

Research on How to Build a Healthy Higher Education System

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Abstract

Because of the role and significance of the higher education system in the world, this paper aims at the advantages and disadvantages of the higher education system in different countries. The higher education system in China and Vietnam is used as the representative to evaluate and score the health status of the higher education system. By using SPSS, Matlab, Excel, Python and other software to program, screen and collate the data, a comprehensive evaluation method of Rank-sum ratio, grey prediction method and principal component analysis model are established to obtain the comparison results of the health status of higher education system in China and Vietnam. The rank sum ratio comprehensive evaluation model is established according to the requirement of problem one. Firstly, the collected data is sorted by Excel, then the collated data is applied to the rank sum ratio comprehensive evaluation model established by SPSS. The rank and RSR equivalence is obtained to obtain the final evaluation result that the health status of China's higher education system is superior to that of Vietnam's higher education system. The grey prediction model is established to obtain the prediction data of higher education in China in the future. The prediction data and ideal data and the information data of previous years are evaluated by using the rank sum ratio comprehensive evaluation model established by problem one again. The proposed higher education system is verified.

Keywords

Higher Education; Rank-sum Ratio Comprehensive Evaluation; Grey Prediction.

1. Introduction

1.1. Background

In the development of today's era, the national higher education system not only plays a role in improving the cultural level of citizens, but also has the value of industry itself. Looking around the world, we can see different ways of higher education in different countries. At the same time, they are not only limited to educating their own students, but also choose to attract some international students to enrich campus culture.

But these different ways of higher education have their own advantages and disadvantages. If the country wants to adjust and improve its higher education system, it can not be pushed forward overnight. Any institutional reform will take a long time to achieve a more healthy and sustainable system.

1.2. Summary of Research Process

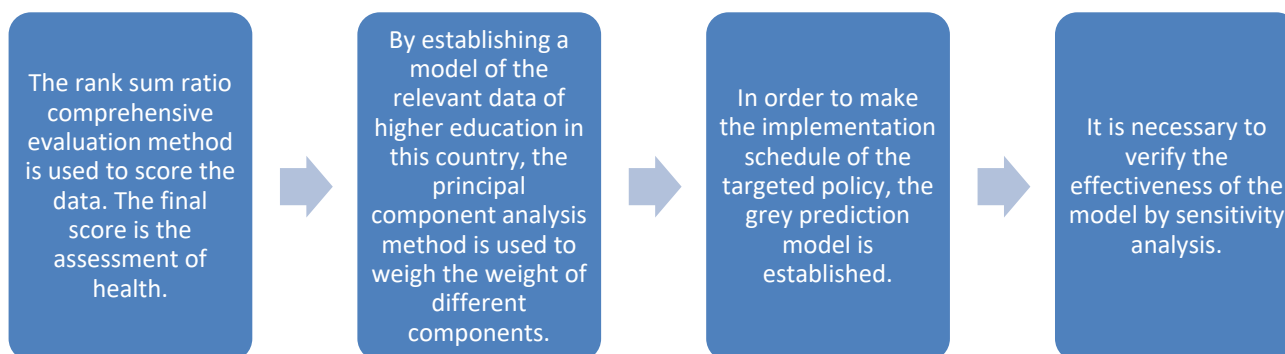


Fig 1. Research Process

2. General Assumptions and Justifications

For problem solving and model building, it gives the following basic assumptions, each of which is reasonable and basically true.

- No sudden-onset disasters have an impact on higher health systems;
- It is assumed that the factors affecting the health status of higher education system only include the number of college students, the number of teachers and the number of graduates;
- It is assumed that the main analysis of the health status of the higher education system covers the period from 2006 to 2010.
- Since the latest known data is 2019, higher education data after 2019 are treated as unknown data.

3. Symbol Description

Table 1. Symbol Description

Symbol	Meaning
f	Frequent and successive
Σf	Cumulative frequency
p	Cumulative frequency down
x	Invariate
y	Factor
X	Matrix

4. Problem Solving

4.1. Establish a Model to Assess the Health of the Higher Education System

4.1.1. Modeling Ideas

To evaluate the health status of a national higher education system, I should first collate the data collected from the national higher education information, and then screen out the indicators that need to be used to solve the problem. This problem uses rank sum ratio comprehensive evaluation method to carry on the processing.

In the application of this method, the graduation rate of national colleges and universities is regarded as the high excellent index, and the ratio of students to teachers is regarded as the low excellent index.

4.1.2. Establishment of the Model

(1) Data collection and collation

The data collected on the number of students in China and Vietnam, the number of teachers, the number of schools and the ratio of male and female students are screened and reorganized, and the graduation rate and teacher-student ratio of colleges and universities in China and Vietnam are used as indicators and applied to the later modeling.

Table 2. Data comparison between Chinese and Vietnamese students

Country	Year	College graduation rate	The student-teacher ration in institutions of higher learning
China	2010	0.87	4.93
China	2009	0.83	4.94
China	2008	0.84	4.91
China	2007	0.79	4.85
China	2006	0.69	5.08
viet Nam	2010	0.15	28.98
Viet Nam	2009	0.13	28.11
Viet Nam	2008	0.13	28.33
viet Nam	2007	0.15	28.58
Viet Nam	2006	0.14	31.2

Place the collated data in a matrix of the following styles:

$$X = \begin{pmatrix} x_{11} & \cdots & x_{1p} \\ \vdots & \ddots & \vdots \\ x_{n1} & \cdots & x_{np} \end{pmatrix}$$

Among them, x_{ij} represents the value of the evaluation indicator for item j of the i sample

(2) Modeling and Analysis

The rank order is obtained according to the size of each specific evaluation index R , and the rank R is used to replace the original evaluation index value.

The rank data matrix of each index is established according to the rank result.

$$R = \begin{pmatrix} R_{11} & R_{12} & \cdots & R_{1p} \\ R_{21} & R_{22} & \cdots & R_{2p} \\ \vdots & \vdots & \ddots & \vdots \\ R_{n1} & R_{n2} & \cdots & R_{np} \end{pmatrix}$$

R_{ij} : Represents the rank of the evaluation index of item j of the i sample.

Non-integrated rank order

- High-quality indicators:

$$R_{ij} = 1 + (n - 1) \frac{X_{ij} - X_{\min}}{X_{\max} - X_{\min}}$$

- Low-quality indicators:

$$R_{ij} = 1 + (n - 1) \frac{X_{\min} - X_{ij}}{X_{\max} - X_{\min}}$$

$X_{\max} = \max(X_{1j}, X_{2j}, \dots, X_{nj})$, $X_{\min} = \min(X_{1j}, X_{2j}, \dots, X_{nj})$

Within a n row (n evaluation object) p column (p evaluation index) matrix, the RSR formula is:

$$RSR_i = \frac{1}{n \times p} \sum_{j=1}^p R_{ij}$$

In the upper formula, $i = 1, 2, \dots, n$; $j = 1, 2, \dots, p$, R_{ij} Represents the rank of the j column in line i.

If the weight of each evaluation index is different, the weighted rank sum ratio is calculated WRSR, and its formula is:

$$WRSR_i = \frac{1}{n} \sum_{j=1}^p W_j R_{ij}$$

Table 3. RSR value calculation table

Item	Teacher-student ratio in institutions of higher learning	Graduation rate of institutions of higher learning	RSR value	RSR ranking
	[Order]	[Order]		
1	8	10	0.9	1
2	7	8	0.75	4
3	9	9	0.9	1
4	10	7	0.85	3
5	6	6	0.6	5
6	2	4.5	0.325	7
7	5	1.5	0.325	7
8	4	1.5	0.275	9
9	3	4.5	0.375	6
10	1	3	0.2	10

The Probit value is p standard normal deviation plus 5:

Table 4. RSR distribution table

RSR distribution	f	Σf	Average rank	Average rank/n*100%	Probit value
0.2	1	1	1	10	3.718
0.275	1	2	2	20	4.158
0.325	2	4	3.5	35	4.615
0.375	1	5	5	50	5
0.6	1	6	6	60	5.253
0.75	1	7	7	70	5.524
0.85	1	8	8	80	5.842
0.9	2	10	9.5	97.5	6.96

Note: The grey table is estimated by $(1-1/4 * n)$.

The Probit value is used as the x, and the RSR distribution value is used as the y, to fit the regression model:

$$\text{RSR distribution} = -0.769 + 0.254 * \text{Probit value}$$

Table 5. Regression model table

	Non-standardized coefficient		Standardized coefficient	t	p	R ²	Adjust R ²	F
	B	Standard error	Beta					
Constant	-0.769	0.203	-	-3.798	0.009	0.877	0.857	F(1,6)=42.852,p=0.001
Probit value	0.254	0.039	0.937	6.546	0.001			

Finally, the different years of China and Vietnam are divided:

Table 6. File sorting result table

Item	RSR value	RSR rank	RSR fitting value	Level
1	0.9	1	0.998	3
2	0.75	4	0.634	2
3	0.9	1	0.998	3
4	0.85	3	0.714	2
5	0.6	5	0.565	2
6	0.325	7	0.403	2
7	0.325	7	0.403	2
8	0.275	9	0.287	2
9	0.375	6	0.5	2
10	0.2	10	0.175	1

Note: 1-5 is the level of higher education in China from 2010 to 2006, and 6-10 is the level of higher education in Vietnam from 2010 to 2006.

(3) Model conclusions:

- In the final table results, the larger the grade number, the higher the grade level, that is, the better the effect.
- Therefore, China's higher education system was relatively healthy in 2010 and 2008, and Vietnam's higher education system was relatively poor in 2006.
- Although the higher education system in Vietnam is relatively immature, the level of China is not very high, and the development of higher education in China is relatively stable.

4.2. Grey Forecasting Model

In order to evaluate and compare the health level of the proposed state, it is necessary to predict the data of the next few years, and then put the target state data together with the previous data to evaluate the results. The higher education system of the target state is reasonable and sustainable.

Forecast the number of graduates, enrollment, schools and teachers in the next six years.

(1) Line diagram of forecast results:

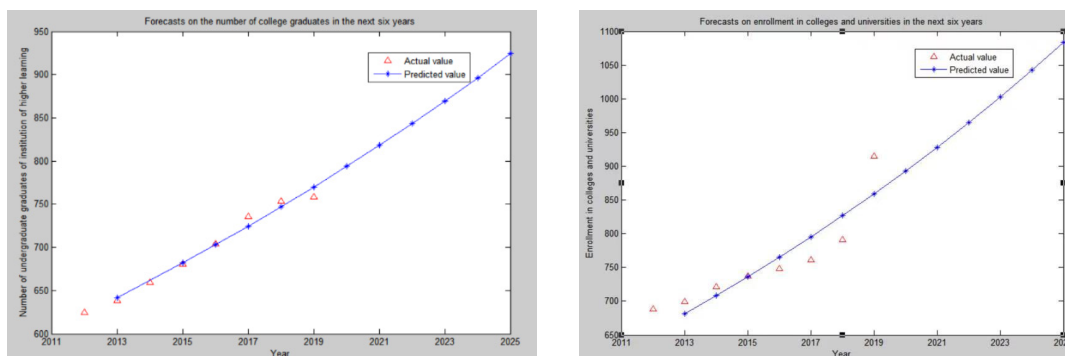


Fig 2. Line diagram of forecast results

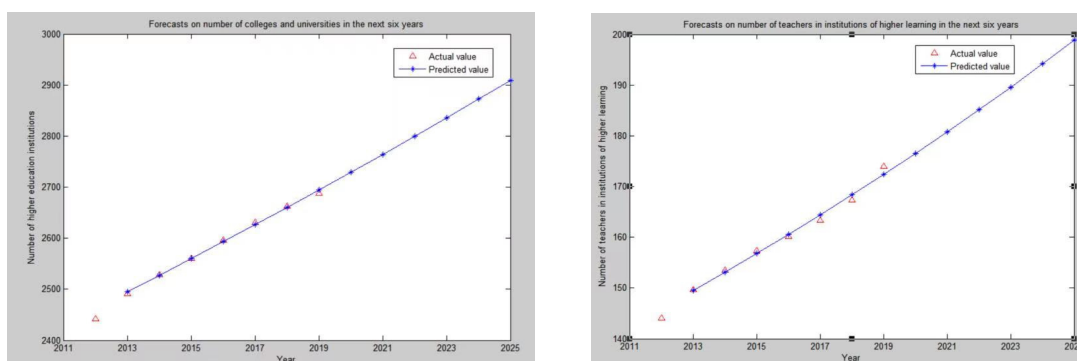


Fig 3. Verification results

(2) Verification results

From the final verification results in the above table, we can see that the target data is the highest and most effective in the final level, so the verification is successful.

4.3. Impact of Implementation on the World

(1) Because of the limited teaching resources, in order to maintain a more healthy and sustainable higher education system, the requirements for students' learning level and self-

cultivation are getting higher and higher, and the entrance threshold for colleges and universities is also getting higher and higher, which is undoubtedly a difficult challenge to mankind. But at the same time, it has a positive impact on the development of the world's cultural level and the progress of science and technology. Colleges and universities will train more and more high-cultural talents to promote the development of the times.

(2) In the face of the imbalance in the number of teachers and students, it is necessary to continuously increase the number of teachers, which makes people have a certain change in the teaching profession, and to reduce or eliminate the prejudice and discrimination in people's hearts. But changing people's stereotypes often takes a long time. The increase of investment in education is often reflected in the increase of teacher welfare and teachers' colleges and universities. It can be seen that this can not be realized overnight and needs people to cooperate with the government to adjust slowly.

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