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## Utilize time sequence to brief discuss general undergraduate english major students' development trend

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### ABSTRACT

With economic globalization constantly development and international exchange increasingly frequency, it leads to Chinese emphasis on English education has been constantly strengthened, English education proportion in Chinese education has also constantly increased, general undergraduate English major students play important roles in propelling to Chinese English education development. Through analyzing difference points among science, engineering, art and other majors and English, the paper puts forward that in undergraduate education, engineering occupies larger proportions; on the contrary, Chinese general undergraduate English major proportion in university students' undergraduate education is relative smaller, based on this, the paper studies on recent years' Chinese general undergraduate English major students numbers by time sequence model's modified exponential curve and growth curve, it gets future years' development trend, which has certain promotion to Chinese education development. © 2014 Trade Science Inc. - INDIA

### KEYWORDS

English major;  
Development prediction;  
Time sequence model;  
Growth curve model;  
Mathematical model.

### INTRODUCTION

The broadest second language in the world-English, English is commonly used language in the world, is also one of working language in the united nations, with Chinese reformation constantly deepening, English education emphasis has also been constantly deepened, English is also regarded as an important mark of Chinese university students' language level.

For English aspect research, predecessors have made many efforts, and got plentiful results, such as Tian Li in vocational English's Business English student ability cultivation aspect research, by comparing Chinese and western cultural differences, she proposed that

it should expand students' cultural horizon in English education so that improved their business English cultural level, and analyzed with concrete examples, finally discussed improving students' cross-cultural communicative ability by all circles of society abilities to arrive at foreign English level; Song Ju and others in Chinese general undergraduate English major construction development, they put forward it should make full use of teaching systematic technical theory frame so that provided theoretical supports for fulfilling English major development.

The paper just on the basis of predecessors' research, makes quantitative analysis of Chinese general undergraduate English major students, and finally gets

prediction model, by modified exponential model, it further gets more accurate results, which builds important foundation for exploring Chinese general undergraduate English major students' development.

### MODEL ESTABLISHMENTS

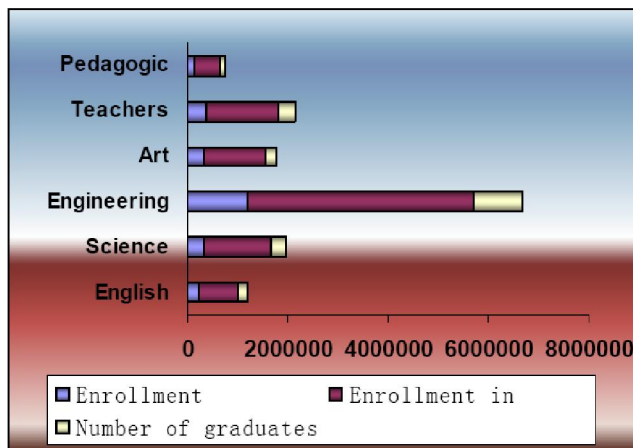
English is a kind of languages that has the most widely usage in present world. In China, English is also rapidly received by Chinese people with Chinese economic rapidly development. Carry out researching on present Chinese general undergraduate English major student is beneficial to propel to Chinese English education development and English impacts among national people's life, so the paper selects general undergraduate English major students as research objects, due to English major and other majors emphasis is different, its enrollment, enrollment in and number of graduates are also different. As following TABLE 1 shows.

Analyze above data, it can get Figure 1.

By Figure 1 analysis, we can get that science and engineering enrollment, enrollment in and number of

**TABLE 1 : Chinese general undergraduate each major students' numbers comparison in 2013**

Major	Enrollment	Enrollment in	Number of graduates
English	206235	811844	205110
Teachers	367421	1443936	328575
Engineering	1155231	4522912	964582
Pedagogy	142412	514590	103287
Science	354670	1324645	224062
Art	335810	1215535	240456

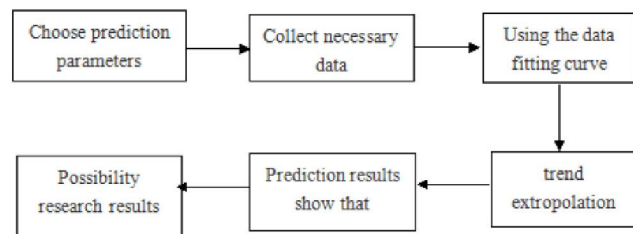


**Figure1 : Ordinary undergraduate course each major students**

graduates is more while students of liberal arts are less, liberal arts education is relative weak, which is mainly because Chinese education puts main emphasis on science education. Relatively, English major occupied proportion among these majors is relative little, no matter in enrollment, enrollment in or number of graduates; all is fewer, which further indicates weak point of English education in Chinese education.

### Chinese general undergraduate English major student development research

Trend extrapolation prediction method is one of methods in time sequence, its main thought is finding out things development general rules according to their development history and reality information, and further predicating development trend in some time in future based on this. Its predication method steps are mainly following Figure 2:



**Figure 2 : Trend extrapolation prediction steps**

For Chinese general undergraduate English major student development prediction belongs to trend extrapolation prediction method research range, it applies growth curve and modified curve method to predict Chinese general undergraduate English student number here.

All things development has certain limitations, modified exponential curve overcomes exponential curve method drawback of predicted value being infinitely increased with time passing when predict, its prediction gets closer to actual things change rules. Modified exponential curve method mathematical model is:

$$\hat{Y}_t = N + ab^t \tag{1}$$

Among them,  $N, a, b$  should be defined with historical data.

### Modified exponential curve method model

Features of modified exponential curve description: In the preliminary stage, growth is rapid, and sub-

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sequently growth rate gradually reduces;

When  $N > 0, a < 0, 0 < b < 1, t \rightarrow \infty, ab^t \rightarrow 0$ , that

$$\hat{Y}_t \rightarrow N$$

When  $K$  value can be implemented and defined, adopt least square method to define parameters in model, and when  $N$  value cannot be defined in advance, adopt three sums method.

TABLE 2 : General undergraduate English major number of people status during 2005~2013

Year	Enrollment	Enrollment in	Number of graduates
2005	158972	648821	129876
2006	168857	683796	130133
2007	179824	698071	132691
2008	189393	706300	149693
2009	198025	715329	159925
2010	207716	783068	172377
2011	199946	799245	185771
2012	205236	810846	201115
2013	206520	811855	203983

TABLE 3 : Chinese general undergraduate English major enrollment prediction

Year	2014	2015	2016	2017
Enrollment predicted value	207984	210256	211681	219850

Among them, divide time sequence corresponding  $n$  pieces of observation value into three parts, and three parts are equal as well as every part totally has  $m$  periods, that is also  $n = 3m$ .

Part one:  $Y_1, Y_2, Y_3, \dots, Y_m$ ;

Part two:  $Y_{m+1}, Y_{m+2}, Y_{m+3}, \dots, Y_{2m}$ ;

TABLE 4 : Chinese general undergraduate English major enrollment in prediction

Year	2014	2015	2016	2017
Enrollment in predicted value	817524	819973	827461	829918

TABLE 5 : Chinese general undergraduate English major number of graduates' prediction

Year	2014	2015	2016	2017
Number of graduates predicted value	209977	217584	218794	220920

Part three:  $Y_{2m+1}, Y_{2m+2}, Y_{2m+3}, \dots, Y_{3m}$

In above, observation value sum is every part trend sum, and corresponding three sums method steps are as following:

Record observation value, it gets each part sum is:

$$S_1 = \sum_{t=1}^m Y_t, S_2 = \sum_{t=m+1}^{2m} Y_t, S_3 = \sum_{t=2m+1}^{3m} Y_t, \tag{2}$$

And it has:

$$\begin{cases} S_1 = \sum_{t=1}^m \hat{Y}_t = \sum_{t=1}^m (N + ab^t) = mN + ab(1 + b + b^2 + \dots + b^{m-1}) \\ S_2 = \sum_{t=m+1}^{2m} \hat{Y}_t = \sum_{t=m+1}^{2m} (K + ab^t) = mN + ab^{m+1}(1 + b + b^2 + \dots + b^{m-1}) \\ S_3 = \sum_{t=2m+1}^{3m} \hat{Y}_t = \sum_{t=2m+1}^{3m} (K + ab^t) = mN + ab^{2m+1}(1 + b + b^2 + \dots + b^{m-1}) \end{cases} \tag{3}$$

Among them:  $(1 + b + b^2 + \dots + b^{m-1})(b - 1) = b^m - 1$

It further can get:

$$\begin{cases} S_1 = mN + ab \frac{b^{m-1}}{b-1} \\ S_2 = mN + ab^{m+1} \frac{b^{m-1}}{b-1} \\ S_3 = mN + ab^{2m+1} \frac{b^{m-1}}{b-1} \end{cases} \tag{4}$$

Thereupon, it can get:

$$\begin{cases} b = \left( \frac{S_3 - S_2}{S_2 - S_1} \right)^{\frac{1}{m}} \\ a = (S_2 - S_1) \frac{b-1}{b(b^m - 1)^2} \\ N = \frac{1}{m} \left[ S_1 - \frac{ab(b^m - 1)}{(b-1)} \right] \end{cases} \tag{5}$$

Besides, when predict data, it should test data, test method is:

$$\frac{Y_{t+1} - Y_t}{Y_t - Y_{t-1}} \approx b \tag{6}$$

Modified exponential curve method application

According to Chinese general undergraduate English major student's number, by Chinese statistical year-

book and national sports bureau database investigation reports, it gets following data TABLE 2:

I. Predict targeted general undergraduate English major students enrollment

Now divide above nine data into three parts, every part with three data that  $n = 9, m = 3$ , and take year 2005 as initial year that  $t = 1$ .

At first, it is easily known by calculating:  $\frac{Y_{t+1} - Y_t}{Y_t - Y_{t-1}} \in [0.55, 1.25]$

According to formula (2), it gets:  $S_1 = 1872, S_2 = 1952, S_3 = 1993$

Then by formula (5), it gets:  $b = 0.8003, a = -84.022, N = 678.708$

So obtained Chinese general undergraduate English major student enrollment modified exponential curve mathematical model is:

$$Y = N + ab^t = 678.708 - 84.022 \times 0.8003^t$$

When predict Chinese general undergraduate English major student enrollment development change in future four years since 2013, only need to input  $t$  value into above formula, as predicting  $Y_{2014}$ , and then it has  $t = 2014 - 2005 + 1 = 10$ . It further gets following TABLE 3 prediction result:

II. Predict targeted general undergraduate English major students enrollment in

According to a. step, it is clear:

At first, it is easily known by calculating:  $\frac{Y_{t+1} - Y_t}{Y_t - Y_{t-1}} \in [0.48, 1.02]$

According to formula (2), it gets:  $S_1 = 1865, S_2 = 1742, S_3 = 1876$

Then by formula (5), it gets:  $b = 0.7112, a = -75.015, N = 698.797$

So obtained Chinese general undergraduate English major student enrollment in modified exponential curve mathematical model is:

$$Y = N + ab^t = 698.797 - 75.015 \times 0.7112^t$$

When predict Chinese general undergraduate English major student enrollment in development change in future four years since 2013, only need to input  $t$  value

into above formula, as predicting  $Y_{2014}$ , then it has  $t = 2014 - 2005 + 1 = 10$ . It further gets following TABLE 4 prediction result:

III. Predict targeted general undergraduate English major students number of graduates

According to a. step, it is clear:

At first, it is easily known by calculating:  $\frac{Y_{t+1} - Y_t}{Y_t - Y_{t-1}} \in [0.42, 1.75]$

According to formula (2), it gets:  $S_1 = 1792, S_2 = 1758, S_3 = 1921$

Then by formula (5), it gets:  $b = 0.8011, a = -80.022, N = 667.598$

So obtained Chinese general undergraduate English major student number of graduates modified exponential curve mathematical model is:

$$Y = N + ab^t = 667.598 - 80.022 \times 0.8011^t$$

When predict Chinese general undergraduate English major student number of graduates development change in future five years since 2012, only need to input  $t$  value into above formula, as predicting  $Y_{2014}$ , and then it has  $t = 2014 - 2005 + 1 = 10$ . It further gets following TABLE 5 prediction result:

### CHINESE GENERAL UNDERGRADUATE ENGLISH MAJOR STUDENT NUMBER PREDICTION GROWTH CURVE APPLICATION

In above modified exponential curve, it only predicts things development trend in some time in future, but things change rate in each period is different. Chinese general undergraduate English major student number change trend is uncertain with time passing, so prediction accuracy of purely using modified exponential curve method is lower. In order to pursuit better solution on development trend uncertainty problem, the paper introduces growth curve model.

#### Growth curve model

Growth curve general mathematical model:

$$\frac{dY}{dt} = rY \left(1 - \frac{Y}{M}\right) \tag{7}$$

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Among them,  $y$  is predicted value,  $M$  is its limit value,  $r$  is growth constant, and  $r > 0$ . So the differential equation, finally it gets:

$$Y = \frac{M}{1 + ce^{-rt}} \tag{8}$$

In the following, record Logistic curve general form as:

$$Y_t = \frac{1}{N + ab^t}, N > 0, a > 0, 0 < b \neq 1 \tag{9}$$

Among them, in Logistic curve, parameter estimation makes following changes:  $Y'_t = \frac{1}{Y_t}$ , that:

$$Y'_t = N + ab^t \tag{10}$$

Follow modified exponential curve method's three sums method to estimate parameters, and then it has:

$$S_1 = \sum_{t=1}^m Y'_t, S_2 = \sum_{t=m+1}^{2m} Y'_t, S_3 = \sum_{t=2m+1}^{3m} Y'_t, \tag{11}$$

And it has:

$$\begin{cases} b = \left( \frac{S_3 - S_2}{S_2 - S_1} \right)^{\frac{1}{m}} \\ a = (S_2 - S_1) \frac{b-1}{b(b^m - 1)^2} \\ N = \frac{1}{m} \left[ S_1 - \frac{ab(b^m - 1)}{(b-1)} \right] \end{cases} \tag{12}$$

**Logistic curve model application**

By formula  $Y'_t = \frac{1}{Y_t}$ , we can get data during year

2005~2013 after changing as following TABLE 6.

I, Predict targeted general undergraduate English major students enrollment

According to formula (11), it gets:  $S_1 = 0.00482, S_2 = 0.004626, S_3 = 0.00453$

Then by formula (12), it gets:  $b = 0.829, a = 0.0002057, N = 0.001462$

So obtained Chinese general undergraduate English major student enrollment mathematical model is:

$$Y_t = \frac{1}{0.001462 + 0.0002057 \times 0.829^t}$$

When predict Chinese general undergraduate English major student enrollment development change in future four years since 2013, only need to input  $t$  value into above formula, as predicting  $Y_{2014}$ , and then it has  $t = 2014 - 2005 + 1 = 10$ . It further gets following TABLE 7 prediction result:

II. Predict targeted general undergraduate English major students enrollment in.

Then by formula (12), it gets:  $b = 0.821, a = 0.0002049, N = 0.001387$

So obtained Chinese general undergraduate English major student enrollment in mathematical model is:

$$Y_t = \frac{1}{0.001461 + 0.0002056 \times 0.828^t}$$

When predict Chinese general undergraduate English major student enrollment in development change in future four years since 2013, only need to input  $t$  value into above formula, as predicting  $Y_{2014}$ , then it has

**TABLE 6 : Data table after logistic curve changing**

Year	Enrollment $Y'_t / \times 10^5$	Enrollment in $Y'_t / \times 10^5$	Number of graduates $Y'_t / \times 10^5$
2005	0.627	0.155	0.768
2006	0.593	0.146	0.768
2007	0.555	0.143	0.754
2008	0.529	0.142	0.669
2009	0.504	0.138	0.625
2010	0.482	0.128	0.581
2011	0.501	0.125	0.539
2012	0.487	0.123	0.497
2013	0.207	0.119	0.622

$t = 2014 - 2005 + 1 = 10$ . It further gets following TABLE 8 prediction result:

III. Predict targeted general undergraduate English major students number of graduates

According to formula (11), it gets:  $S_1 = 0.00423, S_2 = 0.004621, S_3 = 0.00457$

**TABLE 7 : Chinese general undergraduate English major enrollment prediction**

Year	2014	2015	2016	2017
Enrollment predicted value	207881	210236	211876	219822

**TABLE 8 : Chinese general undergraduate English major enrollment in prediction**

Year	2014	2015	2016	2017
Enrollment in predicted value	817529	819871	827461	829926

Then by formula (12), it gets:  $b = 0.835, a = 0.0002157, N = 0.001402$

So obtained Chinese general undergraduate English major student number of graduates mathematical model is:

$$Y_t = \frac{1}{0.001402 + 0.0002157 \times 0.835^t}$$

When predict Chinese general undergraduate English major student number of graduates development change in future four years since 2013, only need to input  $t$  value into above formula, as predicting  $Y_{2014}$ , and then it has  $t = 2014 - 2005 + 1 = 10$ . It further gets following TABLE 9 prediction result:

To sum up, Chinese general undergraduate English major students development future 5 years prediction as TABLE 10:

In order to able to more vividly present change trend in four years after year 2013, the paper draws bar chart, as following Figure 3 shows:

**Comprehensive analysis**

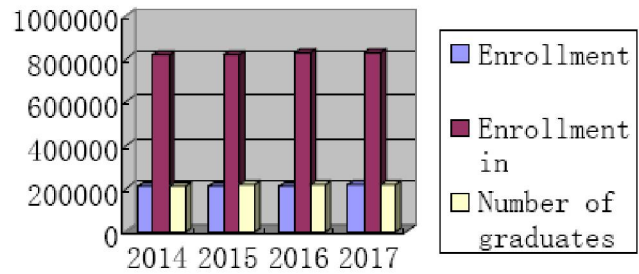
Trend extrapolation prediction method predicted objects present rising or diminishing trends with time changing, and it can find out such corresponding functions, apply the model into Chinese general English major students' development prediction is just proper.

**TABLE 9 : Chinese general undergraduate English major number of graduates' prediction**

Year	2014	2015	2016	2017
Number of graduates predicted value	209961	217552	218787	220908

**TABLE 10 : Chinese general undergraduate English major students' development prediction**

Year	2014	2015	2016	2017
Enrollment	207881	210236	211876	219822
Enrollment in	817529	819871	827461	829926
Number of graduates	209961	217552	218787	220908



**Figure 3 : Our students to develop general prediction for English majors**

Due to exponential curve method has drawbacks like its predicted values will infinitely increase with time passing when predict, in order to overcome the drawback, the paper introduces modified exponential curve method, the method is a kind of prediction method on the basis of exponential curve method, according to the method, it analyzes year 2005~2013 Chinese general undergraduate English major students number, and get modified exponential curve method equations, so that makes reasonable prediction on Chinese general undergraduate English major students number in four years after 2013, and gets its Chinese general undergraduate English major students' development trend tends to stable.

**CONCLUSION**

- (1) By comparing Chinese general undergraduate English major student with other majors, the paper can get engineering, science, art, teachers, pedagogy and other majors as well as general undergraduate English major student numbers different points, and use Chinese statistical yearbook's relative data to make quantitative research and predict

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its change trend, finally it proposes that current stage Chinese general undergraduate each major comparison analysis result is Chinese general undergraduate English major occupied proportion in college students undergraduate education is smaller, its enrollment, enrollment in and number of graduates are fewer with respect to other majors, which shows Chinese English education aspect has obvious shortcomings.

- (2) The paper utilizes trend extrapolation predication method, predicts Chinese general undergraduate English major student number in four years after 2013. Firstly it adopts modified exponential curve method to make quantitative analysis of Chinese general undergraduate English major student development during 2005~2013, gets prediction mathematical model, and so predicts corresponding number of people. Based on this, considering Chinese general undergraduate English major student's number each period change rate differences, and utilize growth curve to make further number of people's prediction, let predicted value to be more accurate, and further research on Chinese general undergraduate English major student development trend in four years after 2013. Thereupon it proves that Chinese English education overall trend is still rather optimistic.

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