

# A Study on the Efficiency of Higher Education at Provincial Level—Take Universities of Hunan Province as an Example

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**Abstract.** For the education system of a country, colleges and universities play the role of the main force of scientific research from the beginning to the end. Based on the undergraduate training data of 17 colleges and universities in Hunan Province, this paper establishes the efficiency evaluation system of educational input and educational achievements. The input index includes scientific research funds, the proportion of high-quality students and the number of tutors with high professional titles. The output index uses the number of degrees granted, papers granted and patents granted. And the expert scoring method is used to give each index a certain weight. Finally, the empirical data is fitted by function. It is found that the educational efficiency of 17 colleges and universities in Hunan Province presents a polynomial distribution trend, and the overall law is in the form of increasing, and the increasing trend increases with the increase of educational investment.

## **1.Introduction**

Since the reform and opening up, the state has paid more and more attention to higher education, and the funds used in education are increasing year by year. However, there are also some problems in this process, such as the waste of resources and the investment in education is not directly proportional to the return on education<sup>[1]</sup>. The high quality based on the waste of resources is not the real high quality. How to run a real high-quality higher education with limited resources, we should first pay attention to efficiency. Therefore, whether it is to improve the quality of undergraduate education, or to solve the growing demand for undergraduate education, we need to pay attention to efficiency first<sup>[2]</sup>.

## 2. Educational efficiency

Educational efficiency is also called educational investment efficiency, resource utilization efficiency, internal efficiency of investment, etc. "Efficiency" belongs to the research category of economics, which is often used to evaluate the relationship between economic input and return<sup>[3]</sup>. Education efficiency refers to the contribution rate of education to the development of single individual or group education.

At present, the research on education efficiency is very hot. Different scholars use different research models to study education efficiency, and put forward reasonable suggestions to improve education efficiency. Domestic and foreign scholars' research on educational efficiency is generally divided into parametric and non parametric methods. The most commonly used non parametric method is data envelopment analysis, which uses input and output data to establish an evaluation model<sup>[4]</sup>. The principle is to determine the correlation of data based on statistical data. Xu Ling used DEA model to evaluate the service industry input-output of 31 provinces in 2014. Teng Yuhua used DEA model to analyze the education index efficiency of Jiangxi Province from 2005 to 2012. Based on the undergraduate training data of 17 colleges and universities in Hunan Province, this paper establishes the efficiency evaluation system of educational input and educational achievements. The expert scoring method is used to give each index a certain weight, and SPSS is used In order to

explore the law of educational efficiency in Colleges and universities in Hunan Province, the software makes function fitting for empirical data, and provides limited suggestions for the rational use of resources.

#### **3.Research Model**

At present, the whole academic community mainly measures education input from the perspective of people, finance and materials. According to the basic positioning and tasks of undergraduate education activities, this paper measures education output from the perspective of talent training, scientific research and social services, as shown in Table 1. Under the guidance of input-output theory, this paper adheres to the principles of representativeness, feasibility, objectivity and scientificity.

The data of scientific research funds are from yearbook database, the data of the number of senior teachers are from the official websites of colleges and universities, the proportion of high-quality students is from the graduate schools of colleges and universities, the number of degrees awarded is approximately replaced by the number of Undergraduates in that year, and the data of papers and patents are from China HowNet, as shown in Table 2 and table 3.

The expert scoring method is used to give a certain weight to each index of input and output. The whole process follows the principle of objectivity to ensure the rationality of the research model. This paper gives 50%, 25% and 25% weight to the index of education input and 20%, 50% and 30% weight to the index of education output, as shown in Table 2 and table 3.

Category				Index				
Educational input				Scientific research funds (100 million) Senior teachers (Thousand)				
				Number of degrees awarded (Thousand)				
Education output				Number of papers (Thousand) Number of patents(Thousand)				
Tab.2 Index data and weight of education investment								
University	Scientific	Senior	Proportion	University	Scientific	Senior	Proportio	
	research	teachers	of high		research	teachers	n of high	
	funds	(Thousand)	quality		funds	(Thousa	quality	
	(100		students		(100	nd)	students	
	million)				million)			
А	40.090	1.700	0.380	J	1.200	0.211	0.070	
В	26.490	1.428	0.420	K	2.950	0.700	0.190	
С	3.510	1.023	0.320	L	3.560	0.242	0.140	
D	3.340	1.116	0.210	Μ	0.930	0.151	0.060	
E	3.870	0.943	0.080	Ν	1.540	0.139	0.060	
F	5.990	0.313	0.120	0	1.260	0.387	0.070	
G	4.620	0.315	0.150	Р	0.950	0.155	0.080	
Н	6.410	0.780	0.250	Q	0.840	0.077	0.050	
Ι	3.320	0.248	0.080					
Weight	50%	25%	25%	Weight	50%	25%	25%	
Tab.3 Index data of educational output and its weight								
University	Number of	Number of	Number of	University	Number of	Number of	Number of	

Tab.1 Evaluation index of educational efficiency

University	Number of degrees	Number of papers (Thousand)	Number of patents (Thousand)	University	Number of degrees	Number of papers (Thousand)	Number of patents (Thousand)
	(Thousand)	(Thousand)	(Thousand)		(Thousand)	(Thousand)	(Thousand)
А	8.526	8.280	3.042	J	4.687	1.626	0.135
В	5.262	4.704	0.882	Κ	5.131	0.822	0.125
С	7.500	1.932	0.156	L	7.798	1.002	0.366
D	7.571	1.446	0.630	Μ	4.008	0.272	0.015
Е	8.750	2.004	0.276	Ν	3.102	0.484	0.114



F	8 250	1 1 2 8	0.654	0	4 254	0 264	0.228
G	6.944	1.002	0.618	P	2.564	0.750	0.282
H	7.155	2.178	0.450	0	3.671	0.288	0.102
Ι	6.500	0.900	0.216	C C			
Weight	20%	50%	30%	Weight	20%	50%	30%

The English letters in the table respectively represent Central South University, Hunan University, Hunan Normal University, Xiangtan University, Nanhua University, Changsha University of science and technology, Hunan University of science and technology, Hunan Agricultural University, Central South Forestry University of science and technology, Hunan University of traditional Chinese medicine, Jishou University, Hunan University of technology, Hunan Institute of technology, Hunan Institute of engineering, Shaoyang University, Hunan Province College of Humanities and technology

## 4. Empirical Analysis

In this paper, two groups of data are fitted by function. By comparing different function types, it is found that R2 of exponential type curve is 0.885, R2 of linear type is 0.911, R2 of logarithm is 0.652, R2 of polynomial is 0.988, R2 of power function is 0.898. From R2, it can be seen that polynomial curve can fit two groups of data together well, while logarithmic curve is the least suitable for fitting two groups of data, such as Figure 1-5.



Fig.5 Power

Through the fitting results, we can get the mathematical function model of education input and education output as follows:

$$y = 0.5177x^2 - 0.4775x + 0.6049 \tag{1}$$

Through the data fitting image and mathematical function, we can see that 1) education input and education output show an increasing trend, that is, the more education input, the more education output; 2) with the increasing of education input, the increasing trend of education output shows an



increasing trend; 3) compared with education input, education output shows a phenomenon of insufficient.

### 5. Conclusions and Suggestions

From the perspective of education input, to improve the quality of undergraduate education, we need to pay more attention to the quality of input elements, not only to guarantee the quantity of education input, but also to the quality of input elements<sup>[5]</sup>. Quantity is the basis and quality is the key. To solve the problem of insufficient output of undergraduate education in Hunan Province, first of all, we should ensure the quantity and quality of input. In addition, we should pay attention to the use process of input elements, and pay more attention to the use mode and efficiency of input.

From the perspective of education output, education output is the key problem of undergraduate education in Hunan Province. The key way to solve this problem is to establish a scientific and effective incentive mechanism. It is not only necessary to motivate students, but also to motivate excellent teachers, so as to play the leading and guiding role of Teachers to students. From schools, colleges and task groups, it's necessary to increase incentives to stimulate students' scientific research and innovation ability, so as to improve educational output.

#### References

- [1] Brent R J. The value of a year's general education for reducing the symptoms of dementia[J]. Social Science Electronic Publishing.
- [2] Galindev R. Leisure goods, education attainment and fertility choice[J]. Journal of Economic Growth, 2011, 16(2):157-181.
- [3] Hendricks L. Cross-country variation in educational attainment: structural change or within-industry skill upgrading?[J]. Journal of Economic Growth, 2010, 15(3):205-233.
- [4] Qureshi, Javaeria A. Additional Returns to Investing in Girls' Education: Impact on Younger Sibling Human Capital[J]. The Economic Journal, 2017.
- [5] Fairlie R W, London R A. The Effects of Home Computers on Educational Outcomes: Evidence from a Field Experiment with Community College Students[J]. Economic Journal, 2012, 122(561):0-0.