

# The Evaluation of Graduate Education in China: A Comprehensive Analysis

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## ABSTRACT

*In the past five years, the China Science Education Evaluation Research Center has published annual China Graduate Education Evaluation Reports in order to create a comprehensive and systematic evaluation of graduate education. Multi-indicator evaluation methods have been adopted to produce an overall competitiveness score for graduate institutions. Based on development and changes in Chinese graduate education, evaluation operations are fine-tuned every year. This paper gives a new perspective on the overall development of Chinese graduate education, which has seen steady progress in recent years. The ranking of graduate institutions has developed significantly and science, engineering and comprehensive universities are offering more competitive graduate education programs. There is, however, still room for Chinese universities to improve, according to a comparative analysis of the recent five evaluation reports. There are also some limitations in the evaluation of current Chinese graduate education. A major deficiency is that there is more emphasis on the sciences and less on the humanities. In addition, the design of evaluation indicators and their relative weights also need to be improved. Further validation of the accuracy and reliability of data is also needed.*

**Keywords:** *graduate education, evaluation, competitiveness, ranking, survey*

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## **Introduction**

Rising demand for university evaluation in China has intensified over the years and the public need to know more about universities (Wuhan University, 2009a). For a long time, many organizations have undertaken statistical and reputational rankings of colleges and have tried to provide guidance for potential students. The significance and the validity of college rankings have become a hotly debated issue.

University ranking dates back to the late 19th and early 20th centuries in the United States. As early as 1870, the Federal Bureau of Education collected various data about more than hundred universities and evaluated their educational performance based on these data. In the 1980s, university ranking in the United States developed and matured. During this period, there were various types of ranking that reflected the performance of U.S. universities from different perspectives. Today, a lot of university rankings have been published in various parts of the world. In addition to national, there are also international university rankings including comprehensive and special rankings. These differ from each other not only in publisher and publication but also in the design, indicators, data and results.. They include “World’s Best Colleges”, also known as the QS World University Rankings, published by *U.S. News and World Report (U.S. News and World Report, 2011)*, “Academic Ranking of World Universities” published by Shanghai Jiao Tong University in Mainland China (Shanghai Jiao Tong University, 2011), “THE World University Rankings” published by *Times Higher Education (Times Higher Education, 2011)*, and “Webometrics Rankings of World Universities” published by Consejo Superiorde Investigaciones Científicas (CSIC) in Spain (Cybermetrics Lab of Consejo Superiorde Investigaciones Científicas, 2011), CHE University Ranking published by the Centre for Higher Education Development (CHE) in German (CHE, 2011), and so on. However, graduate level education ranking has not yet been implemented in a systematic and neutral manner as in other professional disciplines. Most college rankings have focused on undergraduate education and a few publications provide annual graduate school rankings.

Perhaps the best known college ranking is *U.S. News & World Report*. Besides peer assessment, their rankings are also based on graduation rates, financial resources, average GRE scores, student staff ratio and so on. Notably, a new publication, doctoral program rankings, developed by the U.S. National Research Council (NRC) in 2010, collected data

from slightly more than 5,000 doctoral programs in 62 academic fields at 212 universities.

The first results of the “Ranking of Chinese Graduate Schools” by the Academic Degree & Graduate Education Evaluation Center, entrusted by the State Education Commission of China was published at the end of 1995. Thirty-three graduate schools were included as the evaluation subjects and three aspects: the quality of the graduate student body, discipline development and achievements and institutional establishment, were chosen as evaluation indicators.

In April 1998, Yanhou Cai conducted an investigation of the talent of Chinese universities. The number of doctoral degree programs, the number of post-doctoral “circulation stations”, the number of national key disciplines (including the state key laboratories, national engineering and technical research centers) and national science research establishments were taken into account. Yanhou Cai is now a professor in the Department of Education Studies at Beijing Geely University and is the research group director of China University Evaluation sponsored by the Alumni Association of China since 2005. The results were published on the website of the Alumni Association of China (<http://www.cuaa.net/>) over the past five years.

In July 2000, the Guangdong Institute of Management Science made a study of 187 Chinese institutions, graduate schools, graduate offices and graduate departments that offered doctoral degrees. Guangdong Institute of Management Science (GIMS) was a branch institute of China Academy of Management Science (CAMS) which was established by the former State Science and Technology Commission in 1987. GIMS published the first evaluation report on China universities in 1993. It released annual evaluation reports on Chinese universities until 2008.

Based on previous evaluation programs, the first evaluation report on Chinese graduate education was produced by China Science Education Research Center (CSEERC) and released in 2005. In the past five years, CSEERC has conducted comprehensive studies on the current quality of graduate education in China. CSEERC has issued five annual reports. From March to June every year, researchers in CSEERC concentrate their efforts on investigating the graduate educational strength of Chinese graduate institutions, publishing and then distributing evaluation reports with ranking tables and analyses throughout China. The leading disciplines of each institute and ranking tables from various perspectives are included in the reports. Graduate schools and institutions are ranked by overall competitiveness scores. Subjects are also compared with regard

to each indicator. Leading graduate disciplines of all the institutions are also ranked. First-level disciplines and specialties are ranked by scores of excellence. The investigation and the analysis of Chinese graduate education are of great significance since they yield a blueprint for the development of Chinese graduate education. Consequently, the five reports lend support not only to identifying problems within graduate education but also encourage the advancement of higher education.

## **Approaches to China Graduate Education Evaluation**

Metrological methods are used to evaluate the competitiveness of Chinese graduate institutions. The evaluation of graduate education is carried out according to various factors. First, the measurement indicators and weights are decided based on surveys, the results of which were published in 2004. Second, assessment methods such as comprehensive evaluation, classified evaluation and multi-level evaluation are adapted. Third, throughout the evaluation process, several important principles (Qiu et al., 2005a, 2005b, 2005c, 2005d) such as conducting the evaluation according to national guidelines on scientific, educational and cultural activities are strictly observed. For evaluation focused on graduates, scientific research carries a little more weight than teaching in the index system.

## **Evaluation Subjects and Scope**

To ensure the continuity of evaluation and comparability of the results, research subjects and scope, data sources and data processing method, the indicators are those used in previous years with some modifications to reflect new laws and characteristics of Chinese graduate education. For example, only Innovative Research Teams nominated by the National Natural Science Foundation of China (NSFC) are included in the indicator “Number of National Innovative Research Teams” in previous years. Since 2009, the Innovative Teaching Teams nominated by the Ministry of Education of China have also been taken into account in this indicator.

At present, Chinese graduate institutions are mainly scattered

throughout colleges and national academies or research institutes. There are three main types of graduate institutions in universities: graduate schools, graduate departments and graduate offices, according to the overall strength of the university. The number of each type of graduate institution is shown in Table 1.

In 1978, the Chinese State Council approved the first graduate school in the University of Science and Technology of China. Including the eighth doctor and master degree authority audits in 2003, except for four provinces or autonomous regions (Hainan Province, Guizhou Province, Ningxia Autonomous Region and Tibet Autonomous Region), 56 universities in 27 provinces have established graduate schools. The 56 universities with graduate schools can with approval add a limited number of master's degree programs. However, China Peking Union Medical College was renamed Beijing Union Medical College, and has been collaborating with the Chinese Academy of Medical Sciences since 2008, so there is a total of 55 universities with graduate schools in 2009. Up to the present, these 55 graduate schools have trained 76% of all doctors and 55% of all masters (Ministry of Education of China, 2010). Graduate school is the most important form of graduate education in China. Universities with graduate schools have approximately 20% of graduate students exempted from admission tests, while that percentage for universities without graduate school is less than 10%. Graduate schools are authorized to set their own admission criteria, while other graduate institutions have to comply with national regulated rules. Only graduate institutions with good performance for teaching and research are qualified to apply to establish graduate schools.

It is not realistic to evaluate all graduate institutions in China for there are complex and intertwined relationships among them. There are many multiple-level graduate institutions and universities with graduate schools and it is also difficult to define an institution. There are graduate programs affiliated to national academies, such as the Chinese Academy of Sciences. In addition, the management of many Chinese graduate schools has a hierarchical structure, resulting in many small institutions affiliated with a larger one, further contributing to the difficulty of clearly defining an independent entity for evaluation. Also, based on the latest list of graduate institutions released by the Chinese Ministry of Education, enrollment in the different disciplines and specialties of these graduate institutions varies year by year. Finally, we took four graduate schools from the National Academy of Sciences (Chinese Academy of Sciences, Chinese Academy of Social Sciences, Chinese Academy of

Agricultural Sciences and Chinese Academy of Medical Sciences) and 477 universities with graduate institutions as evaluation subjects for 2009. These 477 universities include 52 with graduate schools (excluding the three military academies and the graduate school of the CPC Central Committee Party School) and 425 colleges or universities with graduate institutions (graduate departments, offices, centers and so on). As for the discipline evaluations, 11 primary disciplines and 81 first-level disciplines were taken into account. One primary discipline and eight first-level disciplines related to military sciences were excluded. Eventually, this graduate education evaluation covered 477 institutions, 11 primary disciplines, 81 first-level disciplines and 373 specialties.

Table 1: Number of Chinese Graduate Institutions

Administration	Organizational system	
	Type	Number
National academy	Graduate school	4
	Graduate department	-
National institute	Graduate office	(No specific statistical data)
	Graduate center	
University	Graduate school	56
	Graduate department	
	Graduate office	425
	Graduate center	

## Index System

Methods based on multi-indicator evaluation are used to evaluate graduate education in China. Three primary indicators, 11 secondary indicators and 22 extra indicators were selected to form the indicator system. The weight of each indicator was computed on the basis of the advice of experts and calculated by the method of analytic hierarchy. The index system is shown in Table 2.

Table 2: Indicator System of Research Competitiveness Evaluation of Chinese Graduate Education

Primary indicators	Secondary indicators	Extra indicators	Weight	
Educational resources	Disciplines	Number of primary disciplines for master degrees	0.03	
		Number of primary disciplines for doctoral degrees	0.05	
	Research base	Number of key research base for Chinese National Natural Science	0.03	
		Number of key research base for Chinese National Social Science	0.03	
	Scientific research item	Number of scientific research items from National Natural Science Foundation of China	0.03	
		Number of scientific research items from National Social Science Foundation of China	0.03	
	Research fund	Amount of research fund from National Natural Science Foundation of China	0.03	
		Amount of research fund from National Social Science Foundation of China	0.03	
	Outstanding scientific researcher	Number of National Innovation Research Team	Number of outstanding researchers	0.01
			Number of Fellow of Chinese Academy of Science and Chinese Academy of Engineering	0.01
Number of tutors of Ph.D candidates		Number of tutors of Ph.D candidates	0.02	
Teaching and output	Graduate	Number of postgraduates and Ph.D graduates	0.08	
	Patent	Number of patents certified	0.07	
	Paper	Number of papers embodied by SCI or SSCI or A&HCI database	0.07	
		Number of papers embodied by EI or ISTP or ISSHP database	0.07	
		Number of papers embodied by CSTPC or CSSCI database	0.06	
Quality	Award of scientific research	Number of National Science & Technology Award and number of Social Award from Ministry of Education	0.07	

Primary indicators	Secondary indicators	Extra indicators	Weight
	Award of graduate student	Number of national excellent Ph.D Dissertations	0.06
	Quality of paper	Number of top papers embodied by Science or Nature	0.07
		Total cites by papers embodied in SCI or SSCI or A&HCI database	0.07
		Total cites by papers embodied in CSTPC or CSSCI database	0.06

*Source:* Qiu et al. (2005a, p. 54, 2005b, p.20, 2005c, p.32, 2005d, p.7)

## Data Sources

In graduate education evaluation, data comes from four sources: (1) statistical data (compilations, yearbooks, reports etc.) issued by Chinese government departments, *i.e.*, “zhong guo gao xiao da quan” published by the Ministry of Education of China, (2) domestic academic databases and databases from abroad, such as the Chinese Social Sciences Citation Index (CSSCI) published by Chinese Social Sciences Research Evaluation Center, Chinese Science and Technology Paper and Citation Database (CSTPC) provided by the Institute of Scientific and Technical Information of China, Science Citation Index (SCI), Social Science Citation Index (SSCI) and Arts & Humanities Citation Index provided by Thomson Reuters, (3) websites of government departments, colleges, universities etc., (4) relevant national publications, books, newspapers, internal sources etc. In data processing, we conducted a comprehensive verification of raw data, developed relevant databases and then handled exceptions. After this, all the effective data were computed and statistically analyzed.

## Result Analyses

Upon completion of data processing, analysis and evaluation, the results of the evaluation project on Chinese graduate education were published.



### The Current Graduate Education Situation in 31 Provinces

Overall competitiveness rank of regions was introduced in domestic graduate education evaluation for the first time in 2005. The ranking results of the top ten provinces are shown in Table 3.

Table 3: Top 10 Graduate Educational Provinces of China(2009)

Area	Overall ranking in 2009	Educational resources	Teaching & output	Quality & effect	Total score	Overall ranking in 2009 compared with previous years			
						2008	2007	2006	2005
Beijing	1	1	1	1	100	→	→	→	→
Shanghai	2	2	3	2	89.72	↑1	→	↑1	↑1
Jiangsu	3	3	2	3	89.53	↓1	→	↓1	↓1
Hubei	4	4	4	4	84.07	→	→	→	→
Shanxi	5	5	5	8	78.28	↑1	↑1	→	→
Guangdong	6	6	6	6	78.06	↓1	↓1	→	→
Shandong	7	7	7	7	76.03	↑1	↑2	↑2	↑3
Zhejiang	8	12	9	5	75.26	↑2	→	→	→
Liaoning	9	8	8	12	74.34	↓2	↓2	↓2	↓2
Sichuan	10	10	10	10	72.99	↓1	→	→	↓1

Source: Qiu et al. (2008, p. 43), Qiu et al. (2008, p. 125), Qiu et al. (2005a, p. 55, 2005b, p.21, 2005c, p.32), Qiu et al. (2006, p.109), Wuhan University (2009b, 2008, 2007, 2006)

The area competitiveness ranking underwent little change from 2005 to 2009. Among the 31 provinces in China, there are 11 areas with no institution ranked among the top 50 graduate institutions. Most of these 11 areas are located in western China where there is a relatively weak economy. Nearly 50% of the top institutions are located in Beijing, Shanghai, Jiangsu and Hubei. In particular, eight or nine institutions are recorded as located in Beijing every year. In Zhejiang, Anhui, Heilongjiang, Jilin, Shandong, Fujian, Gansu, Henan and Yunnan, only one institution from each region was ranked among the top 30 in 2009. These findings indicate that the strength of graduate education in China is unevenly distributed, as can be seen in Table 4.

Table 4: Distribution of the Top 50 Graduate Institutions Over Provinces

Area	2009		2008		2007		2006		2005	
	Number	P.C.	Number	P.C.	Number	P.C.	Number	P.C.	Number	P.C.
Beijing	9	18%	9	18%	8	16%	8	16%	9	18%
Shanghai	6	12%	5	10%	5	10%	5	10%	5	10%
Hubei	6	12%	6	12%	6	12%	6	12%	6	12%
Jiangsu	4	8%	5	10%	5	10%	5	10%	8	16%
Shaanxi	3	6%	3	6%	3	6%	3	6%	3	6%
Guangdong	3	6%	3	6%	3	6%	3	6%	2	4%
Sichuan	3	6%	2	4%	2	4%	2	4%	2	4%
Tianjin	2	4%	2	4%	2	4%	2	4%	2	4%
Hunan	2	4%	3	6%	2	4%	2	4%	2	4%
Liaoning	2	4%	2	4%	2	4%	2	4%	2	4%
Chongqing	2	4%	2	4%	2	4%	2	4%	1	2%
Zhejiang	1	2%	1	2%	1	2%	1	2%	1	2%
Jilin	1	2%	1	2%	2	4%	2	4%	1	2%
Shandong	1	2%	1	2%	1	2%	1	2%	2	4%
Anhui	1	2%	1	2%	1	2%	1	2%	1	2%
Heilongjiang	1	2%	1	2%	1	2%	1	2%	1	2%
Fujian	1	2%	1	2%	1	2%	1	2%	1	2%
Gansu	1	2%	1	2%	1	2%	1	2%	1	2%
Henan	1	2%	1	2%	1	2%	1	2%	-	-
Yunnan	-	-	-	-	1	2%	1	2%	-	-

Source: Qiu et al. (2008, p.43), Qiu et al. (2008, p.125), Qiu et al. (2005a, p. 55, 2005b, p.21, 2005c, p.32), Qiu et al. (2006, p.109), Wuhan University (2009b, 2008, 2007, 2006)

## Overall Competitiveness of Chinese Graduate Schools

A total of 15 (50%) science and engineering graduate schools, twelve (40%) comprehensive graduate schools, two normal graduate schools and one literature graduate school were ranked among the top 30. Among all the 56 graduate schools, there were 12 comprehensive graduate schools, which were all ranked in the top 30. While the two graduate schools of normal universities from the top 30 were both located between the 20<sup>th</sup> and 30<sup>th</sup> places, most of the top 30 graduate schools were science, engineering or comprehensive graduate schools. In fact, these two types of graduate schools accounted for 90% of the top 30 graduate schools in 2006, 2007 and 2009. As for the humanities and law, only Renmin University of China is ranked in the top 30 every year. The Chinese Academy of Social Sciences was also ranked among the top 30 in 2005 but has not been one of the top 30 since 2006. There are only two graduate schools of a normal university, Beijing Normal University and East China Normal University. They have been ranked within top 30 every year, indicating their competitive advantage over other institutions of the same type.

Only two graduate schools of agriculture and forestry type reached the top 30 in 2005 and 2008, as shown in Table 5.

Table 5: Distribution of Institution Types Over the Top 30 Graduate Schools

Type	2009		2008		2007		2006		2005	
	Number	%	Number	%	Number	%	Number	%	Number	%
Science and engineering	15	50%	13	43.3%	15	50%	16	53.3%	13	43.3%
Comprehensive	12	40%	12	40%	12	40%	11	36.7%	11	36.7%
Literature and law	1	3.3%	1	3.3%	1	3.3%	1	3.3%	2	6.7%
Normal	2	6.7%	2	6.7%	2	6.7%	2	6.7%	2	6.7%
Agriculture and forestry	-	-	2	6.7%	-	-	-	-	2	6.7%

As is shown by overall competitiveness rankings of graduate schools, there is a big gap between the Chinese Academy of Sciences and the graduate schools of the universities. The overall competitiveness of university graduate schools is much inferior to graduate schools attached to the Chinese Academy of Sciences, which is evident from the overall ranking and discrete data.

In 2009, the Chinese Academy of Sciences was ranked as the best, while Tsinghua University and Peking University were still ranked the second and the third respectively with a large advantage over other institutions. Huazhong University of Science and Technology (HUST), Sichuan University (SCU), Shandong University (SDU), Central South University (CSU) and Lanzhou University (LZU) saw a steady rise in ranking from 2005 to 2009. The ranking of HUST, SCU and SDU rose continuously from 2007 to 2009 and LZU has seen the biggest increase in recent years. There are some graduate schools that are falling such as University of Science and Technology of China (USTC), Xi'an Jiaotong University (XJTU), Beijing Normal University (BNU) and Tianjin University (TJU). Compared with 2008, Tianjin University had the biggest rise of seven places in 2009. However, it should be noted that the ranking of Tianjin University kept going down from 2005 to 2008 so that the rise in 2009 simply restored the same ranking in 2005. Dalian University of Technology (DLUT) and South China University of Technology (SCUT) had the second biggest rises in the ranking, both with a rise of six places. Renmin University of China (RUC), Beijing University of Aeronautics and Astronautics (BUAA) and East China

Normal University (ECNU) had the largest drop of five places. Compared with 2005, when the evaluation of graduate schools of CSEERC was conducted for the first time, LZU, SDU and Southeastern University (SEU) witnessed the biggest increase in ranking over 2009, with a rise of 16, 10 and 8 places respectively. Tongji University showed the biggest decrease of 10 places, followed by USTC, Nankai University (NKU) and BNU with the second biggest decline. Other graduate schools showed some modest fluctuations .

### **Overall Competitiveness Rankings of Chinese Graduate Institutions**

There are nine types of graduate institutions: comprehensive, normal, national, literature, financial and law, science and engineering, agricultural and forestry, medicine and sport and arts. For historical reasons, there are a lot of graduate institutions with only a few disciplines in China. The scores of these graduate institutions may be relatively low, since they are ranked by the total scores of primary disciplines. The ranking of the top 50 universities over the past five years is shown in Appendix 1 (see Appendices).

Besides four graduate schools affiliated to four national academies of science, the Ministry of Education of China between March 1984 to August 2003 approved a total of 56 universities to establish graduate schools. No more graduate schools were established after 2003. In the overall competitiveness evaluation of Chinese graduate schools, there is a total of 56 graduate schools and four graduate schools affiliated to four national academies of science (except for three military graduate schools) that are evaluated by subjects. These include 52 graduate schools established in universities (the graduate school of “Beijing Union Medical College” is regarded as part of “Chinese National Academy of Sciences”). Nine university graduate schools failed to reach the top 52 graduate institutions on overall competitiveness in 2009. Nine graduate institutions of universities reached the top 52 in 2009. Among these nine universities, three were located in Wuhan, indicating relatively strong graduate educational competitiveness. Except for the top 29 universities which were analyzed previously, only 23 universities rated from 30th to 52th will be analyzed here. East China University of Science and Technology had the most remarkable achievements. It jumped from 59th in 2005 to 42nd in 2009 while rising every year. Apart from that, Zhengzhou University, Beijing University of Science and Technology,

Suzhou University and Capital Medical University performed quite well in general, maintaining a strong growth trend despite some fluctuations. Wuhan University of Technology has risen steadily in the ranking over the past three years. There are, however, some institutions showing a falling trend. For example, Huazhong Agricultural University showed a continuous decline from 2005 to 2009, except for an increase in 2008.

Compared with 2008, the University of Electronic Science and Technology of China and Capital Medical University made the largest increase of 11 places and 10 places respectively in 2009. Their growth rate was larger than other institutions and it showed a clear growth trend from 2005 to 2009. Beijing Jiaotong University was ranked 51th. Compared with the results of first evaluation on graduate education in 2005, Capital Medical University increased from 82th in 2005 to 46th in 2009 with the biggest ranking rise of 36. Zhengzhou University took the second biggest ranking increase of 23 places. Besides, Jinan University and East China University of Science and Technology both saw a rise of 17 places. Nanjing Agricultural University dropped from 28th to 47th position with a biggest decline of 19 places, while Nanjing University of Aeronautics and Astronautics and China Agricultural University made the second and third largest decline in these five years with a decrease of 17 and 13 places, respectively.

### **Ranking of Overall Competitiveness of Primary Chinese Graduate Disciplines**

There are ten graduate institutions offering all the 11 primary disciplines. Another ten institutions offer ten primary disciplines. Among these, with the exception of Tianjin University, nine universities offer graduate programs in ten primary disciplines other than agriculture sciences. Even Renmin University of China and University of Science and Technology of China, which are both of relatively smaller size, offer graduate programs in nine primary disciplines. All these findings indicate the comprehensive development of Chinese graduate institutions. The overall competitiveness ranking of primary disciplines of the top 30 graduate institutions in 2009 is shown in Appendix 2 (see Appendices). In 2009, philosophy, economics, law, literature, science, engineering and management were included in the top 30 institutions. Neither Renmin University of China nor the China Agricultural University in the top 30 has yet offered a discipline or specialty corresponding to education science. Seventeen institutions have yet to set agriculture science,

followed by seven institutions that do not offer history and five that do not offer medical science.

Peking University received the first place in literature, science and medical science. Renmin University of China ranked first in philosophy, economics and law, which indicated its strong leading position in humanity. Beijing Normal University was ranked first in education, Nankai University and Tsinghua University took first place in history and engineering science respectively. China Agricultural University led agriculture and Wuhan University obtained the first position in management. The number of institutions for each discipline is shown in the head of Appendix 2 (see Appendices). As can be seen, 343 graduate institutions offer engineering and the same number offer management. Only 11 institutions offer agricultural science. Figure 1 shows the distribution of the 11 primary disciplines over the 477 institutions.

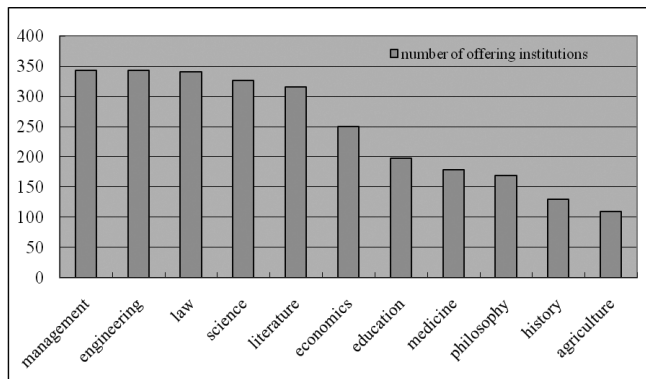


Figure 1: Number distribution of the 11 primary disciplines over 477 graduate institutions (2009)

### Ranking of First-level Disciplines and Specialties in Graduate Institutions

Table 6 and Table 7 show first-level disciplines and specialties of the top ten graduate institutions. Considering scores of overall competitiveness of institutions, we use numbers of stars to represent strength of the institutions or disciplines. 5\* represents those first-level disciplines or specialties which are ranked in the top 5% of all offering institutions. 4\* indicates an advanced discipline which falls between the top 5% and 20%. 3\* indicates a good discipline which falls between the top 20% and 50%. 2\* indicates an ordinary discipline falling between the lower 50% to 80%. 0\* indicates one of the ordinary disciplines which falls in the

last 20%. Those disciplines and specialties of 5\* and 4 \* are considered dominant disciplines and specialties. Peking University, for example, has a total of 46 first-level disciplines, 29 of which are ranked in the top 5% of all the offering institutions. Its excellent rate (84.78%) ranks first among all the graduate institutions. Excellent rates of disciplines (specialties) are not distributed uniformly over graduate institutions. A majority of the superior disciplines (specialties) come from the top graduate institutions.

Table 6: Grade of First-level Disciplines in the Top 10 Chinese Graduate Institutions (2009)

Ranking in 2009	University	Total number of first-level discipline	Number of 5*	Number of 4*	Number of 3*	Number of 2*	Number of 0*	Excellence rate of discipline %
1	Tsinghua University	49	26	7	13	2	1	67.35
2	Peking University	46	29	10	6	1	0	84.78
3	Zhejiang University	70	25	25	11	6	3	71.43
4	Shanghai Jiao Tong University	63	16	16	18	12	1	50.79
5	Huazhong University of Science and Technology	51	16	21	7	5	2	72.55
6	Fudan University	36	19	10	5	2	0	80.56
7	Sichuan University	56	9	25	18	3	1	60.71
8	Wuhan University	52	12	22	11	6	1	65.38
9	Nanjing University	49	8	22	10	2	7	61.22
10	Jilin University	65	9	23	19	12	2	49.23

Source: Wuhan University (2009b)

Table 7: Grade of Specialties in the Top 10 Chinese Graduate Institutions (2009)

Ranking in 2009	University	Total number of first-level discipline	Number of 5*	Number of 4*	Number of 3*	Number of 2*	Number of 0*	Excellence rate of discipline %
1	Tsinghua University	170	73	57	29	9	2	76.47
2	Peking University	186	101	64	20	1	0	88.71
3	Zhejiang University	267	59	105	50	41	12	61.42
4	Shanghai Jiao Tong University	182	52	67	45	15	3	65.38
5	Huazhong University of Science and Technology	182	45	62	43	16	16	58.79
6	Fudan University	170	43	82	32	12	1	73.53
7	Sichuan University	225	15	89	70	33	18	46.22
8	Wuhan University	213	30	74	79	25	5	48.83
9	Nanjing University	169	20	69	52	13	15	52.66
10	Jilin University	232	23	55	94	38	22	33.62

Source: Wuhan University (2009b)

## The Most and the Least Popular Graduate Disciplines and Specialties

Table 8 and Table 9 show the 20 most popular first-level disciplines and the 20 least popular first-level disciplines. Marxist Theory is the most common first-level discipline among the institutions with 67% (319/477) institutions offering it. But Armament Science and Technology has been established in only nine institutions.

The frequency of the most common and least common specialties was also examined. Ideological and political education, computer application technology, business management, basic tenets of Marxism and applied mathematics are offered in more than 200 institutions. On the contrary, unpopular specialties such as weapon firing theories and techniques, fishing science, nuclear fuel cycle and materials, military law, military chemistry and pyrotechnics technology, military preventive medicine, astrometry and celestial mechanics and Indian language and literature are offered in four or fewer institutions. It should be noted that military institutes and military disciplines are not included as evaluation subjects, so the actual number of military-related subjects might be greater.

Table 8: Distribution of First-level Disciplines in Graduate Institutions: Most and Least Popular

First-level discipline	Number of institutions offering courses	First-level discipline	Number of institution offering courses
Marxist theory	319	Veterinary medicine	43
Business administration	287	Ethnology	42
Computer science technology	277	Horticulture	42
Applied economics	233	Agricultural resources utilization	40
Mathematics	227	Geology	38
Biology	215	System science	37
Foreign language and literature	214	History of science & technology	29
Public administration	213	Ocean science	28
Chemical engineering and technology	207	Fisheries	27
Art science	201	Textile science and engineering	25
Materials science and technology	196	Metallurgical engineering	25
Mechanical engineering	196	Nuclear science and engineering	21
Environmental science and engineering	191	Aviation and Aerospace sciences and engineering	18
Control science and engineering	183	Ship and Ocean Engineering	17
Law	182	Geophysics	17
Chemistry	175	Forestry engineering	17
Management science and engineering	173	Atmospheric science	16
Philosophy	170	Astronomy	16
Information and communication engineering	166	Oil and natural gas engineering	14
Politics	166	Armament science and technology	9

Source: Wuhan University (2009b)



Table 9: Distribution of Specialty in Graduate Institutions: Most and Least Popular

First-level discipline	Number of institutions offering courses	First-level discipline	Number of institution offering courses
Ideological and political education	277	Fishery resources	8
Computer application technology	271	Sugar engineering	8
Business management	253	Space physics	7
Basic tenets of Marxism	234	European language and literature	7
Applied mathematics	209	Leather chemistry and engineering	7
Applied chemistry	191	Forest engineering	7
Mechanical design and theory	176	Underwater acoustics engineering	7
Linguistics and Applied	175	Oil-gas well engineering	7
Linguistics in Foreign Languages			
Management science and engineering	173	Aviation, aerospace and nautical medicine	5
Computer Software and Theory Engineering	166	Nuclear Energy Science and	5
Marxism Sinolization Research	163	Artillery, Automatic Gun and Ammunition Engineering	5
Biochemistry and molecular biology	162	Physical oceanography	5
Materials science	161	Weapon firing theories and techniques	4
Control theory and control engineering	159	Fishing science	4
Industrial economics	157	Nuclear fuel cycle and materials	4
English language and literature	156	Military law	3
Environmental engineering technology	151	Military chemistry and pyrotechnics	3
Materials physics and chemistry	150	Military preventive medicine	2
Accounting	149	Astrometry and celestial mechanics	2
Environmental science	146	Indian language and literature	2

Source: Wuhan University (2009b)

## Conclusions

Comparative analysis of the five evaluation reports of graduate education in China from 2005 to 2009 indicates that the overall competitiveness of graduate institutions has maintained a steady development in general graduate education (Wuhan University, 2009b). The trend of evolving Chinese graduate institutions is that they are becoming more focused on the quality and efficiency of their graduate programs and they are also more aligned with international standards in the following respects.

It is noticeable that data source of several three-level indicators came from databases abroad, that is the “number of papers indexed by SCI, SSCI or A&HCI database”, “number of papers indexed by EI or ISTP or ISSHP database” under secondary indicator “paper”, “number of top papers published in *Science* or *Nature*” and the “total citations of papers indexed in SCI or SSCI or A&HCI database” under “quality”. These four indicators together account for a weighting of 30%. More

and more universities are paying attention to performance in foreign databases. In fact, academic achievement in English has become one of the most important indicators for teachers' titles, awards and funding opportunities. Those universities ranked higher usually perform better in databases abroad.

The ranking of competitiveness of graduate educational areas remains stable, with the results of the five area rankings from 2005 to 2009 indicating agreement with each other. As for overall competitiveness of graduate education, the top ten areas have always been Beijing, Shanghai, Jiangsu, Hubei, Shaanxi, Guangdong, Shandong, Zhejiang, Liaoning and Sichuan, with some minor variations. Over the past five years, the rankings of Beijing and Hubei have remained unchanged while the other eight provinces have changed but not much. Notably, the fastest growth has come from Shandong province. It is interesting to note that the competitiveness of graduate education and the area's economic development are closely related. For example, Beijing has firmly held the first place in graduate educational competitiveness ranking. On the three primary indicators of educational resources, teaching and research output, and quality and impact, Beijing also ranks first. In addition, four national academies are located in Beijing and this makes Beijing's score higher. After Beijing, the other two developed areas, Jiangsu province and Shanghai, are in second and third place. Among the top ten provinces, Hubei, Shaanxi and Sichuan, where the local economy is relatively weak, rank ahead of other provinces due to location advantages and historical reasons. On the other hand, administrative departments also should provide a solid foundation for graduate institutions to maintain and improve the level of graduate education by promoting economic growth with policies and measures. Within provinces, there are also a few changes. The relative strengths and weaknesses of each area can be found out by comparing rankings and changes from indicators. On the whole, except for Beijing, Shanghai, Jiangsu and Hubei where rankings are relatively stable, there are evident changes in the rankings of the other areas.

The competitiveness rankings of graduate schools have changed significantly, showing intense competition among schools. The results of the five evaluations of 56 graduate schools reveal that only a few graduate schools have kept stable positions although some graduate schools of several institutions have taken relatively smaller changes in the rankings, such as the Chinese Academy of Sciences, Tsinghua University, Peking University, Zhejiang University, Shanghai Jiaotong University and Jilin

University. Other graduate schools fluctuated in the rankings from 2005 to 2009. Most of the top 30 graduate schools are science and engineering or comprehensive graduate schools.

The competitiveness ranking of graduate institutions in China has changed significantly, again demonstrating intense competition among Chinese graduate institutions. Except for Tsinghua University, Peking University, Zhejiang University, Shanghai Jiaotong University, Jilin University, Beijing Institute of Technology, and Southwest University demonstrating smaller changes in rankings, the institutions in the top 50 have changed substantially. East China University of Science and Technology, Zhengzhou University, Beijing University of Science and Technology, Suzhou University and Capital Medical University have shown strong growth over the past five years. In addition, Wuhan University of Technology has continued to rise over the past three years. Huazhong Agricultural University dropped continuously from 2005 to 2009 and Jinan University has also shown a clear declining trend.

The results of the evaluation of competitiveness in the primary disciplines suggest that the top 30 institutions include more complete disciplines. Even for those institutions with a relatively smaller size, such as Renmin University of China and University of Science and Technology of China, nine primary disciplines of the total of 11 evaluated disciplines are included. First-level disciplines and specialties are distributed unevenly. Each institution had a mean of 5.67 first-level disciplines in 2009. There are 28 institutions with all the 11 disciplines but there are 54 institutions with only one primary discipline in all of the 477 institutions. Engineering and management are offered in 343 institutions. There are few institutions with agriculture programs, with only 109 institutions offering agriculture-related graduate programs. All of the 81 first-level disciplines appeared 8,310 times in 2009. Marxist Theory is the most common first-level discipline among the institutions with 67% (319/477) of them offering it, while “armament science and technology” is just offered in 9 institutions. Among the 373 graduate specialties, ideological and political education, computer application technology, business management, basic tenets of Marxism and applied mathematics are more popular than other specialties. There are also some less popular graduate specialties, such as weapon firing theories and techniques, fishing science, nuclear fuel cycle and materials, military law, military chemistry and pyrotechnics technology, military preventive medicine, astrometry and celestial mechanics and Indian language and literature.

However, there are also some limitations of the graduate education evaluation. A major deficiency is that we did not consider the scale factor. The current evaluation system always favors larger-scale universities, especially in indicators such as resources and output. In addition, the design of evaluation indicators and their relative weights also need to be improved. Further verification of accuracy, reliability and authoritative sources of data is also required. We are currently working towards removing these obstacles and producing a more accurate evaluation in the future.

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Appendices

Appendix 1. Top 50 Chinese graduate institutions in 2009

Ranking in 2009	Graduate school	Total score	Rank of Development Resources	Rank of teaching and production	Rank of quality and effect	Rank within the province	Rank within the same type of school	Overall ranking in 2009 compared with previous years				
								2008	2007	2006	2005	
1	Tsinghua University	100	2	2	2	Beijing	S&T	1	↑1	↑1	↑1	→
2	Peking University	98.69	3	4	1	Beijing	S&T	1	↓1	↓1	↓1	→
3	Zhejiang University	97.38	1	5	3	Zhejiang	Comprehensive	2	→	→	→	→
4	Shanghai Jiao Tong University	95.57	5	3	4	Shanghai	Comprehensive	2	↑1	↑1	→	→
5	Huazhong University of Science and Technology	92.77	10	1	8	Hubei	S&T	3	↑2	↑3	↑2	↑3
6	Fudan University	89.52	4	14	5	Shanghai	S&T	3	↓2	↓2	↓1	↓1
7	Sichuan University	86.69	7	6	11	Sichuan	Comprehensive	4	↑1	↑8	↑5	↑4
8	Wuhan University	86.51	9	7	9	Hubei	Comprehensive	5	↑2	↓1	↓2	↓1
9	Nanjing University	86.18	6	10	10	Jiangsu	Comprehensive	6	↓3	↓3	↓1	↓3
10	Jilin University	85.86	11	21	6	Jilin	Comprehensive	7	↓1	↑1	↑1	→
11	Sun Yat-sen University	84.62	8	12	13	Guangdong	Comprehensive	8	→	↓2	↓2	↑4
12	Shandong University	84.28	12	9	12	Shandong	Comprehensive	9	↑4	↑5	↑4	↑10
13	Central South University	82.29	16	8	16	Hunan	Comprehensive	4	↑4	↑6	↑6	↑8
14	University of Science and Technology of China	81.43	27	23	7	Anhui	S&T	5	↓1	↓4	↓4	↓5
15	Xi'an Jiaotong University	80.54	19	17	15	Shaanxi	S&T	6	↓1	↓2	↑3	↓1
16	Harbin Institute of Technology	80.54	21	13	14	Heilongjiang	S&T	7	↑3	→	↓2	↓4
17	Renmin University of China	79.7	23	11	17	Beijing	S&T	1	↓5	↓5	↓4	↑1

18	Nankai University	78.2	24	15	19	Tianjin	1	Literature, economics and law	10	↓3	↓4	↓3	↑5
19	Dalian University of Technology	77.61	22	18	20	Liaoning	1	Comprehensive	8	↑6	↑4	↑6	↑5
20	Tianjin University	76.09	15	34	18	Tianjin	2	S&T	9	↑7	↑6	↑1	→
21	Beijing Normal University	75.61	34	16	23	Beijing	4	S&T	1	↓3	↓3	↓4	↓5
22	Southeastern University	74.61	25	22	26	Jiangsu	2	Normal	10	→	↑3	↑2	↓3
23	Tongji University	74.22	17	33	24	Shanghai	3	S&T	11	↑1	↑1	↑1	↓10
24	Xiamen University	73.56	18	29	29	Fujian	1	S&T	11	↓4	↓4	↓4	↑2
25	South China University of Technology	73.09	32	19	32	Guangdong	2	Comprehensive	12	↑5	↑3	↑2	↑4
26	Beijing University of Aeronautics and Astronautics	71.94	43	20	35	Beijing	5	S&T	13	↓5	↑3	↑2	↓1
27	Lanzhou University	71.37	26	28	27	Gansu	1	S&T	12	↓1	→	↑3	↑17
28	East China Normal University	71.05	35	36	21	Shanghai	4	Comprehensive	2	↓5	↓7	↓5	↓1
29	Hunan University	69.71	33	24	39	Hunan	2	Normal	14	→	↓5	↓3	↑10
30	China Agricultural University	69.66	20	49	49	Beijing	6	Agriculture and forestry	1	↓2	↑3	↑1	↓13
31	Chongqing University	69.11	31	65	22	Chongqing	1	S&T	15	↑1	↓1	↓2	↓1
32	Beijing Institute of Technology	68.67	29	42	31	Beijing	7	S&T	16	↓1	→	→	↓1
33	Zhengzhou University	68.64	36	32	34	Henan	1	Comprehensive	13	↑1	↑10	↑9	↑23
34	University of Science & Technology Beijing	68.48	13	86	56	Beijing	8	S&T	17	↑3	↑7	↑14	↑8
35	Northeastern University	68.38	41	25	40	Liaoning	2	S&T	18	↑1	↑1	↑1	↓2
36	Soochow University	67.84	39	26	47	Jiangsu	3	Comprehensive	14	↓1	↑1	↑1	↑10
37	Northwestern Polytechnical University	67.68	54	27	33	Shaanxi	2	S&T	19	↑8	↓6	↓4	↓3



38	Northwest Sci-Tech University of Agriculture and Forestry	66.96	14	59	231	Shaanxi	3	Agriculture and forestry	2	↓5	↑10	↑5	↓6
39	Wuhan University of Technology	66.9	30	43	43	Hubei	3	S&T	20	↑1	↑3	↑1	↑2
40	Southwest University	65.93	47	30	52	Chongqing	2	Comprehensive	15	↓1	→	↑1	-
41	Jinan University	65.87	67	54	25	Guangdong	3	Comprehensive	16	↓3	↓3	↓5	↑17
42	East China University of Science and Technology	65.75	85	38	28	Shanghai	5	S&T	21	↑7	↑12	↑12	↑17
43	Shanghai University	64.78	40	57	42	Shanghai	6	S&T	17	↑9	↓7	↓5	↓7
44	Southwest Jiaotong University	64.58	56	46	37	Sichuan	2	S&T	22	↓3	↑2	↑6	↓7
45	China University of Geosciences	64.37	70	31	53	Hubei	4	S&T	23	↑5	↓10	↓6	↑3
46	Capital Medical University	64.33	58	39	45	Beijing	9	Medicine	1	↑10	↑28	↑22	↑36
47	Nanjing Agricultural University	63.98	48	41	55	Jiangsu	4	Agriculture and forestry	3	↓5	↓2	↓1	↓19
48	Huazhong Normal University	63.7	59	35	60	Hubei	5	Normal	3	↓5	↓4	↓3	↑2
49	University of Electronic Science and Technology of China	63.69	28	87	50	Sichuan	3	S&T	24	↑11	↑4	↑10	↑8
50	Huazhong Agricultural University	63.55	49	44	59	Hubei	6	Agriculture and forestry	4	↓4	↓1	↓3	↓7
51	Beijing Jiaotong University	63.29	55	66	38	Beijing	10	S&T	25	↓7	↑9	↑13	↓4
52	Nanjing University of Aeronautics and Astronautics	63.08	71	56	36	Jiangsu	5	S&T	26	↑6	↑9	↑9	↓17

Source: Qiu et al. (2008, p.43), Qiu et al. (2008, p.125), Qiu et al. (2005a, p. 55, 2005b, p.21, 2005c, p.32), Qiu et al. (2006, p.109), Wuhan University (2009, 2008, 2007, 2006)

Appendix 2. Primary disciplines rankings of the top 30 Chinese graduate institutions in 2009

Ranking in 2009	University	Philosophy (169)	Economics (250)	Law (341)	Education (198)	Literature (316)	History (130)	Science (326)	Engineering (343)	Agricultural (109)	Medicine (179)	Management (343)
1	Tsinghua University	15	28	27	36	32	55	4	1	—	84	3
2	Peking University	2	11	2	7	1	2	1	28	—	1	5
3	Zhejiang University	19	15	22	9	13	28	6	2	3	9	4
4	Shanghai Jiao Tong University	89	45	53	51	69	99	14	3	40	4	9
5	Huazhong University of Science and Technology	25	26	33	34	42	108	18	4	84	5	8
6	Fudan University	5	7	8	124	4	5	5	48	—	2	12
7	Sichuan University	18	18	21	74	5	4	16	17	49	6	10
8	Wuhan University	4	5	3	64	7	16	9	16	—	15	1
9	Nanjing University	6	21	14	67	3	15	3	41	—	36	7
10	Jilin University	10	14	5	56	31	7	8	19	29	17	14
11	Sun Yat-sen University	3	25	7	48	23	13	7	53	45	3	6
12	Shandong University	12	22	13	72	11	14	11	25	—	12	21
13	Central South University	51	43	37	32	45	82	22	12	81	7	20
14	University of Science and Technology of China	52	217	135	176	211	92	2	18	—	—	91
15	Xi'an Jiaotong University	72	89	209	197	142	123	40	5	—	—	28
16	Harbin Institute of Technology	71	13	67	65	120	—	34	7	—	19	13
17	Renmin University of China	1	1	1	—	16	6	118	202	—	146	2
18	Nankai University	8	3	15	80	25	1	13	70	52	91	15
19	Dalian University of Technology	62	68	175	100	161	86	25	8	97	135	29

20	Tianjin University	70	77	123	78	124	—	39	6	79	90	16
21	Beijing Normal University	7	32	11	1	2	3	10	81	56	151	24
22	Southeastern University	27	64	122	58	57	—	46	11	—	47	41
23	Tongji University	36	60	64	49	62	—	24	9	—	50	31
24	Xiamen University	14	2	12	37	22	12	17	56	—	96	17
25	South China University of Technology	61	85	128	122	129	—	49	13	—	—	40
26	Beijing University of Aeronautics and Astronautics	159	88	305	83	127	—	80	10	—	—	25
27	Lanzhou University	58	47	20	132	40	21	12	77	44	46	45
28	East China Normal University	22	41	19	2	9	11	15	119	—	—	39
29	Hunan University	59	16	48	61	67	45	43	24	—	156	34
30	China Agricultural University	95	87	231	—	253	—	28	52	1	117	30

Source: Wuhan University (2009)