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Master's Degree Students in Engineering Academic and Professional Degrees Quality Comparison of Student Sources

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Abstract

Against the backdrop of rapid expansion in professional master's programs, this study analyzes 48,834 engineering-related academic and professional master's students from 19 universities between 2014 and 2017. Through comparative analysis of two dimensions quality of applicant composition and educational background, the findings reveal that while the overall quality of engineering-related professional master's applicants remained stable, there was a slight decline. Moreover, compared with academic degree programs, engineering-related professional master's applicants showed weaker quality overall. Vertical mobility among applicant groups from different universities became increasingly challenging, with non-"Double First-Class" universities experiencing a general decline in applicant quality. To promote coordinated development of both scale and quality in engineering-related professional master's programs, the study proposes the following recommendations, strengthen quality monitoring and implement quality-based enrollment plan adjustments, explore and practice distinctive training models for specialized engineering master's programs and enhance brand building to attract high-quality applicants actively.

Keywords

Comparison; Engineering; Professional degree; Quality of students

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1. Introduction

The quality of training is the focus of educational resources and activities for professional degree graduate students in universities. The quality of student recruitment has a direct impact on the quality of professional degree graduate training, which is one of the key concerns of universities [1–3]. Establishing quality-oriented enrollment and talent development coordination mechanisms in higher education institutions is a crucial initiative for enhancing the quality of professional degree graduate education. As professional degrees increasingly dominate master's programs with continuously expanding

enrollment scales, they accounted for 60% of all master's degree enrollments in 2020 [4].

In this context, does the quality of professional degree graduate students remain stable? What differences exist compared to academic degree graduate students? What patterns emerge in their temporal evolution? These questions are crucial for determining whether professional degree graduate education can achieve coordinated development between scale and quality, providing significant reference value for graduate enrollment policy decisions. Urgent research is needed to address these issues.

Although some scholars have analyzed the quality of professional degree graduate students in specific categories or some universities, there are few empirical studies on big data at the macro level of provinces, especially the comparative study between academic degree and professional degree [5,6]. This paper takes 2014–2017 master's students in engineering academic and professional degrees from 19 universities as the subjects (hereinafter referred to as "students" unless otherwise specified.

This comparative study focuses on big data analysis of graduate admissions for "academic degree "and "professional degree" students in engineering disciplines. By addressing these research questions, the study aims to provide actionable insights for optimizing professional degree graduate enrollment policies and advancing the quality enhancement of professional degree education during China's 14th Five-Year Plan period (2021–2025).

2. Research design

2.1. Construction of a quality evaluation system for academic and professional degree graduate students

Evaluating the quality of graduate student recruitment remains a key challenge in assessing and monitoring postgraduate education quality. To address this, we must first clarify the core question: "What exactly constitutes the quality of graduate student recruitment?" This fundamental inquiry determines both the evaluation criteria and methodologies.

Two prevailing perspectives exist regarding graduate recruitment quality. The first perspective maintains that, as advanced academic programs primarily admitting undergraduate graduates, graduate education quality is intrinsically linked to undergraduate competencies, with key measurement points focusing on knowledge comprehension and practical application. The second perspective, however, argues that according to the "Opinions on Deepening Graduate Education Reform" jointly issued by the Ministry of Education, National Development and Reform Commission, and Ministry of Finance, academic degree programs aim to "enhance innovative capabilities."

In contrast, professional degree programs prioritize "developing career competencies." Consequently, graduate recruitment quality is associated with developmental outcomes, primarily assessed through innovation/entrepreneurship potential, career advancement performance, and research achievements. This study contends that the first perspective overlooks the fundamental distinction between undergraduate and graduate education. whereas undergraduate programs focus on cultivating knowledge comprehension, graduate education emphasizes developing creative knowledge production capabilities. Based on this analysis of undergraduate education, etc.

The current evaluation system for graduate student selection inherently suffers from misalignment between its targets and objectives. The second perspective erroneously conflates the distinction between "quality of incoming students" and "quality of cultivation," overlooking the developmental impact of the training process on graduate students' growth specifically, the value of process-oriented enhancement. The relationship between these two concepts isn't a simple linear correlation, which precisely reflects the essence and significance of education. This paper argues that graduate admissions serve as a bridge between undergraduate and postgraduate education, undertaking dual missions of talent selection and vertical mobility. The quality of incoming graduate students exhibits stage-specific characteristics and temporal validity. The two-stage admission model preliminary exams followed by interviews respects objective talent selection principles, demonstrating scientific rigor and practicality. By analyzing admitted students, this study provides insights into the connotation and extension of "quality of

incoming graduate students."

Based on the research of scholars on the evaluation index of student quality, and considering that this paper is a third-party evaluation based on provincial big data, this paper constructs an evaluation index system of graduate student quality including two dimensions: student structure quality and student knowledge quality, as shown in **Table 1** [7–9].

Table 1. Evaluation system of quality of graduate students in academic and professional engineering degrees

Aspect	Measuring point
Quality of student structure	(1) Type of the institution to which the first applicant applies, type of the candidate's source institution, source of the candidate (2) Whether the candidate is a first choice or a local student
Knowledge quality of source material	Overall first test score

Note: This classification categorizes Chinese universities into seven tiers based on their talent cultivation levels: Category A (First-Class University Construction Institutions), B (First-Class University Construction Institutions), C (First-Class Discipline Construction Institutions), D (Non- "Double First-Class" Graduate Education Institutions), E (Non-Graduate Education Undergraduate Institutions), F (Independent Colleges), and G (Vocational Colleges and Other Higher Education Institutions). This paper uses Excel software and SPSS21.0 to process the data.

2.2. Research sample

This study selected 19 regular higher education institutions as research subjects. The composition includes:

(1) 2 Category A institutions (Xi'an Jiaotong University and Northwestern Polytechnical University);

(2) 1 Category B institution (Northwest A&F University);

(3) 4 Category C institutions (Xi'an Electronic Science and Technology University, Chang'an University, Shaanxi Normal University, and Northwest University);

(4) 12 Category D institutions (Xi'an University of Technology, Xi'an University of Architecture and Technology, Shaanxi University of Science and Technology, Xi'an University of Science and Technology, Xi'an Technological University, Xi'an Petroleum University, Xi'an Polytechnic University, Xi'an University of Posts and Telecommunications, Yanan University, Shaanxi University of Technology, Baoji University of Arts and Sciences, and Xi'jing University).

From 2014 to 2017, these institutions collectively enrolled 24,183 academic degree postgraduate students and 24,651 professional degree postgraduate students through national unified examinations, with 32,262 male and 16,572 female students. Detailed statistics are presented in **Table 2**.

As seen from **Table 2**, since 2014, when the enrollment scale expanded by 39.15%, the enrollment proportion of professional degree postgraduates increased rapidly from 40.94% in 2014 to 58.67% in 2017, showing a significant effect of structural adjustment.

3. Results and discussion

3.1. Comparison of the first choice institutions for master's students in academic and professional engineering degrees

Due to their strong research and teaching capabilities, solid social reputation, and excellent employment prospects, Class A, B, and C universities consistently attract outstanding students from other institutions [11]. The admission rate-to-enrollment ratio remains high, indicating intense competition. As shown in **Table 3** and **Table 4**, for Class A universities, the gap between academic degree and professional degree applicants' first-choice institutions is minimal, with nearly all applicants choosing peer-class Class A universities. For Class B universities, the proportion of academic degree applicants first choosing peer-class Class B institutions fluctuates between 64.21% to 85.71%, showing an upward trend, while slightly increasing for Class C institutions. Conversely, the proportion of professional degree applicants first choosing peer-class Class B institutions ranges from 54.96% to 75%, demonstrating a downward trend. Meanwhile, the proportions of applicants first choosing Class A or Class C institutions continue to expand despite fluctuations, reflecting a significant increase in student transfers and persistent enrollment shortages.

Table 2. Enrollment of master's students in academic and professional degrees of engineering from 2014 to 2017

Degree	A class	B class	C class	D class	Total
2014					
Academic degree	1655	217	2062	2453	6387
Professional degree	1109	108	1572	1639	4428
Ratio	1.49	2.01	1.31	1.50	1.44
2015					
Academic degree	1103	271	1589	2679	5642
Professional degree	1277	220	2086	1998	5581
Ratio	0.86	1.23	0.76	1.34	1.01
2016					
Academic degree	1178	255	1898	2604	5935
Professional degree	1294	225	2164	2129	5812
Ratio	0.91	1.13	0.88	1.22	1.02
2017					
Academic degree	1243	266	2010	2700	6219
Professional degree	2150	282	3079	3319	8830
Ratio	0.58	0.49	0.65	0.81	0.70

Table 3. Proportion of first-choice applicants for academic master's degree in engineering (%)

Class	Year	Type of university to apply for in the first choice			
		A class	B class	C class	D class
A class	2014	100	0	0	0
	2015	100	0	0	0
	2016	100	0	0	0
	2017	100	0	0	0
B class	2014	23.04	71.43	5.53	0
	2015	27.68	64.21	8.12	0
	2016	19.61	72.55	7.06	0.78
	2017	7.14	85.71	7.14	0
C class	2014	2.76	0.24	96.99	0
	2015	6.99	0.44	92.57	0
	2016	5.80	0.47	93.73	0
	2017	5.37	0.20	94.43	0
D class	2014	11.99	0.98	10.03	77.01
	2015	11.27	0.86	15.79	72.12
	2016	8.95	0.81	17.86	72.39
	2017	7.67	0.59	12.96	78.78

Table 4. The proportion of master's students majoring in engineering disciplines who apply for their first choice (%)

Class	Year	Type of university to apply for in the first choice			
		A class	B class	C class	D class
A class	2014	99.91	0.09	0	0
	2015	99.92	0.08	0	0
	2016	99.92	0	0.08	0
	2017	100	0	0	0
B class	2014	18.52	75.00	6.48	0
	2015	34.09	55.91	10	0
	2016	24.89	65.33	9.33	0.44
	2017	33.33	54.96	11.70	0
C class	2014	4.52	0.38	95.04	0.06
	2015	5.99	0.34	93.67	0
	2016	7.02	0.51	92.38	0.09
	2017	9.03	0.29	90.00	0.68
D class	2014	15.07	1.16	22.39	61.38
	2015	16.77	1.10	23.52	58.61
	2016	15.55	1.22	24.99	58.24
	2017	11.78	1.60	24.19	62.43

Among students admitted to Category C universities, academic degree candidates predominantly (over 90%) and consistently choose Category C universities as their first-choice institutions, at the same time professional degree candidates also show this pattern, but at a declining rate. Notably, some first-choice applicants now select Category D universities, whereas applications to Category A universities have been increasing. For Category D universities, academic degree candidates maintain a stable 72%–78% first-choice preference for Category D institutions, while professional degree candidates show a significant 58%–62% preference. This data reveals distinct differences between Category B and D universities' admission patterns, particularly regarding first-choice institution preferences.

3.2. Comparison of the sources of graduate students in engineering academic and professional degrees

Candidates from different sources have different professional theoretical bases and different purposes of pursuing graduate study.

The cultivation phase has a direct impact. According to the Ministry of Education's regulations, the sources of master's degree candidates can be categorized into recent undergraduate graduates, higher education teachers, researchers, other working professionals, secondary school teachers, undergraduate students who have completed their studies, and vocational college students. In practice, this article divides the candidate sources into two categories: "fresh graduates" and "others".

As shown in **Table 5**, among students enrolled in Category A universities, the proportion of recent undergraduate graduates in both academic and professional degree programs remains relatively stable, with a gap of approximately 10% between the two categories. In Category B universities, the proportion of recent undergraduates fluctuates significantly between these two degree types, showing an overall downward trend, with some overlap observed between the two

Table 5. Sources of graduate students for academic and professional master's degrees in engineering (%)

Class	Year	Academic degree in engineering		Engineering professional degree	
		Fresh graduate	Others	Fresh graduate	Others
A class	2014	81.39	18.61	71.15	28.85
	2015	82.05	17.95	72.75	27.25
	2016	84.72	15.28	73.18	26.82
	2017	82.62	17.38	69.53	30.47
B class	2014	85.25	14.75	87.96	12.04
	2015	85.24	14.76	87.27	12.73
	2016	89.80	10.2	76.00	24
	2017	85.71	14.29	79.43	20.53
C class	2014	78.81	21.19	76.46	23.54
	2015	81.88	18.12	79.53	20.47
	2016	82.67	17.33	79.81	20.19
	2017	83.68	16.32	78.11	21.89
D class	2014	81.17	18.83	72.73	27.27
	2015	79.47	20.53	75.28	24.72
	2016	80.38	19.62	72.80	27.20
	2017	78.52	21.48	70.44	29.56

categories. For Category C universities, academic and professional degree programs exhibit increasing proportions of recent undergraduates, though the gap remains modest and shows signs of widening. In Category D universities, the proportion of recent undergraduates in academic degree programs is higher than in professional degree programs, indicating a notable difference. Overall analysis suggests that regarding the measurement point of "student source", academic degree programs admit a higher proportion of recent undergraduates than professional degree programs, demonstrating a distinct disparity between the two categories.

3.3. Comparison of graduate students in engineering academic degree and professional degree

As previously mentioned, Class A, B, and C universities maintain high-quality educational standards. Consequently, graduates from these institutions are typically regarded as premium candidates by their respective universities and become prime targets for recruitment. **Table 6** and **Table 7** reveal distinct patterns: In academic degree programs, over 50% of students admitted to Class A universities come from similar-tier institutions, while professional degree programs show a notable preference for graduates from Class D universities.

Data indicate that since 2014, the proportion of graduates from Class A, B, and C universities has been steadily increasing across all academic degree programs. However, the growth rate of academic degree admissions outpaces that of professional degrees. Class B universities exhibit greater diversity in graduate origins, yet academic and professional degree programs maintain Class D universities as their most significant source. For Class C universities, while Class D graduates still dominate academic and professional degree enrollments, their proportion shows a downward trend. Conversely, Class A, B, and C universities demonstrate rising enrollment rates, with academic degree programs surpassing professional degree programs in Class D university representation. Class D universities maintain dominance in academic

Table 6. Source of graduate students for academic master's degree in engineering (%)

Class	Year	A class	B class	C class	D class	E class	F class	G class
A class	2014	44.41	2.72	14.26	34.86	3.02	0.73	0
	2015	60.11	2.36	11.42	23.66	2.09	0.45	0
	2016	63.24	3.40	14.26	17.15	1.87	0.08	0
	2017	62.12	3.62	13.27	19.47	1.45	0	0
B class	2014	3.23	29.03	10.14	49.77	6.91	0.92	0
	2015	1.85	30.26	8.49	54.61	4.06	0.74	0
	2016	1.18	29.41	12.95	52.94	2.35	1.18	0
	2017	0.75	25.19	16.92	52.63	3.38	1.13	0
C class	2014	1.41	1.31	36.42	48.25	9.65	2.96	0
	2015	1.89	1.57	39.27	43.43	10.32	3.52	0
	2016	3.48	1.53	44.73	39.36	9.22	1.69	0
	2017	2.94	1.14	47.56	40.05	7.06	1.24	0
D class	2014	0.61	0.49	2.69	68.12	15.49	12.47	0.12
	2015	0.26	0.37	2.50	71.67	13.25	11.83	0.11
	2016	0.61	0.54	3.23	74.65	12.86	8.10	0
	2017	0.74	0.41	3.19	77.04	10.00	8.48	0.15

Table 7. Source of graduate students for master's degree in engineering (%)

Class	Year	A class	B class	C class	D class	E class	F class	G class
A class	2014	26.24	2.61	14.52	48.42	5.50	2.80	0
	2015	34.69	3.99	14.80	39.94	4.31	2.27	0
	2016	32.15	4.40	14.30	45.05	2.86	1.24	0
	2017	31.67	4.14	19.07	40.28	3.58	1.26	0
B class	2014	3.70	28.70	5.56	48.15	5.56	7.41	0.93
	2015	1.82	28.18	8.64	54.09	4.09	3.18	0
	2016	2.22	22.67	8.00	60.89	4.44	1.78	0
	2017	1.77	26.24	22.7	41.13	7.09	1.06	0
C class	2014	0.95	1.02	27.42	50.13	15.39	5.09	0
	2015	2.11	1.39	33.17	45.64	13.04	4.65	0
	2016	2.96	2.22	37.06	43.35	11.74	2.68	0
	2017	4.09	2.14	35.30	44.17	11.24	3.05	0
D class	2014	0.73	0.61	4.21	56.92	19.65	17.39	0.49
	2015	0.85	0.60	5.11	59.11	17.62	16.22	0.50
	2016	0.85	0.56	3.33	63.22	17.43	14.42	0.19
	2017	0.81	0.81	4.43	62.40	17.69	13.74	0.12

and professional degree admissions, showing consistent growth. Notably, academic degree programs at Class D universities retain a 10% higher proportion of Class D graduates than professional degree programs, highlighting a significant disparity. Overall analysis suggests that in terms of the measurement point of "source graduation unit type", there are differences between academic and professional degree graduate students.

3.4. Comparison of the first choice rate of graduate students in engineering academic degree and professional degree

Universities with higher first-choice admission rates demonstrate greater initiative in their post-admission selection processes. This enables them to better align student recruitment with disciplinary development needs while maintaining the capacity to refine their admission mechanisms and enhance applicant quality continuously. Conversely, institutions with lower first-choice admission rates face uncertainties in both disciplinary structure and applicant quality. Under pressure to meet enrollment targets, these universities often downplay or superficially conduct post-admission evaluations, which negatively impacts their academic cultivation processes.

As shown in **Table 8**, Category A universities consistently maintain a 100% first-choice rate for academic degree programs, while the first-choice rate for professional degree programs has gradually reached 100%. Category B universities show an increase in academic degree first-choice rates despite fluctuations, whereas professional degree first-choice rates decline with these fluctuations. Category C universities maintain relatively high first-choice rates for academic degrees but exhibit a downward trend for professional degrees. Category D universities demonstrate low first-choice rates for academic and professional degree applicants, with professional degree applicants showing significantly lower first-choice rates than academic degree applicants. Overall, the measurement point of "first-choice rate" reveals distinct differences between academic and professional degree graduate students.

3.5. Comparison of the source rate of master's students in engineering academic degree and professional degree in our university

When first-choice applicants predominantly apply to higher-tier universities or regions with more developed economies, the university's domestic student enrollment often represents a high-quality candidate pool for many institutions. Moreover, since these students are more familiar with the institution's environment, their proportion serves as an indicator of satisfaction and recognition towards their host institutions. As shown in **Table 9**, except for Category B universities, academic

Table 8. First choice rate of graduate students in academic and professional master's degrees in engineering (%)

Degree	A class	B class	C class	D class
2014				
Academic degree	100	70.51	96.12	74.4
Professional degree	95.31	75	94.4	54.24
2015				
Academic degree	100	63.1	91.32	67.97
Professional degree	99.30	54.09	92.28	51.00
2016				
Academic degree	100	71.37	91.89	68.66
Professional degree	98.84	61.78	90.43	50.49
2017				
Academic degree	100	84.59	93.38	75.70
Professional degree	100	54.26	86.81	56.37

Table 9. Source rate of graduate students in engineering academic degree and professional degree in our university (%)

Degree	A class	B class	C class	D class
2014				
Academic degree	38.55	27.65	30.21	32.74
Professional degree	19.30	25.93	21.50	17.27
2015				
Academic degree	52.77	30.26	33.67	40.46
Professional degree	29.91	27.73	26.27	21.82
2016				
Academic degree	57.22	28.63	37.41	42.93
Professional degree	26.20	22.22	29.53	21.94
2017				
Academic degree	56.07	24.44	38.61	50.63
Professional degree	25.63	24.47	26.05	27.81

degree programs at Category A, B, and D universities demonstrate significantly higher domestic enrollment rates than professional degree programs, with substantial disparities. Overall, the measurement point of "domestic student enrollment rate" reveals apparent differences between academic and professional degree graduate students.

Through comparative analysis of key measurement indicators, including candidates' first-choice institution type, source institution type, candidates' origin, whether as first-choice applicants, and whether from the same university, it was found that while slight variations exist between different types of universities, overall differences in candidate sources between academic and professional degree postgraduate programs are evident across all measured dimensions. Academic degree postgraduate candidates demonstrate relatively higher quality in the "quality of source structure" dimension.

The study also reveals two trends in master's degree applications:

(1) The proportion of candidates applying to Category A, B, and C universities as their first choice shows an expanding trend, with candidates from higher-tier universities rarely applying to lower-tier institutions. This indicates that lower-tier universities will face increasingly severe adjustment challenges, with long-term fluctuations and uncertainties in student sources that will impact the training process;

(2) Comprehensive analysis reveals an expanding trend in the proportion of candidates admitted to their own type of university. at the same time, it becomes increasingly complex to enroll students from higher-tier institutions. The proportion of candidates from Category E and G universities without master's enrollment authority continues to decline, reflecting growing difficulties in vertical mobility among candidates across different types of universities.

3.6. Comparison of preliminary test scores of master's students in engineering academic degree and professional degree

Although there is still controversy whether the preliminary test results can fully reflect the quality of candidates, some studies have shown that the preliminary test results can represent the long-term development potential of candidates to a large extent [12]. Given that fluctuations in the basic requirements for initial exam scores for annual re-admission significantly impact admitted candidates' preliminary performance, this study introduces the "Group Academic Ranking Index" (EI,

Excellence Index) to mitigate the influence of extreme high or low scores on overall results. The index aims to reflect the macro-level performance of initial exam scores across different categories of graduate student applicants from various universities [13,14]. The EI index measures the overall improvement in initial exam scores by comparing the top 30% and bottom 30% of examines. It operates through two types: division-based and subtraction-based calculations. When the division-based EI index exceeds 1 (with positive subtraction EI), it indicates strong overall performance. A division-based EI index equal to 1 (negative subtraction EI) suggests average-level performance. Conversely, a division-based EI index below 1 (negative subtraction EI) signals weaker overall exam results.

As shown in **Table 10**, from 2014 to 2017, the enrollment scale of academic degree postgraduate students decreased slightly despite fluctuations, while their initial exam scores remained stable and generally excellent. During the same period, the enrollment scale of professional degree postgraduate students expanded rapidly by 99.41%, but their overall initial exam scores slightly declined.

To better analyze variations in initial entrance exam scores among different types of university applicants, this study calculates and compares EI indices for academic and professional degree graduate students across various institutions. To simultaneously reflect the status of different universities in the admissions process of 19 institutions and their own score fluctuations, we introduce two metrics: overall EI and independent EI.

As shown in **Table 11**, from 2014 to 2017, Category A universities maintained overall stability with slight improvements in the initial exam scores of academic degree graduate applicants. Category B universities remained stable overall. While Category C universities experienced minor fluctuations, their academic degree applicant numbers stayed generally stable. Category D universities showed stability but saw a slight decline. However, when analyzing the performance of these applicant groups across all university categories, Category A universities demonstrated clear advantages, attracting most high-scoring students from their respective provinces. Category B universities exhibited cyclical fluctuations, showing varying levels of performance. Among the 19 universities, Category C universities steadily gained prominence. Conversely, Category D universities faced significant disadvantages, with their numbers declining through fluctuating trends.

As shown in **Table 12**, from 2014 to 2017, regarding the initial exam scores of professional degree graduate applicants, Category A universities maintained relative stability despite expanded enrollment scales. Category B universities generally remained stable, with

Table 10. EI index of initial test scores of master's students in academic and professional engineering degrees

Degree	2014	2015	2016	2017
Academic degree				
Overall number of people	6387	5642	5935	6219
Top 30%	1965	1731	1844	1912
Post-30% number of people	1930	1705	1790	1881
EI index number (division)	1.02	1.02	1.03	1.02
EI index number (subtraction)	0.01	0.01	0.01	0.01
Professional degree				
Overall number of people	4428	5581	5812	8830
Top 30%	1368	1723	1758	2690
Post-30% number of people	1343	1705	1792	2710
EI index number (division)	1.02	1.01	0.98	0.99
EI index number (subtraction)	0.01	0	-0.01	0

Table 11. EI index of initial test scores of master's students in engineering academic degree

EI index	2014	2015	2016	2017
A class				
Divided				
Overall	41.19	848	215.75	27.31
Independent	0.98	0.97	0.95	1.02
Subtraction				
Overall	0.63	0.78	0.73	0.68
Independent	-0.01	-0.01	-0.01	0.01
B class				
Divided				
Overall	0.74	1.65	0.95	1.85
Independent	1	0.98	1.03	1.01
Subtraction				
Overall	-0.09	0.12	-0.01	0.15
Independent	0	1.6	0.01	0
C class				
Divided				
Overall	0.9	1.6	1.34	2.04
Independent	1.01	1.04	0.99	0.98
Subtraction				
Overall	-0.03	0.12	0.08	0.17
Independent	0	0.01	0	-0.01
D class				
Divided				
Overall	0.25	0.22	0.26	0.19
Independent	1.03	1.02	1.01	0.98
Subtraction				
Overall	-0.38	-0.39	-0.36	-0.44
Independent	0.01	0.01	0	-0.01

overall performance being relatively strong. Category C universities demonstrated stable and balanced performance. Category D universities maintained overall stability. However, when analyzing the initial exam scores of applicants across 19 universities, Category A universities still held a dominant position, though their advantage over academic degree programs was less pronounced. The overall competitive edge continued to expand. Category B universities exhibited fluctuating performance with cyclical patterns. Category C universities showed a gradual upward trend. Category D universities remained at a disadvantage and experienced a downward trajectory.

Table 12. EI index of initial test scores of master's students in engineering majors

EI index	2014	2015	2016	2017
A class				
Divided				
Overall	2.81	16.61	16.22	22.86
Independent	1	0.99	0.99	1.03
Subtraction				
Overall	0.38	0.63	0.58	0.59
Independent	0	0	-0.01	0.01
B class				
Divided				
Overall	0.6	0.68	0.44	0.52
Independent	1.03	1.02	0.99	1.05
Subtraction				
Overall	-0.17	-0.11	-0.21	-0.15
Independent	0.01	0	0	0.01
C class				
Divided				
Overall	0.75	0.91	1.04	1.01
Independent	0.99	1	0.99	1.02
Subtraction				
Overall	-0.08	-0.03	0.01	0
Independent	0	0	0	0
D class				
Divided				
Overall	0.44	0.27	0.31	0.24
Independent	0.98	0.98	1	1.02
Subtraction				
Overall	-0.22	-0.35	-0.36	-0.38
Independent	0	-0.01	0	0

4. Conclusions

From 2014 to 2017, the enrollment scale of academic degree graduate students at 19 universities remained relatively stable, while the enrollment scale of professional degree graduate students nearly doubled, indicating the basic completion of structural adjustment goals. This study analyzed big data on academic and professional degree graduate admissions from 2014 to 2017 across these 19 institutions.

Through comparative analysis of six measurement points under two dimensions, "quality of applicant composition" and "knowledge quality of applicants," the findings revealed:

(1) The quality of applicants for engineering-related

academic and professional master's programs remained largely stable, with a slight decline observed in professional master's programs;

(2) Significant differences existed in applicant composition between engineering-related academic and professional master's programs, with professional degree applicants demonstrating lower quality;

(3) Vertical mobility of applicants across different types of universities became increasingly challenging. First-class universities (Group A) and first-class discipline construction universities showed distinct advantages with expanding trends, while Group B first-class universities experienced fluctuations in applicant quality. In contrast, non-"Double First-Class" construction universities exhibited an overall downward trend in applicant quality.

This paper analyzes that the above phenomenon has both historical and realistic reasons:

(1) In early 2011, China's Ministry of Education outlined three strategic objectives for professional degree graduate education reform: structural optimization, model transformation, and brand cultivation. This policy shift led to a rapid expansion in the enrollment ratio of professional degree students. However, this growth has been significantly constrained by exogenous factors such as enrollment policies. The development of professional degree programs suffers from inadequate coordination in educational resources, while their training models remain path-dependent on academic degree frameworks, resulting in a lack of distinctiveness. Moreover, an extensive expansion-driven growth model persists, while macro-level quality control mechanisms remain underdeveloped;

(2) During the 2009 national postgraduate admission review phase, China's Ministry of Education implemented a policy allowing full-time professional master's programs to enroll fresh undergraduate graduates. While the plan initially allocated 50,000 additional spots that year, only 38,000 were ultimately filled exclusively by transfer candidates. Compounded by the perceived social stigma surrounding part-time professional degree programs, this policy created lasting negative impacts on both applicant confidence and the quality of full-time graduate candidates in subsequent years;

(3) The mobility of high-quality students across regions and between universities at different tiers has long been a phenomenon in China's graduate admissions system. In October 2015, the State Council issued the Overall Plan for Coordinating the Development of World-Class Universities and Disciplines, sparking a new wave of university expansion. Implementing proactive measures to attract top-tier students remarkably fresh undergraduate graduates from higher-level institutions has become a key strategy for supporting the "Double First-Class" initiative. This trend has also significantly influenced the recruitment dynamics for professional degree graduate programs.

4.1. Policy recommendations

In September 2020, China's Academic Degrees Committee and the Ministry of Education jointly issued the "Development Plan for Professional Degree Graduate Education (2020–2025)", which underscores the vital importance of advancing this educational model and commits to comprehensively enhancing its quality. Guided by the principle of "cultivating virtue, meeting societal needs, improving quality, and pursuing excellence", the plan emphasizes proactive measures to elevate applicant qualifications, achieve balanced growth in both scale and quality, and accelerate substantive quality development. These objectives constitute a critical mission for China's professional degree graduate education during the 14th Five-Year Plan period (2021–2025). To address these priorities, this paper proposes the following recommendations:

(1) Strengthen quality supervision and evaluation in graduate admissions, with scientific allocation of enrollment quotas. Quality remains the cornerstone of postgraduate selection processes. During the 14th Five-Year Plan period, the continuous expansion of professional degree graduate programs will persistently face resource capacity constraints. Balanced development

between enrollment scale and quality constitutes a crucial responsibility for provincial education authorities. This study reveals growing disparities in student quality across different university types. Enrollment quotas, directly linked to fiscal allocations, also influence resource adjustments in discipline development, faculty teams, and scientific research, serving as an effective regulatory tool for supply-side structural reforms. Given the persistence of extensive expansion models where some institutions prioritize "meeting enrollment targets" over quality, provincial education authorities should implement market-oriented mechanisms. Establishing a quota allocation system based on student quality standards is imperative to break the "only increase, no decrease" mentality, guiding universities toward quality-focused development models. Ensuring stable admission quality now carries both urgency and necessity;

(2) Develop quality-oriented education by exploring distinctive graduate training models for specialized disciplines from the supply side. The ability to attract high-caliber students depend on cultivation models and educational quality. During the "Double First-Class" initiative, some universities have made significant progress in funding, infrastructure, pedagogical approaches, and training systems, gradually aligning with global first-tier graduate education standards. Their enhanced appeal to top students is evident in improved applicant quality. Conversely, other institutions lag, preoccupied with meeting enrollment quotas while neglecting systemic reforms. This results in superficial interview processes and declining overall applicant quality. Therefore, during the 14th Five-Year Plan period, universities should prioritize students' long-term development, enhance their sense of fulfillment, and improve process value-added through supply-side reforms. By leveraging strengths to adapt to new economic trends, emerging technologies, industries, business models, and operational paradigms, institutions can cultivate engineering graduate students with distinctive characteristics. This approach will improve talent cultivation's adaptability, foresight, and leadership potential, establishing a sustainable strategy for attracting top-tier students;

(3) Strengthen brand development and enhance the appeal of specialized degree programs with distinctive advantages. The multi-stakeholder governance model in master's admissions grants universities significant autonomy at the enrollment level. By implementing policies that balance fairness, equity, and quality efficiency, institutions can effectively improve student recruitment standards [15]. During the "Double First-Class" initiative, numerous universities have implemented measures to attract high-quality students, particularly fresh undergraduate graduates from top-tier institutions. While academic research indicates that the type of undergraduate institution affects student quality, practical evidence shows that talent cultivation mechanisms and educational models play a more significant role in shaping the overall quality of education [16]. Therefore, while strengthening the connotation of quality education, universities are advised to enhance brand development and transform enrollment promotion strategies. By adopting student-oriented perspectives through diverse platforms and channels particularly by leveraging high-quality alum networks colleges should actively promote their distinctive academic programs and attract top-tier students.

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