# Quantitative Analysis of Higher Education Level in the Yangtze River Delta

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***Abstract:*** This paper first determines ten indicators reflecting the development and regional differences of higher education in the Yangtze River Delta from the four dimensions of education investment level, education development level, teaching staff construction level, and education informatization level, uses the entropy method to calculate the comprehensive index of the development level of higher education in the Yangtze River Delta region from 2015 to 2020, and quantitatively analyzes the differences in the development level of higher education in the three provinces and one city. Then, through the analysis of the problems of higher education in the Yangtze River Delta, some suggestions are put forward for the future development of higher education in the Yangtze River Delta.

***Keywords:*** Higher Education; Quantitative Analysis; Entropy Method

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## Introduction

The Yangtze River Delta is one of the important engines of China's economic development. With the deepening of economic integration, the cooperation in higher education in the Yangtze River Delta region has also been pushed to the front. With the rapid development of the Yangtze River Delta[1], there is an imbalance in the development of higher education in various provinces and cities. For example, Anhui Province is inferior to Zhejiang, Jiangsu and Shanghai in terms of teacher resources, education funds, scientific research and experimental development. How to coordinate the resources of various provinces and cities, develop their strengths and complement their weaknesses, and promote the integration process is an important issue to be studied in the development of education in the Yangtze River Delta. In this regard, this paper selects several indicators to measure the development level of higher education, uses the entropy method to make a quantitative analysis of the current situation of the development of higher education in three provinces and one city in the Yangtze River Delta in recent years and gives corresponding suggestions.

## 1. Quantitative Analysis of the Development Level of Higher Education in the Yangtze River Delta

### 1.1 Indicator selection and data collection

According to the principles of scientificity, universality and guidance, this paper selects 10 indicators from the four dimensions of education investment level, education development level, teacher staff construction level and education informatization level to reflect the development of higher education and regional differences in the Yangtze River Delta, which are respectively: the value of higher education teaching and scientific research instrument assets and equipment, the

number of higher education schools (or institutions), the number of ordinary college graduates of higher education, the book assets of higher education, the average number of students on campus per 100000 people in higher education, the ratio of students to teachers in higher education (undergraduate colleges), the number of full-time teachers in higher education schools (institutions), the number of professional and technical positions of full-time teachers in higher education who are senior, the number of full-time teachers in higher education who have been doctors in middle school, and the average number of computers in colleges (sets) PC (Set)[2].

To quantitatively analyze the development status of higher education in the Yangtze River Delta, the data of these 10 indicators from 2015 to 2020 (data source: education statistics of the Ministry of Education of the People's Republic of China) are collected。

## 1.2 Analysis on the Difference of Higher Education Level within the Yangtze River Delta Region by Using Entropy Method

In order to further understand the development of higher education within the Yangtze River Delta region, this paper uses the entropy method to calculate the comprehensive index of the development level of higher education.

**Step 1** Data standardization

As there are dimensional differences between the evaluation indicators of the development level of higher education, in order to ensure the accuracy of the statistical analysis results, this paper conducts standardized conversion of the original data to eliminate the impact of the dimensional differences between indicators on the statistical results.

**Step 2** Use the entropy method to calculate the index weight value

Suppose there are m indicators and n research objects, and the value of the $j$ th indicator variable of the $i$ th research object is $a_{ij}$（$i=1,2,\cdots n,j=1,2\cdots m$）[3].

1. Use standardized data $a_{ij}$ to calculate $y_{ij}$, $y_{ij}$ is the proportion of the ith research object to the jth indicator value.

$$y_{ij}=\frac{a_{ij}}{\sum_{i=1}^{n}a_{ij}},i=1,2,\cdots n,j=1,2\cdots m \quad (1)$$

2. Calculate the entropy value $e_{ij}$ of the indicator j:

$$e_j=-\frac{1}{ln(n)}\sum_{i=1}^{n}y_{ij}ln(y_{ij})(j=1,2,...,m) \quad (2)$$

3. Calculate the information utility value of $d_j$ (the larger the information utility value, the more important the indicator is):

$$d_j=1-e_j,j=1,2\cdots,m \quad (3)$$

4. Calculate the weight value of each indicator $w_j$ (the greater the weight value, the greater the information

represented by the indicator, and thus the greater the impact on the comprehensive evaluation):

$$w_i = \frac{d_j}{\sum_{j=1}^{m} d_i}, j = 1, 2 \cdots, m \quad (4)$$

**Step 3** Calculation of comprehensive index of higher education development level by weighted average of standardized

Based on standardized data and weights, the comprehensive index of higher education development level of th ree provinces and one city in the Yangtze River Delta from 2015 to 2020 is calculated according to the weighted average of standardized values *H*, as shown in Table 1.

Table 1 Comprehensive Index of Higher Education Development Level in Three Provinces and One City from 2015 to 2020

| Year | Region | H | Year | Region | H |
|---|---|---|---|---|---|
| 2015 | Shanghai | 0.2317 | 2018 | Shanghai | 0.3262 |
| | Jiangsu | 0.6345 | | Jiangsu | 0.851 |
| | Zhejiang | 0.2574 | | Zhejiang | 0.3662 |
| | Anhui | 0.1911 | | Anhui | 0.2576 |
| 2016 | Shanghai | 0.2597 | 2019 | Shanghai | 0.325 |
| | Jiangsu | 0.6838 | | Jiangsu | 0.9208 |
| | Zhejiang | 0.2842 | | Zhejiang | 0.4143 |
| | Anhui | 0.2069 | | Anhui | 0.2795 |
| 2017 | Shanghai | 0.2702 | 2020 | Shanghai | 0.3865 |
| | Jiangsu | 0.7732 | | Jiangsu | 0.9623 |
| | Zhejiang | 0.3263 | | Zhejiang | 0.4456 |
| | Anhui | 0.2381 | | Anhui | 0.2878 |

According to the comprehensive index *H* of higher education development level in the Yangtze River Delta from 2015 to 2020, from 2015 to 2020, the ranking has been Jiangsu>Zhejiang>Shanghai>Anhui. At the same time, from the time dimension, from 2015 to 2020, Jiangsu, Zhejiang, Anhui, and Shanghai have always maintained a state of annual growth. Among them, Jiangsu's comprehensive index of educational modernization development level has the fastest growth rate, while Anhui has a slower growth rate. It can also be seen from the combination of Jiangsu's population and the number of colleges and universities that Jiangsu has a large scale advantage in higher education

# 2. Suggestions on the Future Development Plan of Higher Education in the Yangtze River Delta

In the development of education in the Yangtze River Delta, there is an imbalance in the level of education development in the region, which restricts the integration process of the Yangtze River Delta[3]. The main reason is that the Yangtze River Delta urban agglomeration belongs to different provincial administrative regions, which is difficult to coordinate. At the same time, the integration of scientific and technological innovation and higher education in cities in the Yangtze River Delta is not high. [4].

To sum up, the paper proposes the following suggestions:

(1) Continue to promote regional integration and diversification

We should make full use of the resources of higher education in the Yangtze River Delta, optimize the allocation of resources, create a platform for innovation and talent cultivation, and enhance the new impetus for the supply side reform of

regional higher education resources and the integrated, collaborative, innovative development with the deep integration and collaborative development of the innovation chain. "Integration" does not mean "homogenization". Internal regions should give play to their respective advantages to form regional innovation division, complementary advantages and coordinated development. For example, Shanghai should actively give play to the advantages of high-quality higher education resources and play a leading role in regional coordination and governance; Jiangsu Province should make full use of the advantages of higher education scale, teachers, scientific research and other resources to play a driving role in the development of higher education.

(2) Accelerate the integration of higher education, innovation and industry

Higher education in the Yangtze River Delta should grasp the future development trend of the region and the demand for innovative elements, pay attention to serving regional innovative development in discipline construction, talent training, etc., create a scientific and technological research and development platform, and promote the integration of industry, education and research. As a relatively developed area in China, the Yangtze River Delta is moving towards high-end industry. Colleges and universities in the Yangtze River Delta, especially vocational and technical schools, should strengthen the awareness of "education services support the transformation and upgrading of industrial structure", actively layout, and promote the integration of industry and education.

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