaluation matrix of second level indicator is determined through students' evaluation, which means the membership degree of the second level indicators belonging to the comment set:

$$R_1 = \begin{bmatrix} 0.5 & 0.3 & 0.1 & 0.1 \\ 0.6 & 0.2 & 0.1 & 0.1 \\ 0.4 & 0.3 & 0.1 & 0.2 \\ 0.6 & 0.2 & 0.1 & 0.1 \end{bmatrix}, R_2 = \begin{bmatrix} 0.7 & 0.1 & 0.1 & 0.1 \\ 0.5 & 0.1 & 0.2 & 0.2 \\ 0.4 & 0.2 & 0.3 & 0.1 \\ 0.3 & 0.1 & 0.4 & 0.2 \end{bmatrix} \quad (1)$$

$$R_3 = \begin{bmatrix} 0.5 & 0.1 & 0.2 & 0.2 \\ 0.4 & 0.1 & 0.4 & 0.1 \\ 0.2 & 0.1 & 0.6 & 0.1 \\ 0.3 & 0.1 & 0.5 & 0.1 \end{bmatrix}, R_4 = \begin{bmatrix} 0.6 & 0.2 & 0.1 & 0.1 \\ 0.5 & 0.2 & 0.1 & 0.2 \\ 0.4 & 0.3 & 0.1 & 0.2 \\ 0.3 & 0.2 & 0.3 & 0.2 \end{bmatrix} \quad (2)$$

The following evaluation arrays represent the weighted vector of the second level indicator, which mean the important degree of the two level indicators relative to the first level indicators. This can be obtained from TABLE 1 which is determined by the domain experts. There are four first level indicators, and the four weighted vectors are given as follows:

$$A_1 = (0.3 \quad 0.3 \quad 0.2 \quad 0.2) \quad (3)$$

$$A_2 = (0.2 \quad 0.2 \quad 0.3 \quad 0.2) \quad (4)$$

$$A_3 = (0.2 \quad 0.2 \quad 0.3 \quad 0.3) \quad (5)$$

$$A_4 = (0.3 \quad 0.3 \quad 0.2 \quad 0.2) \quad (6)$$

The second step is fuzzy inference, and the process of calculation can be described as follows: the first level indicators are calculated through the fuzzy compound calculation:

$$B_1 = A_1 \circ R_1 = (0.3 \quad 0.3 \quad 0.2 \quad 0.2) \circ \begin{bmatrix} 0.5 & 0.3 & 0.1 & 0.1 \\ 0.6 & 0.2 & 0.1 & 0.1 \\ 0.4 & 0.3 & 0.1 & 0.2 \\ 0.6 & 0.2 & 0.1 & 0.1 \end{bmatrix} \quad (7)$$

$$= (0.3 \quad 0.3 \quad 0.1 \quad 0.2)$$

The similar calculation can be carried out, and then we get the other three first level indicators results:

$$B_2 = A_2 \circ R_2 = (0.3 \quad 0.2 \quad 0.3 \quad 0.2) \quad (8)$$

$$B_3 = A_3 \circ R_3 = (0.3 \quad 0.1 \quad 0.3 \quad 0.2) \quad (9)$$

$$B_4 = A_4 \circ R_4 = (0.3 \quad 0.2 \quad 0.2 \quad 0.2) \quad (10)$$

So we can get the four first level indicators as shown from Figure 4 to Figure 7, which mean the teaching quality in the four various aspects.

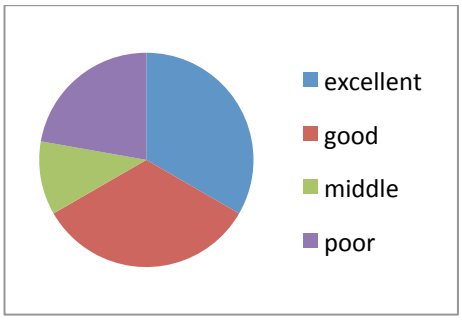

Fig. 4. the evaluation of the "instruction skills"

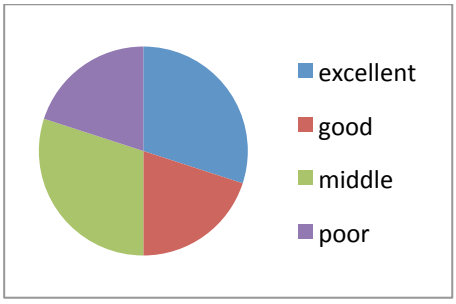

Fig. 5. the evaluation of the "Language skills"

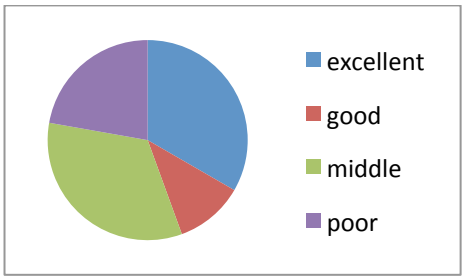

Fig. 6. the evaluation of the "Presentation skills"

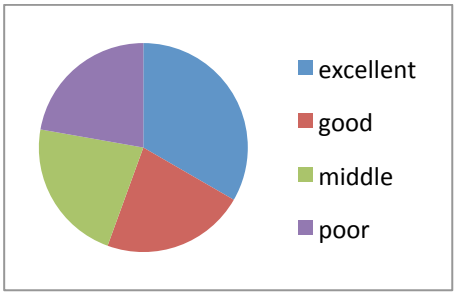

Fig. 7. the evaluation of the "organization skills"

The last step is defuzzification and this is implemented according to the four first level indicators results. The global evaluation matrix is determined according to the four first level indicators:

$$R = \begin{bmatrix} 0.3 & 0.3 & 0.1 & 0.2 \\ 0.3 & 0.2 & 0.3 & 0.2 \\ 0.3 & 0.1 & 0.3 & 0.2 \\ 0.3 & 0.2 & 0.2 & 0.2 \end{bmatrix} \tag{11}$$

Because the first level weight array is:

$$\mathrm{A} = (0.3 \quad 0.2 \quad 0.2 \quad 0.3) \tag{12}$$

And the global evaluation can be implemented:

$$B = \mathrm{A}^{\circ}\mathrm{R} = (0.3 \quad 0.2 \quad 0.2 \quad 0.3)^{\circ} \begin{bmatrix} 0.3 & 0.3 & 0.1 & 0.2 \\ 0.3 & 0.2 & 0.3 & 0.2 \\ 0.3 & 0.1 & 0.3 & 0.2 \\ 0.3 & 0.2 & 0.2 & 0.2 \end{bmatrix} \tag{13}$$

$$= (0.3 \quad 0.3 \quad 0.2 \quad 0.2)$$

According to the final results, we draw a figure to describe the result as shown in Figure 8; apparently we can get a conclusion that the global evaluation is: the "excellent" possibility is 30%, the "good" possibility is 30%, and the possibility of "middle" and "poor" are both 20%. The result is convenient for students to choose the appropriate teaching resource on the MOOC platform.

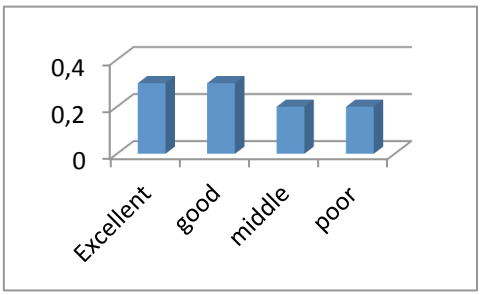

Fig. 8. the global assessment of teaching quality

The Figure 8 shows the evaluation of the teaching quality clearly, so it will provide great help for students to select appropriate resource to learn.

5 Conclusion

The education mode based on MOOC platform has been more and more important as the increasing development of the Internet, so students can obtain more superior

resources and this improves their learning efficiency greatly. Meanwhile, it is difficult for students to make the appropriate selection facing massive teaching videos, so an excellent evaluation method of teaching videos is important for the students' learning efficacy. The article proposed an intelligent evaluation method targeted to identify teachers' different skills in education process based on fuzzy logic. The greatest advantages of this method is to handle uncertain information, which is more like human decision making approach, so it can help students to make an excellent decision from the information full of vagueness, uncertainty, and subjectivity. It will be more significant for the future education as the popularization of students' learning mode based on MOOC platform.

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