Evaluation method for network multimedia teaching quality of English based on information entropy

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Abstract

INTRODUCTION: Evaluation method of network multimedia English teaching quality is studied based on information entropy.

OBJECTIVES: A effective method is proposed to monitor and manage network multimedia teaching of English, which can improve the level of English teaching.

METHODS: Attribute reduction of conditional information entropy is used to obtain the key evaluation indexes by removing the redundant evaluation indexe, and the evaluation model is constructed to evaluate the quality of network multimedia teaching of English.

RESULTS: The results show that in English multimedia classroom teaching, the key knowledge points are explained thoroughly, the ability to analyze and solve practical problems and the ability of innovative thinking have the highest weight, and have the greatest impact on the quality of English network multimedia teaching. In the future network multimedia English teaching, K1, K2 and K3 teachers should properly improve the quality of their network multimedia English courseware; K4, K5 and K6 teachers should pay attention to improving the teaching effect of Multimedia English classroom.

CONCLUSION: This method effectively evaluates the quality of English multimedia classroom teaching, can help teachers improve the quality of education, provide development suggestions for teachers, and provide a scientific basis for improving the level of English Teaching in Colleges and universities.

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1. Introduction

With the rapid development of information technology and the continuous expansion of its application field, information technology has entered the field of higher education. The application and popularization of network multimedia teaching, one of the manifestations of educational informatization, has been continuously improved in teaching links [1]. According to the requirements of relevant documents of the Ministry of Education, the proportion of required courses taught by network multimedia in colleges and universities under national key construction (ie. the "211 Project") shall not be less than 30%, and that in general colleges and universities shall be 15%. In response to this situation, colleges and universities across the country regard network multimedia teaching as an important aspect of teaching reform. The use of network multimedia teaching has become an important means of teaching in colleges and universities, especially the use of network multimedia in English teaching [2]. With the continuous popularization of network multimedia teaching of English methods, the views of scholars and college teachers on the practical application methods of network multimedia teaching of English have changed from blind optimism to rational thinking [3]. While fully affirming the role and achievements of network multimedia teaching of English in realizing the optimization of English teaching process,

the discussion on the negative and negative effects and improvement measures in the application of network multimedia teaching of English has become one of the hot issues concerned by scholars [4]. However, it is still common in colleges and universities to pay attention to the use of curriculum multimedia and ignore network multimedia teaching of English. The problem of lack of monitoring and effective management process of network multimedia teaching of English and effect has become very prominent. Therefore, it is necessary to adopt appropriate methods to evaluate the teaching quality according to the characteristics of network multimedia teaching of English, so as to lay a foundation for real-time monitoring and managing the process and effect of this teaching method [5].

The teaching quality evaluation index system based on Delphi method and analytic hierarchy process proposed by Cai et al. is to calculate the positive coefficient and Kendall harmony coefficient of relevant experts, combined with analytic hierarchy process to determine the weight of each index in the index system, so as to realize the evaluation of teaching quality and teaching quality. However, some indicators in this method have little impact on the evaluation results [6]; The education quality evaluation method based on interval valued fuzzy rough set proposed by Xu et al. Adopts the attribute reduction method of interval valued fuzzy rough set. In this method, the attribute importance is taken as the important heuristic information of attribute reduction, the indexes with insufficient importance are eliminated, and the reduced graduate education quality evaluation index system is obtained. On this basis, the weight of the evaluation index system is determined, and the comprehensive evaluation method of education quality to realize education quality evaluation is given. However, the importance of evaluation indicators in this method is different, which affects the final evaluation results [7]; The construction method of pre service teachers' technical pedagogical knowledge evaluation test proposed by Baier et al. mainly evaluates and tests teachers' pedagogical knowledge, constructs teachers' pedagogical knowledge evaluation system, and evaluates and tests teachers' pedagogical knowledge level, but too many redundant indicators have a certain impact on the evaluation results [8]; The construction method of the evaluation index system of ecological civilization education in Colleges and universities proposed by Ren et al. Mainly constructs the evaluation system by selecting relevant evaluation indexes to realize the evaluation of the level of ecological civilization education in Colleges and universities. However, this method has a large amount of calculation for the evaluation of teaching quality and increases the calculation time [9].

The evaluation of teachers' English network multimedia teaching quality is the value judgment of teaching results and teaching process [10]. Because the factors provided by colleges and universities to evaluate the quality of teachers' Network Multimedia English teaching are different, once too many evaluation factors

are given, it is easy to increase the workload of teachers' Network Multimedia English teaching quality evaluation. Reducing the evaluation cost by reducing the data collection of some redundant influencing factors will undoubtedly help to establish a scientific evaluation system [11]. Rough set theory mainly studies incomplete and uncertain data. On the premise of maintaining the classification ability of information system, a better sub attribute set of information system attribute set is obtained through reduction [12]. The conditional information entropy attribute reduction algorithm combines the method of information theory, defines entropy and conditional entropy, and reduces the conditional attribute set inspired by the value of conditional information entropy. Through this algorithm, the effective reduction of English network multimedia teaching quality evaluation indexes is realized, the redundant indexes are removed, and the reduced key evaluation indexes are obtained. It greatly reduces the workload of evaluation and improves the scientificity of evaluation [13].

Based on the above analysis, this paper proposes an English network multimedia teaching quality evaluation method based on information entropy. The attribute reduction method of conditional information entropy is used to process the evaluation indexes of English network multimedia teaching quality. After simplification, the key evaluation indexes are obtained, and the evaluation model of English network multimedia teaching quality is constructed to evaluate the network multimedia English teaching quality of different teachers. This method reduces the redundant indicators, obtains the reduced key evaluation indicators, reduces a certain amount of evaluation calculation, provides a basis for colleges and universities to accurately analyze the English network multimedia teaching quality of different teachers, and is convenient for colleges and universities to improve the overall level of English network multimedia teaching.

2. Evaluation method for network multimedia teaching quality of English

2.1 Selection of basic evaluation indexes

Considering the teaching characteristics of network multimedia English course, through many discussions with students, teachers and relevant managers, 29 basic evaluation indexes of network multimedia teaching quality of English are finally selected, as shown in Table 1.

Among the above selected basic evaluation indexes of network multimedia teaching quality of English, the importance of each indicator is different. Some indexes have little impact on the evaluation results and can be regarded as redundant indexes. These redundant evaluation indexes increase the evaluation workload of network multimedia teaching quality of English. In order to effectively solve this problem, on the premise of not

affecting the evaluation results of network multimedia teaching quality of English, according to the importance of each evaluation index to the evaluation results, a group of evaluation index combinations with greater importance to the evaluation results should be selected, so as to simplify the evaluation system for network multimedia teaching quality of English and reduce the amount of calculation of the whole network multimedia teaching quality evaluation of English, saving time and space [14]. Here, by using the concept of conditional information

entropy and introducing a new attribute reduction method, the evaluation indexes in the network multimedia teaching quality evaluation of English are reduced [15], some redundant evaluation indexes are removed, the overall evaluation process of network multimedia teaching quality of English is simplified, the evaluation workload is reduced, and then the management of network multimedia teaching of English is simplified. The specific process is as follows.

Table 1. Basic evaluation indexes of network multimedia teaching quality of English

Level indexes(A)	The secondary indexes(B)	Level 3 indexes(C)
Multimedia English classroom teaching effect(A1)	Ability training(B1)	Innovative thinking ability(C11) Ability to analyze and solve practical problems(C12)
	Knowledge(B2)	Supplementary learning materials and the expansion of knowledge(C21) The cultivation of interest in learning(C22) Practice in time and in various ways(C23) Knowledge teaching satisfies the internal logic of the course(C24) The key points are explained thoroughly(C25)
Multimedia English classroom teaching process(A2)	Equipment usage(B3)	The learning environment of multimedia English classroom(C31) Teaching operation proficiency(C32) Audio and video playback clarity and fluency(C33) Clarity of teaching equipment(C34)
	Classroom teaching control(B4)	The classroom atmosphere(C41) Ability to deal with special situations in class(C42) Teaching rhythm control(C43) Student interaction(C44) Student and teacher interaction(C45) Update of courseware(C46) No innovation according to courseware(C47)
	The technical requirements(B5)	Easy to operate, accurate link(C51) Reasonable combination of sound, video, animation and text(C52)
The creation quality of multimedia English courseware itself(A3)	Art requires(B6)	Video and audio are clear(C61) Moderate writing, easy to record(C62) The page is clear and well laid out(C63)
	Teaching requirements(B7)	Combine with actual cases(C71) Explain thoroughly(C72) Clear priorities, simple and proper(C73) The teaching content is rich and informative(C74) Reflect the characteristics of professional courses(C75) Consistent with the teaching objectives and contents of professional courses(C76)

2.2 Redundancy evaluation index reduction based on conditional information entropy attribute reduction

By introducing a conditional information entropy attribute reduction method, the redundancy reduction is implemented for the evaluation indexes of network multimedia teaching quality of English, and some redundant evaluation indexes are removed through the attribute importance value, so as to reduce the subjective impact of the weight distribution of the evaluation indexes and ensure the objectivity and rationality of the evaluation

results [16]. Let an information system be represented by four tuples $S = (U, A = C \bigcup D, V, f)$, where $U = \{x_1, x_2, ..., x_k\}$ is the universe; A represents attribute set, including conditional attribute set C and decision attribute set D; $V = \bigcup_{a \in A} V_a$, where V_a is the value range of attribute a; $f : U \times C \bigcup D \to V$. Any attribute set on U can be regarded as a random variable on U.

Definition 1. The partition of attribute set P and attribute set Q on U is expressed as $X = \{X_1, X_2, ..., X_n\}$ and $Y = \{Y_1, Y_2, ..., Y_m\}$

respectively. The partition of P and Q on U, and the subset probability distribution is expressed as:

$$\begin{cases} [X:p] = \begin{bmatrix} X_1 & X_2 & \cdots & X_n \\ p(X_1) & p(X_2) & \cdots & p(X_n) \end{bmatrix} \\ [Y:p] = \begin{bmatrix} Y_1 & Y_2 & \cdots & Y_m \\ p(Y_1) & p(Y_2) & \cdots & p(Y_m) \end{bmatrix} \end{cases} \quad (1)$$

Where
$$p(X_i) = \frac{|X_i|}{|U|} \, i = 1,2,...,n \quad ;$$

$$p(Y_j) = \frac{|Y_j|}{|U|} \, j = 1,2,...,m$$
.

Definition 2: the entropy $H(P)$ of attribute set P is defined as:

$$H(P) = -\sum_{i=1}^{n} p(X_i) \log(p(X_i)) \quad (2)$$

Definition 3: the conditional information entropy $H(Q|P)$ of attribute set Q relative to attribute set P is defined as:

$$H(Q|P) = -\sum_{i=1}^{n} p(X_i) \sum_{j=1}^{m} p(Y_j|X_i) \log(p(Y_j|X_i)) \quad (3)$$

$$P(Y_j|X_i) = \frac{|Y_j \cap X_i|}{|X_i|}, \, i = 1,2,\cdots,n,$$
Where
$j = 1,2,...,m$
.

Definition 4: if $R \subseteq C$, the attribute importance $SGF(a,R,D)$ of any attribute a in R relative to decision attribute D is defined as:

$$SGF(a,R,D) = H(D|R-\{a\}) - H(D|R) \quad (4)$$

The value of attribute importance $SGF(a,R,D)$ is directly related to the importance of attribute a to decision attribute D. the larger the value is, the more important element a is to D in R. $SGF(a,R,D)$ can be used as heuristic information to find better or suboptimal reduction, so as to reduce spatial complexity.

The conditional information entropy attribute reduction method is applied to the evaluation index reduction in this paper. Taking the conditional information entropy as the heuristic information, the basic evaluation indexes in the previous section are reduced and a new evaluation index system is established, which belongs to a heuristic attribute reduction algorithm [17]. The index reduction process of the algorithm is as follows:

(1) Input: the known basic evaluation system of network multimedia teaching quality of English, recorded as $S = (U, A = C \cup D, V, f)$; Record R as the reduction result of the evaluation index, and initialize $R = C$;

(2) s1: calculate the value of C positive field $POS_C D$ of D in S and the value of conditional entropy $H(D|a)$ of D with respect to any evaluation index a;

(3) s2: for any evaluation index a in R, calculate the importance $SGF(a,R,D)$ of a to decision attribute D;

(4) s3: sort the evaluation index a_i according to the value of $SGF(a,R,D)$ from small to large. If the value of $SGF(a,R,D)$ is the same, sort a_i according to the value of $H(D|a_i)$ from large to small;

(5) s4: compare $POS_{R-\{a_i\}}D$ and $POS_C D$ according to the evaluation index set $\{a_i\}$ arranged in s3. If they are equal, the evaluation index a_i is redundant, $R = R - \{a_i\}$, the cycle ends and goes to s2; If all elements in $\{a_i\}$ do not satisfy $POS_{R-\{a_i\}}D = POS_C D$, the algorithm ends;

(6) Output: a better evaluation index reduction result R of the original basic evaluation system for network multimedia teaching quality of English.

Through the above reduction process, the basic evaluation indexes in Table 1 are reduced to obtain the reduced evaluation indexes for network multimedia teaching quality of English, as shown in Table 2.

Table 2. Evaluation indexes after attribute reduction of conditional information entropy

Level indexes(A)	The secondary indexes(B)	Level 3 indexes(C)
Multimedia English classroom teaching effect(A1)	Ability training(B1)	Innovative thinking ability(C11)
		Ability to analyze and solve practical problems(C12)
	Knowledge(B2)	Supplementary learning materials and the expansion of knowledge(C21)
		Practice in time and in various ways(C23)

Multimedia English classroom teaching process(A2)	Classroom teaching control(B4)	The key points are explained thoroughly(C25)
		Ability to deal with special situations in class(C42)
		Student interaction(C44)
		Student and teacher interaction(C45)
		Update of courseware(C46)
	The technical requirements(B5)	Easy to operate, accurate link(C51)
		Reasonable combination of sound, video, animation and text(C52)
The creation quality of multimedia English courseware itself(A3)		Combine with actual cases(C71)
	Teaching requirements(B7)	Clear priorities, simple and proper(C73)
		The teaching content is rich and informative(C74)
		Reflect the characteristics of professional courses(C75)

2.3 Construction of teaching quality evaluation model based on reduced evaluation index

Suppose that the school is going to evaluate the teaching quality of m teachers participating in network multimedia teaching of English, in which the main body participating in the evaluation is students. Based on the above reduced 15 evaluation indexes, an evaluation model for network multimedia teaching quality of English is established, and

the established model is used to solve the problem of dynamic distribution of multi-level evaluation index weight, so as to realize the teacher's evaluation of network multimedia teaching quality of English [18]. The establishment process of the evaluation model is as follows:

(1) Teacher's individual evaluation vector R'. Taking a teacher of network multimedia English as an example, the school collects the evaluation forms of 15 teaching quality evaluation indexes from the students in the class taught by the English teacher through the network, as shown in Table 3.

Table 3. Network multimedia English teaching student evaluation questionnaire

Evaluate indexes and factor sets		Assessment language and assessment set				
		Very good e1	Good e2	General e3	Bad e4	Very bad e5
Innovative thinking ability	c1	b11	…	…	…	…
Ability to analyze and solve practical problems	c2	…	b22	…	…	…
Supplementary learning materials and the expansion of knowledge	c3	…	b33	…	…	…
Practice in time and in various ways	c4	…	…	b44	…	…
The key points are explained thoroughly	c5	…	…	…	…	…
Ability to deal with special situations in class	c6	…	…	…	…	…
Student interaction	c7	…	…	…	…	…
Student and teacher interaction	c8	…	…	…	…	…
Update of courseware	c9	…	…	…	…	…
Easy to operate, accurate link	c10	…	…	…	…	…
Reasonable combination of sound, video, animation and text	c11	…	…	…	…	…
Combine with actual cases	c12	…	…	…	…	…
Clear priorities, simple and proper	c13	…	…	…	…	…
The teaching content is rich and informative	c14	…	…	…	…	…
Reflect the characteristics of professional courses	c15	…	…	…	…	b55

After collecting and summarizing the teacher's evaluation questionnaires from all students, the teacher's evaluation matrix is as follows:

$$B = \begin{bmatrix} b_{11} & b_{12} & \cdots & b_{15} \\ b_{21} & b_{22} & \cdots & b_{25} \\ \cdots & \cdots & \cdots & \cdots \\ b_{151} & b_{152} & \cdots & b_{155} \end{bmatrix}$$

(5)

Where, b_{ij} represents the evaluation value (i.e. the number of votes) of n students on the evaluation index i in evaluation set j of the teacher. Here, the evaluation set matrix {very good, good, general, bad, very bad} is

defined. The corresponding quantization matrix is $G = \{5, 4, 3, 2, 1\}$, then the teacher's evaluation vector is $R' = \{r_i'\}$, where $i \in [1,15]$, and has:

$$r_i' = \frac{1}{n} \sum_{j=1}^{5} gj \times b_{ij}$$

(6)

(2) Evaluation matrix E. By calculating the individual evaluation vectors of m English teachers, the evaluation indexes and evaluation objects are composed of m individual evaluation vectors. Table 4 shows the details.

The evaluation matrix obtained from Table 4 is:

$$E = \begin{bmatrix} e_{11} & e_{12} & \cdots & e_{115} \\ e_{21} & e_{22} & \cdots & e_{215} \\ \cdots & \cdots & \cdots & \cdots \\ e_{m1} & e_{m2} & \cdots & e_{m15} \end{bmatrix}$$

(7)

Where, e_{ij} represents the j-th evaluation index for the i-th teacher, that is, the value of r_j'. After standardizing this matrix, we can get:

$$E' = \left(e_{ij}'\right)_{m \times 15}$$

(8)

Under the above assignment rules, the evaluation index can be regarded as a benefit index, so it can make:

$$e_{ij}' = \left(e_{ij} - \min_i\{e_{ij}\}\right) / \left(\max_i\{e_{ij}\} - \min_i\{e_{ij}\}\right)$$

(9)

Table 4. Evaluation indexes and evaluation objects

Evaluation object	k1	k2	…	km
c1	e11	e21	…	em1
c2	e12	e22	…	em2
c3	…	…	…	…
c4	…	…	…	…
c5	…	…	…	…
c6	…	…	…	…
c7	…	…	…	…
c8	…	…	…	…
c9	…	…	…	…
c10	…	…	…	…
c11	…	…	…	…
c12	…	…	…	…
c13	…	…	…	…
c14	…	…	…	…
c15	e115	e215	…	em15

(The leftmost column also carries the label "Evaluation indexes" spanning the c1–c15 rows.)

(3) Determine the weight W of each evaluation index. When evaluating teachers' network multimedia teaching quality of English, we should not only pay attention to the importance of the evaluation index itself, but also pay attention to whether the evaluation index can effectively reflect the differences between different teachers [19]. For an evaluation index, the greater the difference of evaluation index values among participating teachers is, the greater its role in comprehensive evaluation is; If the evaluation index values are all equal, the evaluation index does not work in the comprehensive evaluation and does not provide any useful information. In information theory, information entropy is a measure of system disorder. The greater the index value variation of an evaluation index is, the smaller the information entropy is, the greater the amount of information provided by the evaluation index is, and the greater the weight of the evaluation index is; On the contrary, the weight of the evaluation index is smaller [20]. Next, we will calculate the entropy weight of each evaluation index by using the concept of entropy weight according to the variation degree of index value of each evaluation index.

The entropy of the j-th evaluation index is defined as:

$$H_i' = \sum_{i=1}^{15} -q_{ij} \ln\left(q_{ij}\right)$$

(10)

$$q_{ij} = e_{ij}' / \sum_{i=1}^{15} e_{ij}'$$

Where, .

The entropy weight of the j-th evaluation index is defined as:

$$W_i = \left(1 - H_j'\right) / \sum_{i=1}^{15}\left(1 - H_j'\right)$$

(11)

(4) Comprehensive evaluation index L. The distance between the evaluation value obtained by the standardization of the evaluation matrix and the ideal point is used to sort the network multimedia English teachers in real time, and the evaluation result queue is determined according to the distance, that is, the shorter the distance is, the better the results are, and the longer the distance is, the worse the results are. If $Q' = (1, 1, ..., 1)$ is taken as the ideal point here, the distance between teacher i and the ideal point can be defined as:

$$L_i = \sqrt{\sum_{j=1}^{15} W_j^2 \left(1 - q_{ij}\right)^2}$$

(12)

When queuing the results, if two or more distance values are equal, the results can be sorted according to the importance of the evaluation index.

3. Analysis of experimental results

3.1 Experimental setup

In order to test the practical applicability of the proposed method, six English teachers who have been teaching for 10 years or more are randomly selected from a university as the experimental objects. The proposed method is used to evaluate the network multimedia teaching quality of English of the selected teachers from 2010 to 2019, and analyze the changes of teaching quality of each teacher in 10 years. Through the analysis on the evaluation results of teaching quality, the practical application effect of the method in this paper is tested. The selected six network multimedia English teachers are numbered K1 ~ K6, including two male teachers and four female teachers, aged from 38 to 47.

3.2 Analysis of students' teaching evaluation results

Firstly, taking 2019 as an example, this paper uses the proposed method to evaluate the network multimedia

teaching quality of English of six teachers in 2019. The specific evaluation process and results are as follows.

600 students who have participated in 6 teachers' network multimedia English teaching are randomly selected from different grades of the experimental university as the main body of teaching evaluation. After the 6 teachers are evaluated through the network, the statistical results of students' teaching evaluation are shown in Table 5.

Table 5. Statistical table of students' teaching evaluation results

Teacher's number	Evaluation indexes	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12	c13	c14	c15
k1	e1	255	278	359	224	328	428	270	248	408	349	275	280	288	234	369
	e2	296	247	188	311	176	137	285	283	157	198	276	275	257	301	188
	e3	33	55	33	50	76	20	27	48	21	30	23	28	35	45	24
	e4	14	17	18	13	18	13	15	19	14	22	24	17	18	19	16
	e5	2	3	2	2	2	2	3	2	0	1	2	0	2	1	3
k2	e1	245	269	252	280	365	321	266	222	237	281	315	289	306	269	248
	e2	293	252	291	284	149	244	284	294	286	249	246	258	252	261	282
	e3	44	58	36	21	63	20	30	59	55	48	29	30	28	52	50
	e4	16	18	19	13	20	13	16	21	21	22	9	20	10	16	20
	e5	2	3	2	2	3	2	4	4	1	0	1	3	4	2	0
k3	e1	225	133	351	275	365	413	240	220	255	403	385	295	341	230	153
	e2	294	352	185	288	149	152	284	281	269	162	139	268	195	291	332
	e3	62	96	39	22	58	20	55	68	45	22	48	25	31	48	76
	e4	17	16	23	13	24	13	16	24	28	10	26	11	33	31	35
	e5	2	3	2	2	4	2	5	7	3	3	2	1	0	0	4
k4	e1	175	143	351	269	352	391	246	215	235	266	371	362	279	371	163
	e2	344	354	181	294	149	174	284	275	265	264	184	139	284	171	334
	e3	62	81	41	22	68	20	49	72	62	40	30	58	20	31	71
	e4	17	18	23	13	27	13	15	29	38	25	9	38	17	24	27
	e5	2	4	4	2	4	2	6	9	0	5	6	3	0	3	5
k5	e1	326	278	331	418	230	247	168	260	333	345	378	352	298	341	214
	e2	223	199	206	147	270	282	329	299	229	169	176	153	286	181	275
	e3	23	100	45	22	60	45	70	26	25	66	29	60	5	42	69
	e4	18	8	9	13	40	25	28	13	6	17	11	31	2	23	32
	e5	10	15	9	0	0	1	5	2	7	3	6	4	9	13	10
k6	e1	266	225	285	341	336	298	256	279	316	185	288	366	343	258	327
	e2	264	265	243	196	213	276	247	261	217	316	189	152	219	306	241
	e3	40	62	33	52	28	11	55	38	43	76	101	38	23	22	18
	e4	25	40	39	9	13	6	35	18	18	23	11	39	8	9	12
	e5	5	8	0	2	10	9	7	4	6	0	11	5	7	5	2

Through this method, the standardized evaluation matrix is obtained by using the data in Table 5, and the entropy and weight of each evaluation index are obtained, as shown in Table 6.

From table 6, we can see that the weights of c5, c2 and c1 are relatively high, indicating that the three aspects of thorough explanation of key knowledge points, ability to analyze and solve practical problems and ability of innovative thinking have a higher impact on the quality of network multimedia teaching of English; Secondly, there are three evaluation indexes: c3, c4 and c12, namely, the supplement of auxiliary learning materials and the expansion of knowledge, the timeliness and diversity of practice methods, and the combination of actual cases; the weights of c10, c11, c13, c15 and c9 are relatively the lowest, all lower than 0.05, indicating that the five aspects of convenient operation and accurate link, reasonable combination of sound, image, animation and text, clear primary and secondary, appropriate complexity and simplicity, reflecting the characteristics of professional courses and courseware update have relatively little impact on the quality of network multimedia teaching of English.

Table 6. Entropy and weight calculation results of each evaluation index

Evaluation indexes	Entropy(H_i)	The weight(W_i)
c1	0.796	0.095
c2	0.778	0.101
c3	0.826	0.085
c4	0.835	0.082
c5	0.766	0.105
c6	0.883	0.066
c7	0.904	0.059
c8	0.892	0.063
c9	0.940	0.047
c10	0.988	0.031
c11	0.973	0.036
c12	0.862	0.073
c13	0.955	0.042

| c14 | 0.877 | 0.068 |
| c15 | 0.940 | 0.047 |

From the above, in order to improve the quality of teachers' network multimedia teaching of English, we need to focus on improving teachers' ability to explain key knowledge points thoroughly, analyze and solve practical problems and innovative thinking, so as to further improve the English teaching level of colleges and universities.

3.3 Comprehensive distance value of teachers from 2010 to 2019

According to the above results, the comprehensive distance value from each index vector of 6 teachers to the ideal point, i.e. the value of L1 to L6, is obtained through the proposed method, as shown in Figure 1.
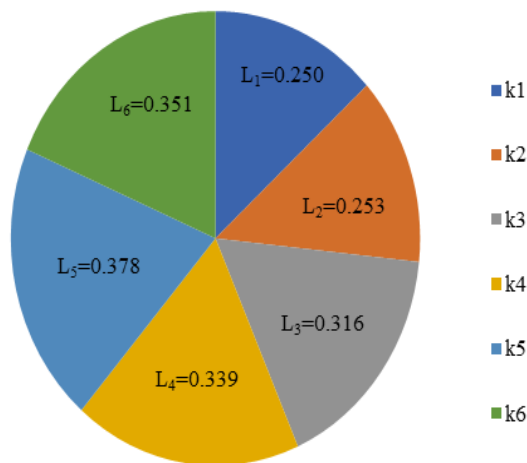
Figure 1. The comprehensive value of the distance between the index vector of 6 teachers and the ideal point

It can be seen from Figure 1 that the comprehensive value of the distance between each index vector and the ideal point of the six teachers is L5-L6-L4-L3-L2-L1 from high to low. It can be seen that the comprehensive value of the distance between each index vector of teacher k5 and the ideal point is the highest, followed by teachers k6, k4, k3 and k2, and the teacher with the lowest comprehensive value of distance is k1, indicating that the final comprehensive evaluation result of teacher k1 is the best. The teacher's network multimedia teaching quality of English is the highest, followed by teachers k2, k3, k4 and k6. Relatively speaking, the teacher k5 has the lowest network multimedia teaching quality of English.

In order to further test the evaluation effect of the proposed method, the network multimedia English teaching quality of the selected 6 teachers from 2010 to

2018 is evaluated according to the above process, and the changes of network multimedia English teaching quality of each teacher in 10 years are comprehensively analyzed according to the evaluation results obtained by the proposed method. The comprehensive statistical results of the distance between the evaluation index vector for network multimedia teaching quality of English and the ideal point of 6 teachers from 2010 to 2019 are shown in Figure 2.
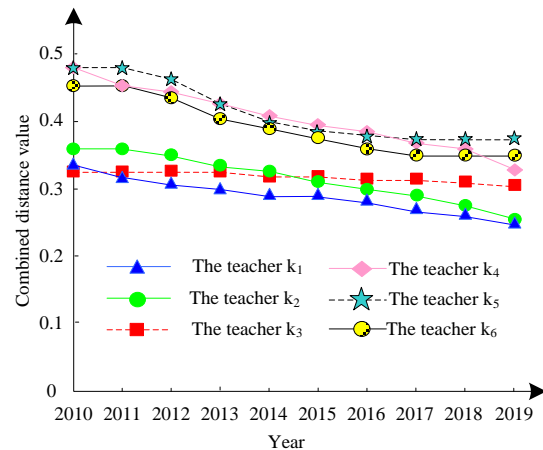
Figure 2. Change of comprehensive distance values of teachers from 2010 to 2019

It can be seen from Figure 2 that the comprehensive value of the distance between the evaluation index vector and the ideal point of teacher k3 in the 10 years from 2010 to 2019 has no obvious change and is almost flat; The comprehensive value of the distance between the evaluation index vector and the ideal point of teachers k1 and k2 in the past 10 years shows a slow decreasing trend, and the overall change is between 0.8 and 1.2; the comprehensive value of the distance between the evaluation index vector and the ideal point of teachers k4 in the past 10 years shows a continuous downward trend, and the decline range is large. Compared with 2010, the comprehensive value of the distance in 2019 is decreased by 1.66; The comprehensive value of the distance between the evaluation index vector of teachers k5 and k6 and the ideal point shows a significant downward trend from 2011 to 2017, and there is no change in other years. It can be seen that there is no significant change in the quality of network multimedia English teaching for teachers k3 from 2010 to 2019, the quality of network multimedia English teaching for teachers k1 and k2 continues to improve, the quality of network multimedia English teaching for teachers k4 is the most significant, and the quality of network multimedia English teaching for teachers k5 and k6 shows no sign of improvement from 2010 to 2011. It has been significantly improved from 2011 to 2017, and the teaching quality in 2017 has

been maintained from 2017 to 2019, with no signs of improvement.

## 3.4 Key factors affecting teachers' Network Multimedia English teaching quality

In order to analyze the key factors affecting the quality of teachers' network multimedia teaching of English, this paper evaluates and analyzes teachers from three aspects: teaching effect of multimedia English class, teaching process of multimedia English class and courseware creation quality of multimedia English class. Among them, the teaching effect of multimedia English class includes $c_1 \sim c_5$ indexes. The teaching process of multimedia English class includes $c_6 \sim c_9$ indexes, and the courseware creation quality of multimedia English class includes $c_{10} \sim c_{15}$ indexes. The evaluation results are shown in Figure 3.
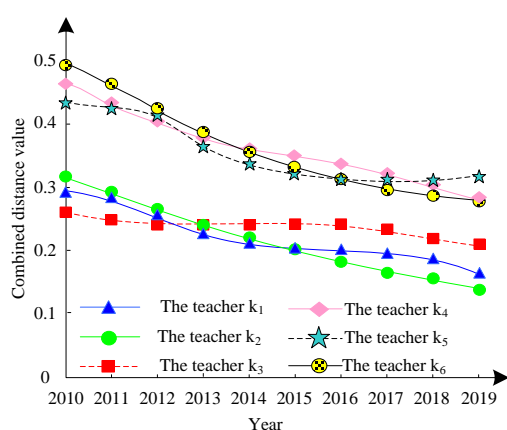
(a)Results and trends of multimedia English classroom teaching effectiveness evaluation
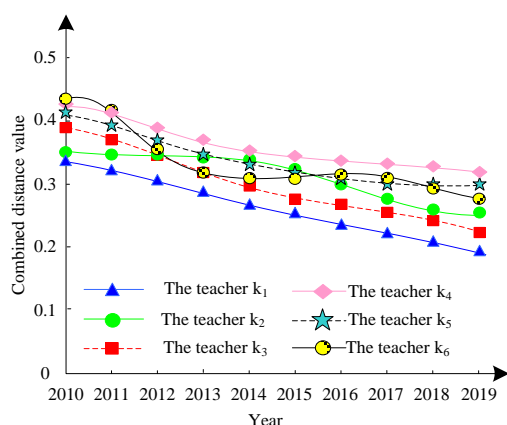
(b)Results and trends of multimedia English classroom teaching process assessment
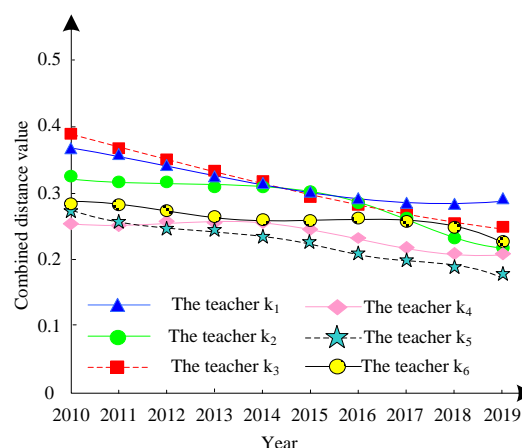
(c)Evaluation results and trends of multimedia English courseware creation quality

Figure 3. Evaluation results and trends of teachers in three aspects

As can be seen from Figure 3, in terms of teaching effect of multimedia English class, the index comprehensive distance values of six teachers show a gradual downward trend, in which the downward trend of teacher k3 is not obvious, teachers k1, k2 and k3 perform better in this aspect, while teachers k4, k5 and k6 perform poorly; in terms of the teaching process of multimedia English class, the comprehensive distance values of the six teachers also show a downward trend, and the overall distance values are close; In terms of the courseware creation quality of multimedia English, the comprehensive index values of teachers k2, k4 and k6 have a slight upward trend, while the comprehensive index values of other teachers still show a downward trend, and in this regard, teachers k4, k5 and k6 are slightly better than teachers k1, k2 and k3. According to the comprehensive analysis, teachers k4, k5 and k6 perform slightly worse in the teaching effect of multimedia English class, so this aspect is the key factor affecting the quality of the three teachers' network multimedia teaching of English, and the weight of the indexes contained in this aspect is relatively high. Therefore, in the future network multimedia teaching of English, teachers k4, k5 and k6, should focus on improving the ability in this aspect; Teachers k1, k2 and k3 are slightly poor in the courseware creation quality of mltimedia English, so this is the key factor affecting the quality of network multimedia teaching of English of these three teachers. Therefore, in the future network multimedia teaching of English, teachers k1, k2 and k3 should appropriately improve the courseware creation quality of Multimedia English and further improve the overall quality of network multimedia teaching of English.

4. Discussion

This paper studies the online multimedia English teaching quality evaluation method based on information entropy, and applies this method to the teaching quality evaluation of 6 online multimedia English teachers in a university. Through practical application, the following analysis results are obtained:.

(1) The key knowledge points are explained thoroughly, the ability to analyze and solve practical problems and the ability of innovative thinking have the highest weight, which has the greatest impact on the quality of English network multimedia teaching. It is necessary to focus on improving the above three abilities of teachers;

(2) The comprehensive value of the distance between each index vector and the ideal point of the six teachers from high to low is L5 > L6 > L4 > L3 > L2 > L1. Therefore, the final comprehensive evaluation result of K1 teachers' English network multimedia teaching quality is the best. The teacher's English network multimedia teaching quality is the highest;

(3) From 2010 to 2019, the online multimedia English teaching quality of K1 and K2 teachers continued to improve, and there was no significant change in the online multimedia English teaching quality of K3 teachers. Among them, the online multimedia English teaching quality of K4 teachers improved most significantly, while the online multimedia English teaching quality of K5 and K6 teachers showed no sign of improvement from 2010 to 2011;

(4) In the future network multimedia English teaching, K1, K2 and K3 teachers should properly improve the quality of their network multimedia English courseware; K4, K5 and K6 teachers should pay attention to improving the teaching effect of Multimedia English classroom, which is the key factor affecting the quality of network multimedia English Teaching of these six teachers.

5. Conclusion

This paper studies an evaluation method of English network multimedia teaching quality based on information entropy. Using the concept of conditional information entropy, a new attribute reduction method is introduced to reduce the evaluation indexes in Teachers' Network Multimedia English teaching evaluation, and some redundant evaluation indexes are removed. Reducing the subjective influence of the weight distribution of evaluation indicators considered by evaluators not only enhances the objectivity of teachers' online multimedia English teaching quality evaluation, but also does not lose its rationality, simplifies the evaluation process of teachers' online multimedia English teaching quality, reduces the evaluation workload, and then simplifies the teaching management of colleges and universities. This method can evaluate the English network multimedia teaching quality of different teachers

in Colleges and universities, and analyze the impact of each evaluation index on the English network multimedia teaching quality of teachers according to the evaluation results, as well as the change of English teaching quality of teachers' network multimedia teaching level in a certain period of time. Through practical application, it is concluded that the key knowledge points are explained thoroughly, the ability to analyze and solve practical problems and the ability of innovative thinking are important indicators that have a great impact on the quality of English network multimedia teaching; K1, K2 and K3 teachers should properly improve the quality of their network multimedia English courseware; K4, K5 and K6 teachers should pay attention to improving the teaching effect of Multimedia English classroom. It provides a scientific basis for colleges and universities to select network multimedia English teachers and improve English teaching level.

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