Construction of Training Scheme and Evaluation Index System for English Major Talents

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***Abstract* — A decision-making scheme design method based on ANP is proposed for decision making of English major talent training index system. Firstly, a model of English major talent training index system is studied and a judgment matrix based on basic qualities, basic skills, English competence, foreign service and management capacity is constructed and its normalized form is constructed. Secondly, decision making is carried out by ANP for English major talent training index system to guide formulation of training scheme. Finally, an example is calculated in terms of English major talent training index and effectiveness of the method proposed is demonstrated.**

Keywords - ANP; english; talent training; index decision making

I. INTRODUCTION

Internet boosts wide application of network technologies. E-commerce-convenient and rapid transaction mode is applied in wide fields, including foreign-related fields. In the new era, e-commerce is more and more introduced in business operation and practice of foreign-related fields and industries and more and more talents of foreign-related majors are needed.

At present, training objective of English major is to develop talents who develop morally, intellectually, physically and aesthetically, are acquainted with and master knowledge and skills of foreign-related majors, use English practically, have good professional ethics, healthy figure and strong business ability, are able to engaged in service and primary and middle management in foreign-related hotel, travel agency and other enterprises. The students shall have good professional ethics, be able to speak and apply English fluently, capable to coordinate public relations, use computer and English and have foreign-related service ability, foreign-related management ability and foreign-related marketing ability.

Colleges and universities have established corresponding talent training modes to develop these abilities. Whether the training mode is scientific shall be evaluated by index evaluation system. Precise master connotation of English talent training, close connection with industrial demand and establishment of a set of talent training evaluation systems that reflect major education features and comply with industrial talent demands have important guiding significance to promote development of English major of colleges and universities and development of skilled talents the society badly needs. Therefore, evaluation index system for English major talent training scheme is constructed on the basis of ANP in the thesis and it is beneficial to guiding colleges and universities to design the training scheme.

II. MODEL OF INDEX SYSTEM FOR ENGLISH MAJOR TALENT TRAINING

Index system is a set of multiple sets. According to the purpose of research, construction is a process of selecting multiple associated indexes and analyzing and integrating them in line with scientific, applicable, systematic, operable and dynamic principles. New mode of English major talent training is reformed and upgraded on the traditional and theory-based training modes. The traditional training modes are integrated and reformed into a new one supported by theory teaching, practice teaching and comprehensive quality cultivation. It forges talents comprehensively by permeation and integration.

(1) Basic qualities: include political quality, professional ethics, healthy figure and psychological quality. (2) Basic skills: include language expression and application, computer application and coordination of public relations. (3) English competence: includes basic English abilities and English application ability. (4) Foreign-related service and management abilities: include foreign-related service ability, foreign-related management ability, foreign-related marketing ability and English application ability. Set the form of judgment matrix as the following:

Set I factors associated to superior factor z as $x_1, x_2, \cdots, x_n$, use α_{ij} to present ratio of impacts of x_i and x_j on z and the judgment matrix of n factors about z is:

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix}, i, j = 1, 2, \cdots, n \quad (1)$$

Relative importance is presented by 1-9 and their reciprocals and values are as follows; "1" means x_i and x_j are equally important; "3" means x_i is a little more important

than x_j; "5" means x_i is obviously more important than x_j; "7" means x_i is greatly more important than x_j; and "9" means x_i is extremely more important than x_j; "2, 4, 6 and 8" are the values between the two importance degrees; "reciprocals" means the contrast and the importance ratio is $a_{ij} = 1/a_{ij}$.

Arbitrary judgment matrix *A* has the following properties:

$$\begin{cases} a_{ij} > 0 \\ a_{ji} = 1/a_{ij}, i, j = 1, 2, \cdots, n \\ a_{ii} = 1 \end{cases} \tag{2}$$

The normalization result of characteristic vector is the weight of factor impact degree. Sum-product method is used in the thesis. The basic process is to normalize vectors of each line in judgment matrix, then calculate algorithmic means of elements of vectors in each row and finally normalize the vectors to obtain ranking weight vector.

(1) Normalize vectors of each line in judgment matrix to obtain $B = (b_{ij})_{n \times n}$:

$$b_{ij} = a_{ij} \Big/ \sum_{k=1}^{n} a_{kj}, i, j = 1, 2, \cdots, n \tag{3}$$

(2) Calculate algorithmic mean of element of *B* row vector:

$$w_i = \frac{1}{n} \sum_{j=1}^{n} b_{ij}, i = 1, 2, \cdots, n \tag{4}$$

The constructed $W = (w_1, w_2, \cdots, w_n)^T$ is the characteristic vector (index weight).

III. DESCRIPTION OF ANP-BASED DECISION MAKING OF ENGLISH MAJOR TALENT TRAINING SCHEME

A. ANP Algorithm Frame

Firstly, we construct a set of decision-making factors for English major talent training scheme and establish decision-making model on the basis of that. As relations between factors in the decision-making process are complex, the relations shall be sorted out and ANP decision-making weight shall be calculated and distributed before decision making to realize the collective decision making of English major talent training scheme. In the decision-making process, ANP algorithm is divided into two layers: control layer with decision-making objective and independent decision-making standards; network layer, elements of this layer is dominated by control layer and connections elements compose a network form. ANP decision-making process is shown in Figure 1.

ANP network has three element relations: internal relation, external relation and feedback relation. External relation reflects the relations and impacts between the element groups: for example, element group C_1 has impact on and association with element group C_3 so they have external association; internal relation reflects the impacts and impacts inside the element group, like the internal associations formed between the elements in C_2; feedback relation reflects the two-way associated between element groups: for example, element group C_1 has impact on element group C_2 and element group C_2 has impact on element group C_1 so the feedback association is formed.

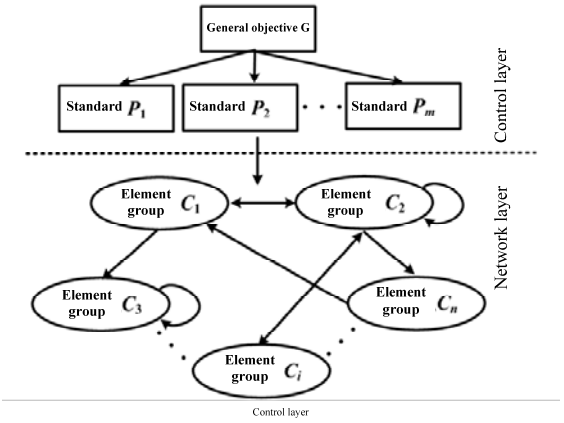

Figure 1. ANP model

B. Dominance Degree

After standards and elements of control layer of network model are formed, the importance of elements dominated by the standards shall be compared subject to the standards, priority shall be determined subject decision-making preference and impact association and the quantized sequence index is dominance degree. Two types of dominance degree are defined here: direct dominance degree to directly compare two elements subject to the given standards; indirect dominance degree to compare the other element (sub-standard) by the association between two elements. Comparison of element dominance degrees is quantized on the basis of 1-9 scale method and details are shown in Table 1.

TABLE 1. SAATY'S 1-9 SCALE METHOD

Scale value	meaning
1	Two elements are equally important
3	One element is lightly more important than the other
5	One element is obviously more important than the other
7	One element is greatly more important than the other
9	One element is extremely more important than the other
2, 4, 6, 8	Value is compromised

IV. ANP-BASED DECISION-MAKING PROCESS OF ENGLISH MAJOR TALENT TRAINING SCHEME

English major talent training scheme is subject to control layer standards $p_1, p_2, \cdots, p_m$ of ANP network, element attributes of decision-making factor set of English major talent training scheme compose network element group $C_1, C_2, \cdots, C_n$ and C_i includes elements $e_{i1}, e_{i2}, \cdots, e_{in_i}$ and $i = 1, 2, \cdots, N$. Firstly, construct an unweighted hyper matrix $\boldsymbol{W}_s$ for control standard $p_s \left(s = 1, 2, \cdots, m \right)$:

Process 1: suppose p_s is control standard and element $e_{jk} \left(k = 1, 2, \cdots, n_j \right)$ in $C_j \left(j = 1, 2, \cdots, N \right)$ is control sub-standard. According to impact of element in C_i on e_{jk} or impact of e_{jk} on element in C_i to compare the dominance degrees, obtain judgment matrix and normalize the characteristics. Then obtain $\left(w_{i1}^{(jk)}, w_{i2}^{(jk)}, \cdots, w_{in_i}^{(jk)} \right)^T$ by ranking.

Process 2: compare the dominance degrees of sub-standards of elements $e_{j1}, e_{j2}, \cdots, e_{jn_j}$ in group C_i by the means demonstrated in Process 1 to obtain judgment matrix and normalize characteristics. Then summarize the normalized characteristic vectors and the obtained matrix $\boldsymbol{W}_{ij}$ form is:

$$\boldsymbol{W}_{ij} = \begin{bmatrix} w_{i1}^{(j1)} & w_{i1}^{(j2)} & \cdots & w_{i1}^{(jn_j)} \\ w_{i2}^{(j1)} & w_{i2}^{(j2)} & \cdots & w_{i2}^{(jn_j)} \\ \vdots & \vdots & \ddots & \vdots \\ w_{in_i}^{(j1)} & w_{in_i}^{(j2)} & \cdots & w_{in_i}^{(jn_j)} \end{bmatrix} \tag{5}$$

In equation (10), $\boldsymbol{W}_{ij}$ is the degree of impact of element group C_i on C_j. If elements in C_j are not associated with elements in C_i, then $\boldsymbol{W}_{ij} = 0$.

Process 3: construct unweighted hyper matrix of control standard p_s by the means demonstrated in Process 1 and Process 2:

$$\boldsymbol{W}_s = \begin{bmatrix} \boldsymbol{W}_{11} & \boldsymbol{W}_{12} & \cdots & \boldsymbol{W}_{1j} & \cdots & \boldsymbol{W}_{1N} \\ \boldsymbol{W}_{21} & \boldsymbol{W}_{22} & \cdots & \boldsymbol{W}_{2j} & \cdots & \boldsymbol{W}_{2N} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ \boldsymbol{W}_{i1} & \boldsymbol{W}_{i2} & \cdots & \boldsymbol{W}_{ij} & \cdots & \boldsymbol{W}_{iN} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ \boldsymbol{W}_{N1} & \boldsymbol{W}_{N2} & \cdots & \boldsymbol{W}_{Nj} & \cdots & \boldsymbol{W}_{NN} \end{bmatrix} \tag{6}$$

In equation (11), hyper matrix element $\boldsymbol{W}_{ij} \left(i, j = 1, 2, \cdots, N \right)$ can be solved in formula (2). Comparison of dominance degrees of hyper matrix elements can reflect the preference and emphasis of decision maker on English major talent training scheme.

Similarly, unweighted hyper matrixes can be constructed for control standards $p_1, p_2, \cdots, p_m$ and they all are non-negative matrixes. Hyper matrix is not normalized entirely but all the sub-blocks $\boldsymbol{W}_{ij}$ shall be normalized. Under such circumstances, hyper matrix cannot present the priority of elements so dominance degrees of different element groups shall be compared and the matrix shall be transferred into weighted hyper matrix.

Suppose element group C_j is the sub-standard of control layer subject to control standard p_s. According to association degree of $C_1, C_2, \cdots, C_N$ with C_j or association degree of C_j with $C_1, C_2, \cdots, C_N$, obtain indirect dominance degree comparison data and judgment matrix and normalize characteristic ranking $\left(a_1^{(j)}, a_2^{(j)}, \cdots, a_N^{(j)} \right)^T$. Line-summarized characteristic ranking weighted matrix can be obtained by successive comparison and the form is:

$$\boldsymbol{A}_s = \begin{bmatrix} a_1^{(1)} & a_1^{(2)} & \cdots & a_1^{(N)} \\ a_1^{(1)} & a_2^{(2)} & \cdots & a_2^{(N)} \\ \vdots & \vdots & \ddots & \vdots \\ a_N^{(1)} & a_N^{(2)} & \cdots & a_N^{(N)} \end{bmatrix} \tag{7}$$

In equation (12), element of weighted matrix $\boldsymbol{A}_s$ is the indirect dominance degree comparison data of element group subject to standard p_s. For sub-standard C_j, the vector ranking result of unrelated element group is 0. Number of weighted matrixes corresponding to *m* groups of standards is *m*.

Assign the weight of elements in $\boldsymbol{W}_s$ by $\boldsymbol{A}_s$ and obtain weighted hyper matrix $\bar{\boldsymbol{W}}_s$:

$$\left(\bar{\boldsymbol{W}}_s \right) = \left(\boldsymbol{A}_s \right) \cdot \left(\boldsymbol{W}_s \right), s = 1, 2, \cdots, m \tag{8}$$

In equation (13), $(\cdot)$ is the matrix element selection operation. Matrix $\bar{\boldsymbol{W}}_s$ normalized to present the relative priority degree between elements.

As elements in ANP decision making have association and feedback relation, element rank is difficult to determine. Ranks of element e_i and element e_j can be determined on the basis of calculation of weighted hyper matrix $\bar{\boldsymbol{W}}_s$ (one-step rank determination), presented by elements $\sum_{l=1}^{N} w_{il} w_{lj}$ in $\bar{\boldsymbol{W}}_s^2$ (two-step rank determination) or presented by elements in matrix $\bar{\boldsymbol{W}}_s^n$ (*n*-step rank determination). To accurately present the association and feedback between elements, weighted hyper matrix shall be stabilized:

$$\bar{\boldsymbol{W}}_s^{\infty} = \lim_{t \to \infty} \bar{\boldsymbol{W}}_s^t \tag{9}$$

If the limit in equation (14) exists, line *j* in matrix $\bar{\boldsymbol{W}}_s^{\infty}$ is the relative value of limit of element e_j subject to standard p_s.

Relative value of limit rank between elements of all the control layers can be obtained subject to the standard steps

above. Then comprehensive result of ANP weighting can be obtained subject to standard weight and comprehensive weight value of English major talent training scheme can be further obtained. As a result, the ranking of English major talent training scheme can be obtained.

V. INDEX CALCULATION EXAMPLE

According to author's experience and experts' discussion and analysis, the judgment matrix for English major talent training scheme calculated in equation (1) and equation (2) is as follows:

$$A=\begin{bmatrix} 1 & 4 & 3 & 1 & 0.5 & 2 & 3 & 4 \\ 0.25 & 1 & 0.5 & 0.33 & 0.25 & 0.5 & 1 & 1 \\ 0.33 & 2 & 1 & 0.5 & 0.33 & 1 & 1 & 2 \\ 1 & 3 & 2 & 1 & 0.5 & 1 & 0.33 & 0.25 \\ 2 & 4 & 3 & 2 & 1 & 2 & 3 & 3 \\ 0.5 & 2 & 1 & 1 & 0.5 & 1 & 2 & 3 \\ 0.33 & 1 & 1 & 3 & 0.33 & 0.5 & 1 & 2 \\ 0.25 & 1 & 0.5 & 4 & 0.33 & 0.33 & 0.5 & 1 \end{bmatrix} \quad (10)$$

The normalization result of judgment matrix of English major talent training scheme obtained in equation (3) is as follows:

$$B=\begin{bmatrix} 0.18 & 0.22 & 0.25 & 0.08 & 0.11 & 0.24 & 0.26 & 0.25 \\ 0.04 & 0.06 & 0.04 & 0.03 & 0.05 & 0.06 & 0.07 & 0.06 \\ 0.05 & 0.12 & 0.07 & 0.04 & 0.06 & 0.12 & 0.08 & 0.11 \\ 0.17 & 0.16 & 0.15 & 0.07 & 0.11 & 0.12 & 0.04 & 0.03 \\ 0.32 & 0.21 & 0.24 & 0.15 & 0.24 & 0.23 & 0.25 & 0.17 \\ 0.07 & 0.12 & 0.07 & 0.11 & 0.12 & 0.17 & 0.18 & 0.18 \\ 0.06 & 0.06 & 0.08 & 0.24 & 0.07 & 0.06 & 0.05 & 0.12 \\ 0.04 & 0.06 & 0.04 & 0.32 & 0.07 & 0.04 & 0.04 & 0.06 \end{bmatrix} \quad (11)$$

Weights obtained subject to content of Chapter III are respectively:

$w_1 = 0.198$, $w_2 = 0.052$, $w_3 = 0.139$, $w_4 = 0.110$,

$w_5 = 0.230$, $w_6 = 0.117$, $w_7 = 0.097$, $w_8 = 0.052$

Index system of English major talent training mode and weight are respectively: basic qualities (0.119), basic skills (0.053), English competence (0.140), foreign-related service and management abilities (0.110), curriculum setting and curriculum system (0.231), case teaching and simulation teaching (0.118), social practice and major survey (0.098) and graduation thesis and internship (0.051). Development and management of major indexes of curriculum setting and curriculum system, basic qualities, case teaching and simulation teaching shall be emphasized and non-major indexes shall be considered to improve talent training quality.

VI. CONCLUSIONS

A decision-making scheme design method based on ANP is proposed in the thesis for index system of English major talent training and a judgment matrix for curriculum setting and curriculum system index system oriented on basic qualities, basic skills, English competence and foreign-related service and management abilities is constructed. Decision making is carried out for the constructed English major talent training index system by used of ANP and experiment result demonstrates effectiveness of method mentioned.

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