

EXPLORING THE ESSENTIALS OF HIGH-QUALITY STUDENT RECRUITMENT IN UNIVERSITIES: A MULTIVARIATE ANALYSIS OF GEOGRAPHICAL AND INSTITUTIONAL DYNAMICS

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Abstract

The advancement of world-class universities hinges on three interdependent factors: a high concentration of talent, substantial resources, and effective governance. Among these, the caliber of students, encompassing distinguished faculty and high-quality students, plays a pivotal role in shaping academic excellence. Factors such as institutional costs, reputation, academic rigor, and career prospects are crucial in attracting top-tier students from around the globe. In China, cultural nuances significantly influence these dynamics, with student geographical distributions and diverse academic offerings emerging as primary determinants of student quality. Despite their importance, the mechanisms by which these factors influence student quality and their interactive effects remain poorly understood. This study addresses this gap through a comprehensive analysis involving factor analysis, cluster analysis, and cross-tabulation analysis, centered on a prominent Chinese university renowned for its global outreach. Our findings delineate the geographical distribution patterns of high-quality students and identify their preferences for academic programs, revealing insights that resonate with effective student recruitment strategies. Furthermore, the cross-tabulation analysis explores the interactions between student geographical distributions and academic program offerings, providing a nuanced understanding of how recruitment strategies can be tailored to attract diverse student populations. The results not only offer a framework for understanding the determinants of student quality but also deliver strategic insights for higher education institutions worldwide seeking to enhance their student profiles. This research underscores the critical importance of student quality in shaping the future of higher education, emphasizing its relevance both in China and beyond. By fostering a deeper understanding of these dynamics, we aim to inspire collaborative efforts among institutions to cultivate talent and drive innovation in higher education recruitment strategies.

Keywords: *Student quality, higher education, academic preference, geographical influences, recruitment strategy.*

1. Introduction

Quality students are recognized as the foundation of world-class universities and play a critical role in the development of academic excellence. Over the past decade, leading global institutions have made significant efforts to understand the factors that influence student quality. While institutional reputation, academic rigor, and career prospects have been widely studied in Western higher education systems (Wilkins & Huisman, 2011; Miotto et al., 2020), the dynamics in culturally diverse contexts such as China present a unique challenge and opportunity. In China, regional disparities and cultural values play a significant role in shaping educational decisions. The uneven distribution of educational resources across regions leads to significant geographical differences in student quality of students. In this context, the geographical distribution of students has a direct impact on the caliber of applicants recruited to educational institutions (Han et al., 2023). Moreover, the cultural emphasis on career prospects leads Chinese families to give preference to academic programs that offer promising employment prospects. This in turn affects the quality of students attracted to certain degree programs (Zhao, 2022).

Despite extensive research on student recruitment, there are still critical gaps in understanding how the geographical distribution and program offerings affect student quality and how they interact to attract high-quality students. For example, while regional differences in student academic performance are well documented (Guo & Li, 2024), the geographical distribution patterns of high-quality students, particularly their concentration in elite educational institutions, remain poorly understood. Although it is known that the availability of diverse academic programs attracts students (Resch, 2023), whether this is true in the Chinese context has not been thoroughly investigated. Furthermore, the interplay between these offerings

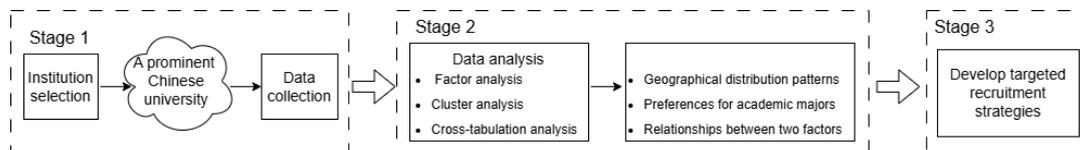
and the geographical distribution in China is unknown. These gaps emphasize the need for a deeper understanding of their interaction and their impact on student quality in China.

To address these limitations, this study focuses on a prominent Chinese university known for its global reach and applies a comprehensive analysis involving factor analysis, cluster analysis, and cross-tabulation analysis. Specifically, the research aims to (a) explore the interactions between student geographical distributions and academic program offerings and their impact on student quality, and (b) develop tailored recruitment strategies and provide strategic insights for higher education institutions.

2. Design and methods

This research employs a three-stage methodological approach centered on a case study university in China. As shown in Figure 1, Step 1 establishes the empirical foundation through comprehensive data collection from a globally recognized institution (Times Higher Education Ranking 301-350, “Double First-Class”) that serves as a representative case reflecting challenges common across Chinese higher education. The dataset includes approximately 10,500 records of student admissions between 2022 and 2024 and captures key metrics such as geographic origin, academic performance indicators and academic program preferences. Step 2 employs a multi-method approach to analyze student distribution and academic program preferences. Factor analysis is applied to map the geographical distribution patterns of high-performing students while preserving underlying relationships through dimensionality reduction. Cluster analysis using the K-Means algorithm, selected for its computational efficiency and interpretability (Jain, 2010), identifies distinct patterns in degree program preferences. The cross-tabulation analysis examines the correlations between geographical distribution and choice of degree program. Building on these empirical findings, Step 3 develops data-driven targeted recruitment strategies that address the identified patterns. This multi-method approach not only provides a robust framework for understanding the determinants of student quality across geographical and disciplinary dimensions, but also generates actionable insights that higher education institutions can implement to optimize their recruitment approaches in China’s evolving educational landscape.

Figure 1. Research Design.



3. Analysis and results

3.1. Factor analysis

The factor analysis utilized 10 indicators (as shown in the first column of Table 1) to assess geographical disparities in student quality. The indicators are identified based on existing literature and annual reports of the case university. The results confirmed the suitability of the data for factor analysis, with a Kaiser-Meyer-Olkin measure exceeding 0.6 and a statistically significant Bartlett’s test of sphericity ($p < 0.001$). Table 2 presents the provinces with outstanding student quality from 2022 to 2024 among the 31 administrative regions analyzed in mainland China. These provinces are selected based on their consistent performance, as their three-year average student quality rankings placed them within the top 10, underscoring their sustained excellence and making them particularly noteworthy for further analysis.

Figure 2 illustrates the spatial distribution of high-performing provinces and shows clear geographical patterns in student quality across China. Analysis of these patterns reveals three significant regional disparities. First, there is a pronounced north-south divide in the distribution of high-performing students. The northern location of the case university appears to enhance its visibility and reputation in the northern regions, especially in the northeastern provinces (marked in red), where student quality metrics are particularly high. Second, an east-west divide is evident, with the eastern coastal regions consistently producing relatively higher quality applicants. This pattern likely reflects the structural advantage of the eastern provinces, which have historically benefited from greater investment in education and a more developed academic infrastructure. Third, despite its relative geographical distance from the case university, the southwestern region (highlighted in blue) shows a promising upward trend in student quality metrics, indicating an emerging recruitment opportunity. The spatial concentration of high-performing students in certain regions underscores how geographical factors, including proximity to the institution, regional educational development, and historical patterns of resource allocation, significantly influence the distribution of academic talent in China’s higher education landscape. These findings show how

geographical determinants create uneven patterns in student quality that universities need to consider in their recruitment strategies.

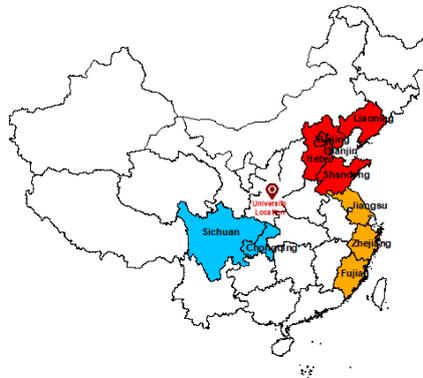
Table 1. Assessment indicators.

Indicators for factor analysis	Indicators for cluster analysis
Standardized minimum score	Current graduate ratio
Standardized average score	Standardized average score
Standardized maximum score	Mean comprehensive score
Mean Chinese score	Mean Chinese score
Mean mathematics score	Mean mathematics score
Mean English score	Mean English score
Average admission raking ratio	Major adjustment rate
Ratio of average score to key university threshold	Program popularity
College preference satisfaction rate	College preference satisfaction rate
League membership rate	League membership rate

Table 2. Provinces with high student quality.

Province	Rank		
	2022	2023	2024
Liaoning	3	1	1
Shandong	7	6	6
Hebei	6	7	10
Tianjin	1	5	20
Beijing	4	4	24
Fujian	2	16	2
Zhejiang	9	3	8
Chongqing	19	8	5
Sichuan	16	10	7
Jiangsu	12	9	15

Figure 2. Geographical Distribution.



3.2. Cluster analysis

Cluster analysis is an important method in the field of data mining and is frequently used in educational research due to its robust ability to classify data (Dutt et al., 2015; Jovanović et al., 2017; Saqr et al., 2023). As one of the most commonly used clustering techniques, the K-means clustering algorithm is used to explore the academic preferences of high-quality students.

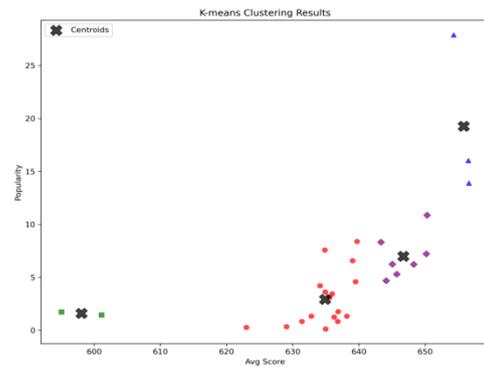
The case university’s academic portfolio centers on aerospace disciplines, with complementary strengths in conventional engineering fields such as automation and computer science. Applying K-means clustering to 30 academic programs based on 10 assessment indicators (as shown in the second column of Table 1) reveals four distinct program clusters. Figure 3 shows the result of the 2022 academic year.

Cluster 1 (blue) includes elite programs characterized by exceptional student quality metrics, high applicant numbers, and superior academic performance indicators; Cluster 2 (purple) represents programs with above-average student quality, solid academic metrics, and moderate popularity; Cluster 3 (red), which includes the majority of programs, meets basic institutional standards while showing potential for improvement; and Cluster 4 (green) identifies programs with suboptimal performance in multiple quality dimensions, indicating areas that require strategic intervention. As shown in Table 3, the longitudinal analysis for the period 2022-2024 shows ten-degree programs that consistently maintain their elite status and belong to the top decile of offerings with their three-year average quality metrics. The university’s flagship Aerospace Engineering program proves to be the top choice for high-performing students — a position reinforced by its historical prestige, national strategic importance and priority institutional investment. Other programs that have proven particularly successful in attracting highly qualified students include Computer Science and Technology, Automation, Flexible Electronics, Engineering Mechanics and Marine Engineering. This cluster approach provides a data-driven framework for understanding the hierarchical structure of academic program offerings and their differential appeal to high-performing student populations.

Table 3. Clustering results of ten programs (2022–2024).

Program	2022	2023	2024
Aeronautics and Astronautics			
- Advanced Research Track	Excellent	Excellent	Excellent
- Elite Honors Program	Excellent	Excellent	Excellent
- Integrated Track	Excellent	Good	Good
- Civil Aviation Specialization	Good	Good	Good
Computer Science and Technology			
- Top Talent Program	Excellent	Excellent	Excellent
- General Track	Good	Good	Good
Flexible Electronics Engineering	Good	Good	Excellent
Mechanics	Good	Good	Good
Marine Engineering	Good	Good	Good
Automation	Good	Satisfactory	Good

Figure 3. Clustering result (2022).



3.3. Cross-tabulation analysis

To systematically examine the relationship between geographical distribution patterns and academic program preferences, this study employs cross-tabulation analysis — a robust statistical approach for investigating associations between categorical variables. The analysis operationalizes two key categorical dimensions that emerged from the previous analysis steps: geographical regions are classified as either high-quality source regions (provinces ranked in the top 10 by the factor analysis) or other regions (remaining provinces); similarly, academic programs are categorized as either excellent (those consistently ranked in the top 10 by the cluster analysis) or others (remaining programs). This methodological approach allows for a rigorous examination of whether high-performing students from specific geographical regions show particular patterns in their choice of degree programs. Pearson’s chi-square tests conducted across all three academic years (2022-2024) yielded statistically significant results ($p < 0.05$ for all years) and provided convincing evidence that geographical origin and program preference are systematically related and not independent variables.

Table 4. Program Admission Rates by Region Quality (2022-2024). Figure 4. Admission Rate of Excellent Programs.

Year	Geographical regions	Academic programs	
		Excellent (Count/%)	Others (Count/%)
2022	High-quality	19.3%	80.7%
	Others	15.9%	84.1%
2023	High-quality	21.4%	78.6%
	Others	17.5%	82.5%
2024	High-quality	23.9%	76.1%
	Others	20.6%	79.4%

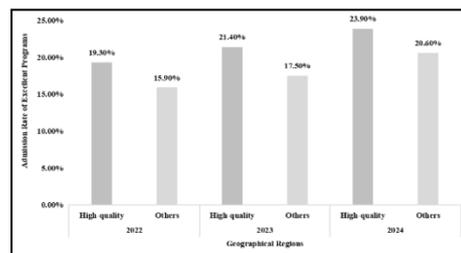


Figure 4 further illustrates this relationship, showing a consistent upward trend in admission rates to excellent programs in both the high-quality geographic regions and the other regions over the study period. This temporal analysis reveals two significant patterns: first, a general increase in the attractiveness of excellent degree programs across all regions, indicating an increasing recognition of the value of these programs, and second, a persistent gap in admission rates, with students from high quality regions consistently being admitted to excellent degree programs at a much higher rate than their peers from other regions. This persistent disparity, despite the general upward trend, shows that geographical advantage translates into differential access to first-class academic opportunities. This empirical evidence supports the statistically significant relationship identified by chi-square tests and highlights the self-reinforcing nature of educational advantage, where students from educationally privileged regions disproportionately secure places in the most prestigious academic programs. These findings highlight the complex interplay between geographical determinants and academic opportunity structures and suggest that targeted interventions may be needed to address persistent regional inequalities in access to world-class educational pathways.

4. Discussions

The results of this study yield actionable implications for recruitment strategies. Universities should pursue a differentiated recruitment approach that makes use of the geographical-academic preference patterns identified. In regions where high-quality students come from, recruitment strategies should enhance the visibility of flagship programs through targeted initiatives that leverage existing advantages, including the strategic use of distinguished alumni as institutional ambassadors, the development of elite partnerships with top secondary schools, and the creation of specialized pre-university enrichment programs aligned with these disciplines. A parallel strategy should address other regions through initiatives that focus on accessibility: implementing virtual engagement platforms that overcome geographical barriers, creating region-specific scholarship incentives that recognize potential rather than prior educational advantage, and developing bridge programs that facilitate successful transition into high-demand technical disciplines. This dual approach recognizes the empirically established relationship between geographical origin and program selection while actively working to expand access pathways. The implementation framework must carefully balance competing institutional needs: Maintaining selective excellence that enhances institutional prestige and expanding equal access that diversifies the talent pipeline. Institutions should adopt quantifiable metrics to monitor how these targeted recruitment strategies impact both the geographical distribution of high-performing students and the quality profile of flagship programs to ensure that efforts to broaden access do not compromise the academic standards that underpin the institution's reputation. This evidence-based approach transforms geographical disparities from passive constraints into strategic opportunities for recruitment management.

5. Conclusions

This study improves the understanding of student recruitment in Chinese universities by analyzing the geographical distribution patterns and preferences for academic programs. Through multivariate analysis, it provides a framework for examining factors that influence student quality of students in different regions. Practical recruitment strategies can be derived from the results. As competition for talent intensifies, universities need to strike a balance between selective excellence and broader access. This study demonstrates the value of data-driven approaches to strategic recruitment management and offers insights that are applicable beyond the immediate context to different higher education systems facing similar recruitment challenges. For future research, the samples can be expanded to a wider range of Chinese higher education institutions in different regions and institutional classifications to improve the generalizability of the findings. The proposed analytical framework can be applied to international contexts to shed light on cross-cultural patterns in the determinants of student quality. Longitudinal studies tracking recruitment metrics would provide hard evidence of the sustained impact of recruitment strategies derived from this research.

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