

# Game Analysis of Cross Cultural Awareness and Innovation Ability of English Education Policy using the Analytic Hierarchy Process

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**Abstract** — This paper first establishes the game and evolutionary game theory model to analyze the necessity of consciousness development about the cross cultural awareness in China’s English, and obtains the best strategy choice. And through the AHP analysis, it finds the main problems of cultivating our multinational consciousness about cross cultural awareness in English, and finally finds the solution to the component of cross cultural awareness in China's English.

**Keywords** - cross cultural awareness in English education; Evolutionary game theory; the innovation of Education; AHP analysis

## I. INTRODUCTION

After the founding of New China, China's national strength increasing, it was the drive of reform and opening up of China's rapid development. Today the areas of politics, economy, society and other have entered a new stage in China. However, due to China's education system problem, it allows students to learn more for exam, greatly limiting the innovative thinking of young people. English education, as a second language, was deviated from its main application purpose [1]. Due to political differences with Western countries at the early existence of our founding, Western countries culture was reflected in the English education almost micro and micro. This made us lack cross-cultural awareness in English education. It also made our young people lack intercultural communicative competence in English slightly less. To solve this problem, this paper will carry out a detailed analysis for necessity of English cultural awareness across the development, and conduct related research for our English innovative education strategies.

## II. RESEARCH ON EVOLUTIONARY GAME OF THE NECESSITY OF DEVELOPING ABOUT THE CROSS CULTURAL AWARENESS IN ENGLISH EDUCATION

### A. Game analysis of the necessity of developing about the cross cultural awareness in English education

For our country, the development of English education in cross culture can be very good to learn the culture of western countries, and promote China and the western countries in communication, so as to improve China's foreign influence. However, the construction of China's English education of cross cultural awareness is still relatively backward, and the lack of practice. So as to cross cultural awareness of English education in China can be a very good development, reform of the status quo is necessary. On the reform issues of the cross cultural awareness in English education, how to treat the relationship between the government and the relevant departments of education has great influence. According to

the following game analysis, the government and relevant departments of education as the object of the game, Now suppose that the government encourages relevant education department reform but related education department does not support the reform, the government benefit for  $x_1$ , related education department benefit for  $0$ ; In turn related education departments to actively reform but the government does not encourage, related departments of education benefit for  $x_1'$ , the government benefit for  $x_2$ . When the government and related departments of education is a positive attitude, government revenue for  $x$ , related education department for  $x'$ ; if it is not positive, then the benefits for both sides are  $0$ . Figure 1 is a game graph about the government and related departments of Education.

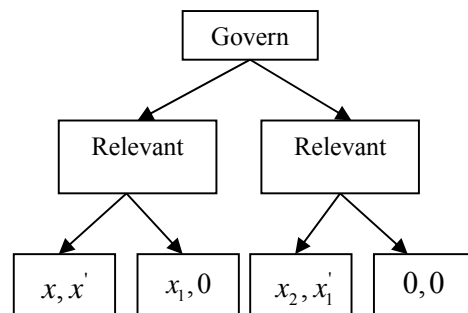


Figure 1 a game graph about the government and related departments of Education

Among them, the  $x', x_1'$  in size cannot be determined, and  $x > x_1 > x_2$ , therefore to establish the evolutionary game model of government and relevant departments of education to analyze the actual situation to cross cultural awareness in English education reform, and make their strategic adjustment.

**B. Evolutionary game analysis of the necessity of developing about the cross cultural awareness in English education**

For the government and related departments of education are independent and random in the cross cultural awareness in English education reform actively and not positive strategies, and can carry on the repeated game. Therefore, the probability of government encourages related education department is the  $a$ , the probability of not encouraging for the  $1-a$ ; the probability of relevant departments reform is  $b$ , the probability of not reform for the  $1-b$ ; According to the Malthusian theorem, the government strategy choice

encourages the growth rate  $(\frac{\dot{a}}{a})$  should be the number of fitness  $(E_A A \{a, 1-a\}^T)$  and average fitness  $(\{a, 1-a\} A \{b, 1-b\}^T)$  difference. When the government encouraged the probability is 1,  $E_A = [1, 0]$ ,

the benefit matrix is  $A = \begin{bmatrix} x & x_1 \\ x_2 & 0 \end{bmatrix}$ ,

and  $\dot{a} = a(1-a)\{1, -1\} A \{b, 1-b\}^T$  Simplify to

$$\dot{a} = a(1-a)[(x-x_1-x_2)a+x_1] \quad (1)$$

Similarly, the relevant departments of education strategy choice to

reform the growth rate  $(\frac{\dot{b}}{b})$  should be the number of fitness

$$(E_B B \{b, 1-b\}^T)$$

and average fitness  $(\{b, 1-b\} B \{a, 1-a\}^T)$  difference. When the related department of education reform of choice probability is 1,

$$E_B = [0, 1], \text{ the benefit matrix is } B = \begin{bmatrix} x' & 0 \\ x_1' & 0 \end{bmatrix},$$

and  $\dot{b} = b(1-b)\{-1, 1\} B \{a, 1-a\}^T$  Simplify to

$$\dot{b} = b(1-b)[x_1' + (x' - x_1')a] \quad (2)$$

So when the  $\dot{a} = 0, \dot{b} = 0$ , the balance point for positive psychology health education reform are  $(0,0)$ ,  $(0,1)$ ,  $(1,0)$  and  $(1,1)$ . According to the analysis of local stability of

these equilibrium points matrix stability, ask the  $\dot{a}$  for the partial derivative of  $a$ , and the  $\dot{b}$  for the partial derivative of  $b$ , the matrix is

$$W = \begin{bmatrix} \partial \dot{a} / \partial a & \partial \dot{a} / \partial b \\ \partial \dot{b} / \partial a & \partial \dot{b} / \partial b \end{bmatrix} = \begin{bmatrix} (1-2a)[(x-x_1-x_2)b+x_1] & a(1-a)(x-x_1-x_2) \\ b(1-b)(x'-x_1') & (1-2b)a \end{bmatrix} \quad (3)$$

Among them

$$\det W = (1-2a)(1-2b)[(x-x_1-x_2)b+x_1][x_1' + (x' - x_1')a] - ab(1-a)(1-b)(x-x_1-x_2)(x'-x_1') \quad (4)$$

$$tr W = (1-2a)[(x-x_1-x_2)b+x_1] + (1-2b)[x_1' + (x' - x_1')a] \quad (5)$$

Table I is the local stability of the equilibrium point.

TABLE I THE LOCAL STABILITY OF THE EQUILIBRIUM POINT

the equilibrium point $(a, b)$	$tr W$		$\det W$		stability
$(0,0)$	$x_1 + x_1'$	+	$x_1 \cdot x_1'$	+	Unstable point
$(0,1)$	$x - x_2 - x_1'$	-	$-(x - x_2) \cdot$	Unkown	Saddle point
$(1,0)$	$x' - x_1$	-	$-x_1 \cdot x'$	Unkown	Saddle point
$(1,1)$	$-(x - x_2 + x'$	+	$(x - x_2) \cdot x'$	-	Stable point

From the table shows, point  $(0,0)$  is the unstable point, and  $(0,1), (1,0)$  are the saddle points, the evolutionary stable point is  $(1,1)$ . So we can find the best strategy about the government and the related education department handling of the cross cultural awareness in English education reform problems. The relevant departments of education should be to actively participate in the reform; to speed up the innovation of the effectiveness of English education in China; the government should increase investment benefit, incentive and drive the relevant education departments involved in the construction of positive psychology health education.

**III. AHP ANALYSIS OF THE INNOVATION STRATEGIES OF ENGLISH EDUCATION IN CHINA**

**A. Established the hierarchical structure**

Analysis of problems in English education in China is the premise to determine the direction of the innovation of China's English education, and then find out the solutions to meet the construction of cross cultural awareness in English education in China, which determines the innovation strategies of English education. This paper, based on the AHP, is to quantify the main factors influencing the effect of the component of cross cultural awareness in English: the establishment of the target layer, criterion layer, solution layer relationship.

The target layer: the component of cross cultural awareness in English.

The criterion layer: the cultural cognition is  $p_1$ , the enthusiasm for learning is  $p_2$ , the learning environment is  $p_3$ , the self expression ability is  $p_4$ .

The solution layer: the strengthen cultural education ( $b_1$ )[5], the improve the way of Education ( $b_2$ ), to establish a good communication environment ( $b_3$ )

Get the hierarchical structure, as shown in Figure 2

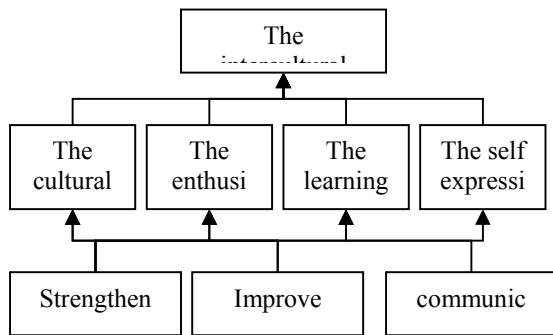


Figure. 2: the hierarchical structure

**B. Constructing judgment matrix**

According to the number of expert experience and referring to lots of references, through the 1 to 9 scale settings that comparison matrix, namely the judgment matrix for table II-VI.

TABLE II COMPARISON MATRIX

G	$p_1$	$p_2$	$p_3$	$p_4$
$p_1$	1	1	3	4
$p_2$	1	1	3	4
$p_3$	1/3	1/3	1	2
$p_4$	1/4	1/4	1/2	1

TABLE III COMPARISON MATRIX

$p_1$	$q_1$	$q_2$	$q_3$
$q_1$	1	3	2
$q_2$	1/3	1	1/2
$q_3$	1/2	2	1

TABLE IV COMPARISON MATRIX

$p_2$	$q_1$	$q_2$	$q_3$
$q_1$	1	2	1
$q_2$	1/2	1	1/2
$q_3$	1	2	1

TABLE V COMPARISON MATRIX

$p_3$	$q_1$	$q_2$	$q_3$
$q_1$	1	1/3	1/4
$q_2$	3	1	1/2
$q_3$	4	2	1

TABLE VI COMPARISON MATRIX

$p_4$	$q_1$	$q_2$	$q_3$
$q_1$	1	1/2	1/3
$q_2$	2	1	1/2
$q_3$	3	2	1

**IV. CONSISTENCY TEST**

According to the formula of  $CI = \frac{\lambda_{max} - n}{n - 1}$ , calculate the  $CI$ , get the consistency of the analysis, analysis of the specific process is as follows.

$$C = \begin{Bmatrix} 1 & 1 & 3 & 4 \\ 1 & 1 & 3 & 4 \\ 1/3 & 1/3 & 1 & 2 \\ 1/4 & 1/4 & 1/2 & 1 \end{Bmatrix} \xrightarrow{\text{normalization}} \begin{Bmatrix} 0.301 \\ 0.254 \\ 0.238 \\ 0.207 \end{Bmatrix} = i^{(0)}$$

$$CI^{(0)} = \begin{Bmatrix} 1 & 1 & 3 & 4 \\ 1 & 1 & 3 & 4 \\ 1/3 & 1/3 & 1 & 2 \\ 1/4 & 1/4 & 1/2 & 1 \end{Bmatrix} \begin{Bmatrix} 0.301 \\ 0.254 \\ 0.238 \\ 0.207 \end{Bmatrix} = \begin{Bmatrix} 2.352 \\ 2.352 \\ 0.874 \\ 0.525 \end{Bmatrix}$$

$$\lambda_{max}^{(0)} = \frac{1}{4} \left( \frac{2.352}{0.301} + \frac{2.352}{0.254} + \frac{0.874}{0.238} + \frac{0.525}{0.207} \right) = 4.16,$$

$$i^{(0)} = \begin{Bmatrix} 0.301 \\ 0.254 \\ 0.238 \\ 0.207 \end{Bmatrix}$$

The judgment matrices are:

$$C_1 = \begin{Bmatrix} 1 & 3 & 2 \\ 1/3 & 1 & 1/2 \\ 1/2 & 2 & 1 \end{Bmatrix}, C_2 = \begin{Bmatrix} 1 & 2 & 1 \\ 1/2 & 1 & 1/2 \\ 1 & 2 & 1 \end{Bmatrix}, C_3 = \begin{Bmatrix} 1 & 1/3 & 1/4 \\ 3 & 1 & 1/2 \\ 4 & 2 & 1 \end{Bmatrix}, C_4 = \begin{Bmatrix} 1 & 1/2 & 1/3 \\ 2 & 1 & 1/2 \\ 3 & 2 & 1 \end{Bmatrix}$$

The maximum corresponding to the characteristic value and characteristic vector are:

$$\left\{ \begin{array}{l} \lambda_{\max}^{(1)} = 3.42, i^{(1)}_1 = \begin{Bmatrix} 0.428 \\ 0.260 \\ 0.312 \end{Bmatrix} \\ \lambda_{\max}^{(2)} = 3.24, i^{(1)}_2 = \begin{Bmatrix} 0.342 \\ 0.216 \\ 0.432 \end{Bmatrix} \\ \lambda_{\max}^{(3)} = 3.54, i^{(1)}_3 = \begin{Bmatrix} 0.226 \\ 0.493 \\ 0.281 \end{Bmatrix} \\ \lambda_{\max}^{(4)} = 3.51, i^{(1)}_4 = \begin{Bmatrix} 0.345 \\ 0.287 \\ 0.368 \end{Bmatrix} \end{array} \right.$$

According to  $CI = \frac{\lambda_{\max} - n}{n - 1}$ , calculate the  $RI$ , the values shown in Table 7

TABLE VII THE VALUES OF  $RI$

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

For the judgment matrix in C,

$$\lambda_{\max}^{(0)} = 4.16, RI = 0.95$$

$$RI = \frac{4.16 - 4}{4 - 1} = 0.05$$

$$CR = \frac{CI}{RI} = \frac{0.05}{0.95} = 0.05 < 0.1$$

The C consistency is reasonable; therefore the C feature vector is the weight vector.

The Judgment matrix C1, C2, C3, C4 with the above principle can through the consistency test. Therefore, results of calculation about the target layer to the solution layer in Figure 3.

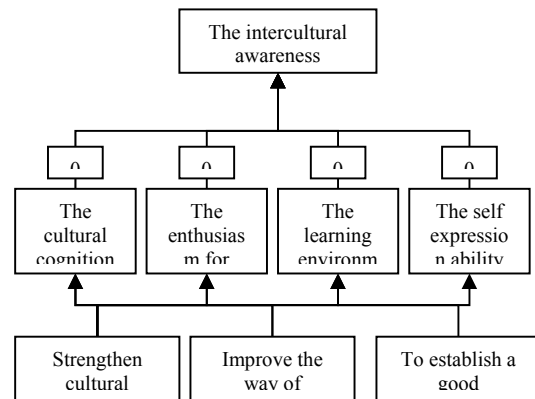


Figure.3: results of calculation

Calculation of the structure is as follows:

$$i^{(1)} = (i_1^{(1)}, i_2^{(1)}, i_3^{(1)}, i_4^{(1)})$$

$$= \begin{Bmatrix} 0.428 & 0.342 & 0.226 & 0.345 \\ 0.260 & 0.216 & 0.493 & 0.287 \\ 0.312 & 0.432 & 0.281 & 0.368 \end{Bmatrix}$$

$$i = i^{(1)} i^{(0)}$$

$$= \begin{Bmatrix} 0.428 & 0.342 & 0.226 & 0.345 \\ 0.260 & 0.216 & 0.493 & 0.287 \\ 0.312 & 0.432 & 0.281 & 0.368 \end{Bmatrix} \begin{Bmatrix} 0.301 \\ 0.254 \\ 0.238 \\ 0.207 \end{Bmatrix} = \begin{Bmatrix} 0.364 \\ 0.323 \\ 0.313 \end{Bmatrix}$$

Through the above analysis that the main problems of cultivating our multinational consciousness about cross cultural awareness in English, are the foreign culture cognition, learning enthusiasm of the students, the education environment and students' ability of expression. The lack of understanding of foreign culture and a bad English learning environment, will affect the students' practical English learning enthusiasm. In this paper, through the analytic hierarchy process, in view of the above problems, it finds out the solution to the component of cross cultural awareness in China's English. That is to strengthen the foreign cultural education, improve education and to create a good English communication environment, and that their weights were 0.364, 0.323 and 0.313. To strengthen the foreign excellent culture education can cultivate students' interest in English, to create a good English communication environment is conducive to the cultivation of students ability to express, to improve English education mode can improve the students' learning efficiency

## V. CONCLUSION

This paper first establishes the game and the evolutionary game theory model to analyze the necessity of consciousness development about the cross cultural awareness in China's English. Obtained the best strategy choice should be more actively involved in education reform for the relevant departments. It accelerates innovation of the effectiveness in

English education. The Government should also improve the efficiency of investment. It should be incentive and drive relevant education sector in English Education across building cultural awareness.

Through the AHP analysis, we can know that the main problems of cultivating our multinational consciousness about cross cultural awareness in English, are the foreign culture cognition, learning enthusiasm of the students, the

foreign cultural education, improve education and to create a good English communication environment, and obtain their weights.

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