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English multimedia teaching system based on Matlab multi-level grey evaluation research

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ABSTRACT

To study and put forward the theory of multilevel grey evaluation model, and through the model of multimedia in English teaching evaluation system as an example to illustrate, in order to establish a multi-level comprehensive evaluation model, and finally the comprehensive evaluation of the results of quantitative, it is concluded that the three weak link of English multimedia teaching system and the system belongs to the category of the general, and proves that the government in this regard has yet to be perfected and developed further, at the same time also proved the validity of this model.

KEYWORDS

Matlab software; Multi-level; Grey evaluation; English multimedia; Teaching system.

INTRODUCTION

Since 2004, ministry of education issued a book “Classroom requirements”, the book became one of main evidences in universities English teaching reformation aspects in future dozens of years, it required English teaching mode to combine with computer multimedia, changed from original teachers’ blackboard single teaching to multiple kinds of plentiful teaching mode centered on multi-media so as to improve universities campus teaching quality.

Regarding multimedia teaching aspect researches, many people have made efforts, such as Chen Bing-Bing and Chen Jian-Lin two people in computer and classroom English multimedia teaching modes, by questionnaire surveying on 33 university English teachers, they found that teachers teaching believes are different from teaching classroom, it should make full use of multimedia teaching mode so as to let the two to form into unification, and trained relative teachers to improve teachers’ education level. Xu Ming in the article of relative network English multimedia teaching system designing and implementation, he put forward on the basis of Web browser network teaching mode, utilizing internet as main contents of media teaching, and it could playback and do on-line answer on courses by network platform, and meanwhile it could make comprehensive evaluation on teachers’ teaching quality.

The paper just carries out a deeper research on the basis of context, implements English multimedia teaching multi-level grey evaluation by applying Matlab software, and finally provides writer’s suggestions, which builds theoretical basis for improving and enhancing English multimedia teaching.

MATLAB IMPLEMENTATION-BASED MULTI-LEVEL GREY EVALUATION METHODS

With social development, multimedia teaching has been widely spread in current society, universities teaching equipment has been upgraded in succession, especially for English multimedia widely application, which let teaching quality to get greatly promotion.

But an objective courseware, after exploiting, it needs macro evaluation then can let teaching quality to be really improved, so the paper applies Matlab implemented English multimedia teaching multi-level grey evaluation.

Model establishment

At first, it should define evaluation matrix, we assume that U is all evaluation set matrix, in order to easy to clear state, we takes two layers as examples to explain, then corresponding specific set is defined as:

$$U = \{U_1, U_2, \cdots, U_m\} \quad (1)$$

Corresponding weight set can be expressed as:

$$A = \{A_1, A_2, \cdots, A_m\} \quad (2)$$

Then corresponding second grade indicators set form can be expressed as:

$$U_i = \{U_{i1}, U_{i2}, \cdots, U_{in}\} \quad (3)$$

Weight can be further expressed as:

$$A_i = \{a_{i1}, a_{i2}, \cdots, a_{in}\} \quad (4)$$

According to specific problems, we can define grey group whitening functions evaluation grade grey group, and we also let e as evaluation type, it is described by whitening functions.

According to evaluators evaluation result, we can provide scores, then corresponding matrix is D:

$$D = \begin{bmatrix} d_{111} & d_{112} & \cdots & d_{11p} \\ d_{121} & d_{122} & \cdots & d_{12p} \\ \cdots & \cdots & \cdots & \cdots \\ d_{in1} & d_{in2} & \cdots & d_{inp} \end{bmatrix} \begin{matrix} U_{11} \\ U_{12} \\ \cdots \\ U_{in} \end{matrix} \quad \textbf{(5)}$$

After that, we can use evaluators grey coefficient, here uses X_{ije} to mark, then it has:

$$X_{ije} = \sum_{i=1}^{p} f_e\left(d_{ij1}\right) \quad \textbf{(6)}$$

Make comprehension of each evaluation results, we can get total evaluation result that is X_{ij}, then it has formula:

$$X_{ij} = \sum_{e=1}^{g}\left(X_{ije}\right) \quad \textbf{(7)}$$

With above evaluation result, we can define grey evaluation weight that:

$$r_{ije} = \frac{X_{ije}}{X_{ij}} \quad \textbf{(8)}$$

To each evaluation indicator, it can define grey evaluation weight vector that:

$$r_{ij} = \left(r_{ij1}, \quad r_{ij2}, \quad \cdots, \quad r_{ijg}\right) \quad \textbf{(9)}$$

Integrate each evaluator grey evaluation weight matrix, it can have:

$$R_i = \begin{bmatrix} r_{i1} \\ r_{i2} \\ \cdots \\ r_{in1} \end{bmatrix} = \begin{bmatrix} r_{i11} & r_{i12} & \cdots & r_{i1g} \\ r_{i21} & r_{i22} & \cdots & r_{i2g} \\ \cdots & \cdots & \cdots & \cdots \\ r_{in1} & r_{in2} & \cdots & r_{ing} \end{bmatrix} \quad \textbf{(10)}$$

Evaluator evaluation result on first grade indicator, we can use B_1 to express, then it has:

$$B_i = A_i \cdot R_i = \left(b_{i1}, b_{i2}, \cdots, b_{ig}\right) \quad \textbf{(11)}$$

For second grade indicator each evaluation grey group evaluation weight matrix, we can let it to be R, then it has:

$$R_i = \begin{bmatrix} r_{i1} \\ r_{i2} \\ \cdots \\ r_{in1} \end{bmatrix} = \begin{bmatrix} r_{i11} & r_{i12} & \cdots & r_{i1g} \\ r_{i21} & r_{i22} & \cdots & r_{i2g} \\ \cdots & \cdots & \cdots & \cdots \\ r_{in1} & r_{in2} & \cdots & r_{ing} \end{bmatrix} \quad \textbf{(12)}$$

Then integrate evaluation result B, we can get:

$$B_i = A_i \cdot R_i = (b_{i1}, b_{i2}, \cdots, b_{ig}) \quad \textbf{(13)}$$

By above process, it can get evaluator comprehensive evaluation results, after do normalization processing of it, then can get grey level values, obtained result by

$$Z = B\square D^T \quad \textbf{(14)}$$

Therefore it can get same type test indicators optimal and worse order evidence.

MODEL APPLICATIONS

By above process comprehensive analyzing, combine with formers correlation researches; we can define each indicator about English multimedia teaching system, as following Table shows:

TABLE 1 : Each indicator system

Target layer	Criterion layer	Indicator layer
English multimedia teaching evaluation system(W)	English teaching system (K_1)	English test system (V_{11})
		English homework submission system (V_{12})
		English non-real time discussion system (V_{13})
		English real time coaching system (V_{14})
		English courseware system (V_{15})
	English management system (K_2)	English performance analysis and feedback (V_{21})
		English on-line learning (V_{22})
		English registering course selection (V_{23})
		English grade testing (V_{24})
		English teachers and students exchange account (V_{25})
	English resource system (K_3)	English forum community (V_{31})
		English chat room (V_{32})
		English E-mail (V_{33})

AHP model is also called analytic hierarchy process method, it has stronger logic and hierarchical structures, and algorithm mainly is calculating indicators weights. It can adapt to comprehensive test system, is a powerful mathematical method that converting problems into quantitative researches. English multimedia teaching system analysis gets involved in multiple reference indicators, the kind of decision-making problem adapts to analytic hierarchical process method.

Construct judgment matrix

For above three kinds of indicators, it makes meticulous comparison of the two's relative importance to construct judgment matrix. Such as :Take K_i, K_j to make important comparison, the structure is using K_{ij} to express, and then all factors after comparing can get judgment matrix W. Its expression is as following:

$$W = \begin{pmatrix} K_{11} & K_{12} & \cdots & K_{1j} \\ K_{21} & K_{22} & \cdots & K_{2j} \\ \vdots & \vdots & \ddots & \vdots \\ K_{i1} & K_{i2} & \cdots & K_{ij} \end{pmatrix} \quad \textbf{(15)}$$

K_{ij} represents indicator i and indicator j relative to target (K) importance degree value, paired judgment matrix is $T = (T_{ij})_{n\times n}$, $T_{ij} = \frac{1}{T_{ji}}; (i \neq j; i, j = 1, 2, 3, \cdots, n)$. Use 1—9 number to describe, number representative meaning is as following TABLE 2 show:

TABLE 2 : 1—9 scale meaning

Scale	Meaning
1	Indicates two factors have equal importance by comparing
3	Indicates the former is slightly more important than the later by comparing two factors
5	Indicates the former is more important than the later by comparing two factors
7	Indicates the former is relatively more important than the later by comparing two factors
9	Indicates the former is extremely more important than the later by comparing two factors
Even number	Represents importance is between two odd numbers
Reciprocal	Represents factors positive and negative comparison order

Weight vector and maximum feature calculation

According to first grade indicator's judgment matrix vector, carry out normalization with it; solve the sum and then make normalization, then it can get weight vector. According to feature value and feature vector relations, it can solve feature value; its implementation method is as following:
Firstly, normalize judgment matrix every column, its result is:

$$K_{ij} = K_{ij} / \sum_{k=1}^{n} K_{kj} (i, j = 1, 2, \cdots, n) \quad \textbf{(16)}$$

Then solve the sum by lines on judgment matrix that makes normalization by column, it can get:

$$\overline{\omega_i} = \sum_{j=1}^{n} K_{ij} (i = 1, 2, \cdots, n) \quad \textbf{(17)}$$

Above vector $\overline{\omega} = \left[\overline{\omega_1}, \overline{\omega_2}, \cdots, \overline{\omega_n} \right]^T$ proceeds with normalization processing:

$$\overline{\omega_i} = \frac{\overline{\omega_i}}{\sum_{j=1}^{n} \overline{\omega_j}} (i = 1, 2, \cdots, n) \quad \textbf{(18)}$$

Then: $\omega = [\omega_1\ ,\ \omega_2\ , \ldots\ ,\ \omega_{\mathrm{n}}]^{\mathrm{T}}$ is solved feature vector.

In addition, calculate maximum feature root, process is:

$$\lambda_{\max} = \sum_{i=1}^{n} \frac{(U\omega)_i}{n\omega_i} \quad \textbf{(19)}$$

In above formula, $(U\omega)_i$ represented is vector of the i component in $(U\omega)$.

According to above formula, we can respectively solve Chinese sports scientific research innovative ability comprehensive evaluation analysis first grade indicator, second grade indicator weight on first grade indicator as well as maximum feature values.

Consistency test

To matrix $U = \left(b_{ij}\right)_{n*n}$, if matrix element meets $b_{ij} b_{jk} = b_{ik}$, then matrix is consistent matrix. Among them, $b_{ij} > 0$, $b_{ij} = 1 / b_{ji}$. In order to use it to calculate factor weight, it requires that matrix inconsistency only under acceptable conditions. When problems are relative complicated, we cannot take all factors into account, which causes paired comparison construct judgment matrix instant, judgment matrix cannot arrive at ideal state consistency.

Judgment matrix consistency indicator CI, and judgment matrix consistency ratio CR, its computational method is as following formula show:

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad \textbf{(20)}$$

Among them, n represent order number of judgment matrix that is also the number of compared factors.

$$CR = \frac{CI}{RI} \quad \textbf{(21)}$$

Among them, RI represents RUndom Consistency Index value, as following TABLE 3show:

TABLE 3: RI value table

n	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51

When $CR \geq 0.1$, it is thought that judgment matrix occurs inconsistency that needs to make adjustment on judgment matrix again. When $CR < 0.1$, judgment matrix inconsistency is within acceptable range.

Single hierarchy judgment matrix conforms to consistency requirements by consistency testing; it can be thought that calculated weight is reasonable. Next step is doing combination consistency testing. Assume in one layer, m pieces of factors weights computational result is α_m, corresponding consistency indicator value respectively is CI_m, combination consistency test consistency ratio is:

$$CR = \frac{\sum_{j=1}^{m} \alpha_j CI_j}{\sum_{j=1}^{m} \alpha_j RI_j} \quad \textbf{(22)}$$

By calculating combination consistency ratio, computational value is:

$$CR < 0.1$$

So hierarchical total arrangement consistency testing meets consistency requirements. It can think that Chinese sports scientific research innovative ability analysis each indicator weight calculation result is reasonable.

By above process, we can respectively get each grade indicator corresponding weights and comprehensive weight, as following TABLE 4 shows:

TABLE 4 : Each indicator weight table

Target layer	Criterion layer	Weight	Indicator layer	Weight
W	K_1	0.58	(V_{11})	0.40
			(V_{12})	0.06
			(V_{13})	0.10
			(V_{14})	0.14
			(V_{15})	0.30
	K_2	0.11	(V_{21})	0.26
			(V_{22})	0.18
			(V_{23})	0.26
			(V_{24})	0.12
			(V_{25})	0.18

		(V_{31})	0.19
K_3	0.31	(V_{32})	0.15
		(V_{33})	0.66

By above table, we can get corresponding evaluation matrix D, that:

$$D=\begin{bmatrix} 4 & 3.5 & 3.5 & 3 & 4 \\ 2 & 3 & 2 & 2.5 & 2 \\ 2.5 & 2 & 2.5 & 3 & 2.5 \\ 3 & 2.5 & 3 & 3 & 3.5 \\ 3.5 & 4 & 3.5 & 3 & 3 \\ 4 & 3 & 3 & 3.5 & 2.5 \\ 3 & 3.5 & 3 & 2.5 & 4 \\ 4 & 3.5 & 3.5 & 3 & 3 \\ 2.5 & 2 & 2.5 & 3 & 2.5 \\ 3 & 2.5 & 3 & 3.5 & 2.5 \\ 2 & 2 & 2.5 & 3 & 2 \\ 2 & 2 & 2 & 2.5 & 2.5 \\ 3 & 2.5 & 3 & 3.5 & 3 \end{bmatrix}$$

By above evaluation grades, we can define four kinds of evaluation grey groups that $e=1,2,3,4$, indicators corresponding grey number and whitening function are as following TABLE 5 shows:

TABLE 5: Grey group function table

$e=1$	$e=2$	$e=3$	$e=4$
$\otimes_1 \in [4\ ,\ \infty)$	$\otimes_2 \in [0,3,6]$	$\otimes_3 \in [0,2,4]$	$\otimes_4 \in [0,1,2]$
$f_1\left(d_{ijk}^{(S)}\right)=$	$f_2\left(d_{ijk}^{(S)}\right)=$	$f_3\left(d_{ijk}^{(S)}\right)=$	$f_4\left(d_{ijk}^{(S)}\right)=$
$\begin{cases} \frac{d_{ijk}^{(S)}}{4} & d_{ijk}^{(S)} \in [0,4] \\ 1 & d_{ijk}^{(S)} \in [4,\infty) \\ 0 & d_{ijk}^{(S)} \notin [0,\infty) \end{cases}$	$\begin{cases} \frac{d_{ijk}^{(S)}}{3} & d_{ijk}^{(S)} \in [0,3] \\ \frac{d_{ijk}^{(S)}-6}{-3} & d_{ijk}^{(S)} \in [3,6] \\ 0 & d_{ijk}^{(S)} \notin [0,6] \end{cases}$	$\begin{cases} \frac{d_{ijk}^{(S)}}{3} & d_{ijk}^{(S)} \in [0,2] \\ \frac{d_{ijk}^{(S)}-4}{-2} & d_{ijk}^{(S)} \in [2,4] \\ 0 & d_{ijk}^{(S)} \notin [0,4] \end{cases}$	$\begin{cases} 1 & d_{ijk}^{(S)} \in [0,1] \\ \frac{d_{ijk}^{(S)}-2}{-1} & d_{ijk}^{(S)} \in [1,2] \\ 0 & d_{ijk}^{(S)} \notin [0,2] \end{cases}$

Grey coefficient defining

By above evaluation indicators each weight size, we can get each evaluation grey group total grey evaluation number, its computational process is as following shows:

e=1 $x_{111}=\sum_{k=1}^{5} f_1(d_{11k})=f_1(4)+f_1(3.5)+f_1(3)+f_1(4)=1+0.875+0.875+0.75+1=4.5$

e=2 $x_{112} = f_2(4) + f_2(3.5) + f_2(3) + f_3(3) + f_2(4) = 0.664 + 0.8333 + 0.8333 + 1 + 0.337 = 4$

e=3 $x_{113} = f_3(4) + f_3(3.5) + f_3(3.5) + f_3(3) + f_3(4) = 0 + 0.25 + 0.25 + 0.5 + 0 = 1$

e=4 $x_{114} = f_4(4) + f_4(3.5) + f_4(3.5) + f_4(3) + f_4(4) = 0 + 0 + 0 + 0 + 0 = 0$

By all evaluation indicator e, it can further solve grey evaluation weight vector that:

e=1 $r_{111} = x_{111}/x_{11} = 4.5/9.4 = 0.473$

e=2 $r_{112} = x_{112}/x_{11} = 4.9/9.4 = 0.421$

e=3 $r_{113} = x_{113}/x_{11} = 1/9.4 = 0.106$

e=4 $r_{114} = x_{114}/x_{11} = 0/9.4 = 0$

Above calculation, after corresponding processing, we can further get grey evaluation matrix, its each matrix is:

$$R_1 = \begin{bmatrix} r_{11} \\ r_{12} \\ r_{13} \\ r_{14} \\ r_{15} \end{bmatrix} = \begin{bmatrix} 0.47 & 0.42 & 0.11 & 0 \\ 0.26 & 0.35 & 0.39 & 0 \\ 0.28 & 0.38 & 0.34 & 0 \\ 0.42 & 0.38 & 0.20 & 0 \\ 0.42 & 0.43 & 0.15 & 0 \end{bmatrix}$$

$$R_2 = \begin{bmatrix} r_{21} \\ r_{22} \\ r_{23} \\ r_{24} \\ r_{25} \end{bmatrix} = \begin{bmatrix} 0.39 & 0.42 & 0.19 & 0 \\ 0.39 & 0.42 & 0.19 & 0 \\ 0.42 & 0.43 & 0.15 & 0 \\ 0.29 & 0.38 & 0.33 & 0 \\ 0.33 & 0.41 & 0.26 & 0 \end{bmatrix}$$

$$R_3 = \begin{bmatrix} r_{31} \\ r_{32} \\ r_{33} \end{bmatrix} = \begin{bmatrix} 0.25 & 0.39 & 0.36 & 0 \\ 0.25 & 0.34 & 0.41 & 0 \\ 0.34 & 0.43 & 0.23 & 0 \end{bmatrix}$$

For second grade evaluation indicators, it makes corresponding evaluation, similar to first grade, by applying formula $Z = B \cdot D^T$ it can get evaluation result as following TABLE 6 shows:

TABLE 6 : Evaluation comprehensive table

W	2.96	K_1	3.24	(V_{11})	3.35
				(V_{12})	2.87
				(V_{13})	2.94

		(V_{14})	3.22
		(V_{15})	3.27
		(V_{21})	3.16
		(V_{22})	3.16
K_2	3.15	(V_{23})	3.27
		(V_{24})	2.96
		(V_{25})	3.07
		(V_{31})	2.89
K_3	2.36	(V_{32})	2.84
		(V_{33})	2.08

In order to more clearly present mutual differences, the paper draws bar chart, as following Figure 1 shows:

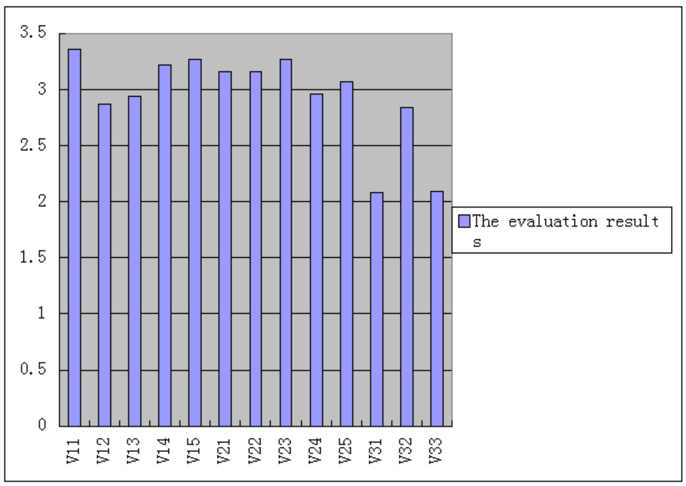

Figure 1 : Index layer evaluation results

CONCLUSION

(1) Introduce multi-level grey evaluation to English multimedia teaching evaluation, it can make full use of the most basic data, avoid data waste and loss, and meanwhile, the method can separately adjust order to see optimal or worse, but also integrate each indicator, finally it gets a comprehensive evaluation result.

(2) The paper proceeds with comprehensive evaluation by defining three layers indicators weights and multiple-level grey forms, by final table, we can get English multimedia teaching final evaluation result is 2.96., it belongs to general level, by summary chart, we can see English non-real time discussion system, English grade testing, English e-mail belong to weak links, and meanwhile it also proves the field should make further improvements in future.

(3) By calculated data, we can see that though final result appears, analysis of result is indispensable, for English multimedia teaching investigation result, the paper finally uses comprehensive investigation, so it needs to make further improvement and enhancing in future targeted at weak links.

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