

Statistical Analysis of Geographic Differences in Group Differences in Academic Performance of Undergraduate Students in Higher Education

--The Example of Undergraduate Students in the School of Tourism of Hainan University

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ABSTRACT

This paper analyzes the four-year (2016-2019) academic performance of four grades in the College of Tourism of Hainan University, a ministerial university, from 2016-2019 to study the differences of students' performance in geographical space. SPSS software was used to test the correlation between students' grades and their provinces, and Moran index and spatial autocorrelation theory were used to study the correlation between students' grades in different provinces and their regions; ArcGIS software was used to conduct cold hotspot analysis and resolve the weighted average grades of students in the four grades. The results show that students' performance is superior in central and eastern regions, and there is a certain convergence of students' performance between neighboring provinces. It helps to deploy of college admissions and can also designate directions for educational research.

Keywords: GPA, spatial autocorrelation, Geoda, ArcGIS, SPSS, Hainan University

1. INTRODUCTION

With the popularization of higher education for the masses in recent years, the construction of China's double-class colleges and universities has steadily moved forward. The deployment and score line delineation of the college entrance examination in previous years has become a hot topic in society. Due to the long-term historical factors and urban-rural dual structure system, the economic development of domestic provinces is still unbalanced. There are obvious geographical differences in students' academic performance, mainly showing the phenomenon of high in the east and low in the west, which seriously restricts social stability and social equity and affects social harmony. Although the central and western regions are close in terms of human and material resources, there is a phenomenon of "central collapse" in terms of education funding.^[1] The investment in education in the eastern region is significantly higher than that in the central and western regions. The reasons for this phenomenon include schooling difficulties, family

relationships, different starting points of learning foundations, different learning priorities, etc... At present, research on the driving mechanism of student achievement usually uses questionnaires to collect data, qualitative data combined with quantitative research methods, and mathematical models to conduct research. There are certain subjective factors in the qualitative data results. The paper can realize the quantitative research on the relationship between students' academic performance and the province to which students belong through spatial autocorrelation analysis, and to propose a feasible quantitative method for academic performance and geographical differences.

2. RESEARCH METHODOLOGY

2.1. Spatial autocorrelation analysis

Spatial correlation measures are introduced to analyze whether there is spatial correlation in student achievement. The paper takes 25 different provinces

including nearly 300 students belong as examples. The global Moran's index can determine whether there is clustering or outliers of student achievement in geographic space, and after variance normalization, its value is normalized to between -1.0 and +1.0.

2.2. Cold hot spot analysis

Based on the hotspot analysis function provided in ArcGIS, given the average performance points of the weighted elements for each year, the Getis-Ord G_i^* statistics were used to identify cold spots and hotspots with significance. By describing the high and low value clustering states, we can find the location of the distribution of high and low value clusters on the space.

2.3. Excellent index analysis

EI is a concept proposed to study the relative level of academic performance among students. GPA is

vulnerable to extreme values and the amount of data, so this paper uses the merit index EI (division / subtraction) to measure the quantitative academic performance of students. GPA is used as the basic index to measure students' academic performance. The formula for calculating GPA at Hainan University is:

$$\text{GPA} = \sum \text{Course Credit Grade Point} \div \sum \text{Course Credit} \quad (1)$$

3. DATA SOURCES

The original data of this study mainly comes from Hainan University College of Tourism from 2016 to 2019. For the purpose of the clarity and usability of the data, we remove incomplete and duplicate data, and classifies the data of each class of each year of each major [2].

4. RESULTS AND ANALYSIS

4.1. Spatial autocorrelation results and analysis

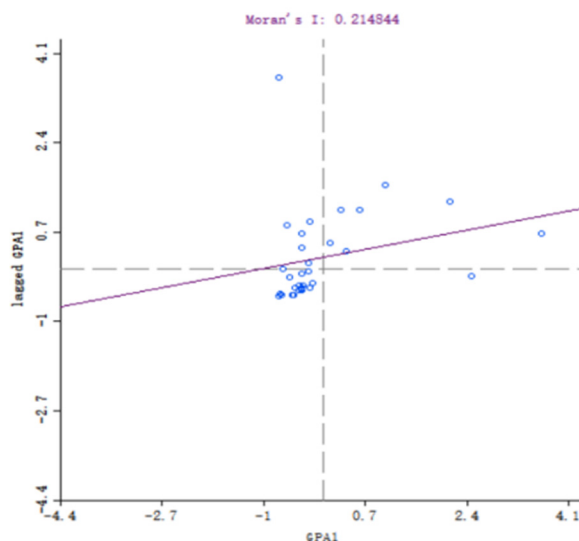


Fig. 1 Moran scatter chart of average GPA of some majors in school of tourism, Hainan University, 2016-2018

In this paper, the weight matrix of 295 students was constructed based on the linear distance between regions. The results show that all 295 students passed the significance test at the 10% significance level. Moran's I was obtained as 0.215, with data greater than 0, indicating that the grades of university undergraduates showed a strong positive spatial correlation and spatial clustering of the same attributes. The results suggest that the performance of undergraduate students in a province will show a trend of convergence with local and neighboring regions.

4.2. Cold hot spot analysis chart

This paper uses hotspot analysis in ArcGIS to study the dynamic changes in the degree of clustering in space

for academic performance. From the results shown in Figure 1, the five provinces of Hunan Province, Guizhou Province, Guangxi Zhuang Autonomous Region, Guangdong Province, and Chongqing Municipality present high clustering in 2016, indicating that these regions have higher student GPA and are clustered in spatial distribution in 2016. Tibet Autonomous Region and Gansu present low clustering; the four-year dynamic changes are small and regular, and these provinces and cities in Guizhou Province and Chongqing Municipality are adjacent to each other in spatial distribution. The students' academic GPA is higher, which indicates that students' academic situation in the geographical location shows the phenomenon of chunking and differentiation. There is a certain connection and influence of education between neighboring regions.

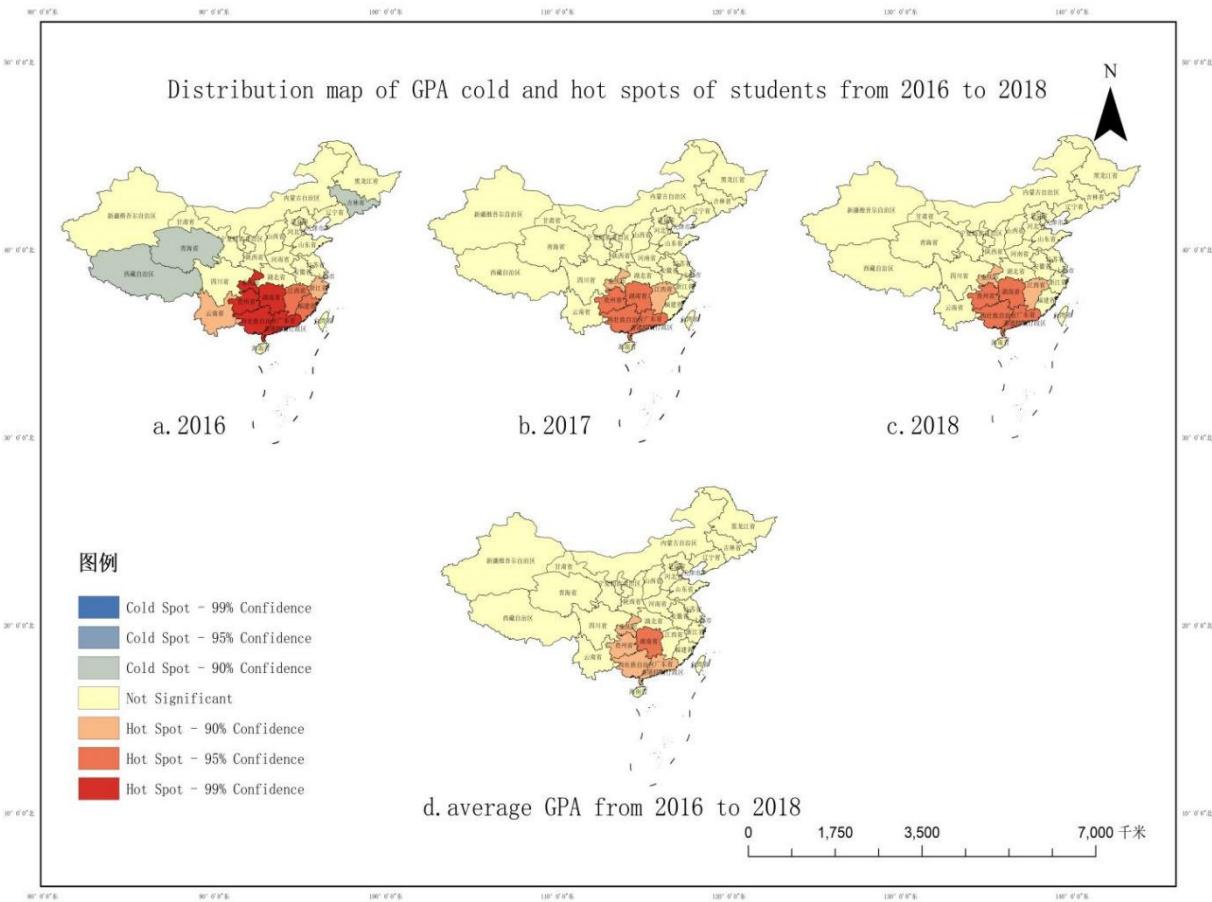


Fig. 2 Distribution of students' GPA cold and hot spots in some majors of Tourism College of Hainan University from 2016 to 2018

4.3. Analysis of student performance by province based on the excellence index

The results show that 13 provinces, including Sichuan, Hunan, Zhejiang, Guangdong, and Anhui, have EI index (division) greater than 1. The provinces with EI index (division) less than 1 include Hainan local and some provinces with relatively low economic level and education investment level. There is a correlation between students' academic performance and external influencing factors such as geographical economic level and academic pressure of each province. The regional economic level and regional academic pressure affect the educational and academic performance.

Table 1 EI index of students from different regions of some majors in Hainan University from 2016 to 2019 (in descending order of EI index)

region	Proportion of the top 30%	Proportion of the last 30%	EI (excellent)	EI (minimum)
East China	38.00%	14.00%	2.71	24.00 %

Northeast	50.00%	25.00%	2.00	25.00 %
Southwest	40.00%	22.22%	1.80	17.78 %
North China	37.50%	34.38%	1.09	3.13%
South China	23.97%	39.67%	0.60	15.70 %
Northwest	14.71%	29.41%	0.50	14.71 %

4.4. Analysis of factors influencing geographical differences

4.4.1. The influence of regional educational resources on students' academic performance

4.4.1.1. Regional investment in education affects the allocation of education resources

The results show that the investment in education funds, basic education facilities and teachers' human resources and education funds are South China, East

China, southwest, North China, northeast and northwest, respectively. This shows that different investment in education leads to the objective unfair distribution of educational resources among regions, and then forms obvious regional differences^[4].

4.4.1.2. The education mode of each region affects the overall quality of students

The results show that with investment in education of each region increasing year by year, the quality of the educated population is improving. However, the improvement of students' comprehensive quality cannot be accomplished through a short period of training, and the different education models in each region still affect the comprehensive quality of students' training^[5].

4.4.2. The influence of family educational capital on students' academic performance

4.4.2.1. Family cultural capital subjectively influences family investment in education and students' study habits and attitudes

Pierre Bourdieu believes that cultural capital is a capital form different from economic capital and social capital^[3]. Families with a high level of cultural capital will pay more attention to cultivating students' comprehensive quality, so that students' learning ability and achievement can be improved to the greatest extent from limited educational resources^[6].

4.4.2.2. Families' economic conditions objectively influence families' investment in education and students' access to education, quality and quantity

Families with higher income than expenditure can appropriately invest more in students' education and bear higher education investment costs and risks. The results show that the level of GDP per capita is ranked as follows: Eastern regions. Central regions, Western regions. The families of students in Eastern regions can afford to invest more in education, which affects the students' ability to receive education.

5. CONCLUSION

In this paper, the Moran's I, cold and hot spot analysis and Excellence Index are used to analyze the students' scores from 2016 to 2019 in the School of Tourism, Hainan University, and it discusses the differences in the geographical distribution of students' scores and the reasons for such differences. The following conclusions are drawn:

1. The spatial autocorrelation test with the Moran's I shows that the students' academic performance is spatially positively correlated in the geographical distribution, and has convergence in adjacent regions.

2. The results of cold and hot spots analysis show that five regions, Hunan Province, Guizhou Province, Guangxi Province, Guangdong Province and Chongqing City, are highly clustered, which means students in these areas have higher GPA, while Gansu province and Tibet presented lowly clustered.

3. Using the Excellence Index to analyze GPA, and it is found that there is a certain correlation between the GPA and the level of economic development and the academic pressure in each province. Further dividing the provinces into six parts, Northeast, East, South, Central, Southwest and Northwest, the results show that students from Northeast, Southwest and East China have better scores, especially students from Northeast China are the best, while those in North China, South China and Northwest China have yet to be improved. This phenomenon suggests that students' academic performance is positively correlated with GPA and educational investment in each province.

4. The investment of education funds, regional education patterns and family investment for education impact on the geographical distribution of students' academic performance in the School of Tourism, Hainan University.

At present, faced with the problem of the disparity of educational resources caused by the imbalance of regional development, government should attach importance on the balanced distribution of educational resources, and universities should adjust their admission policies appropriately, ensuring students from less developed regions having access to higher education.

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REFERENCE

- [1] Deng Xiyao et al: The efficiency criterion of college sub-provincial enrollment plan--a big data study on the geographical differences of academic performance of student groups, China Higher Education Research, Vol. 12, No. 12, 2014, pp. 23-27.
- [2] Liu, H. F., Li, M. C.: The formation and adjustment of the provincial quota system of college entrance examination, Educational Research, No. 6, 2014, pp. 73-80.
- [3] Zhu Bin, Cultural Reproduction or Cultural Mobility? -- A study of inequality in educational achievement acquisition among Chinese university students, Sociological Studies, Vol. 1, 2018, pp. 142-168+245.

- [4] Qi Lingling, Wang Yuanwei Analysis of inter provincial differences in the unbalanced development of education in China [J] Higher education development and evaluation, 2010,26 (5): 34-48.
- [5] Deng Xiyao, Qiao Tianyi, Yu Xiaolei Efficiency criterion of provincial enrollment plan in Colleges and Universities -- a big data study on regional differences in academic performance of student groups [J] China higher education research, 2014,12:23-27.
- [6] Guo Jun, Li Kai, Zhang Lufan An empirical study on the influence of family background on College Students' academic performance [J] Educational academic monthly, 2012 (8): 29-34.

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