ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202210_5(10).0095

Analysis of the Distribution characteristics of kindergarten and its influence on Children in Urban villages: A case study of Tianhe District, Guangzhou City

Jialin Fang[1, a], Xinheng He[1, b], Kunneng Jiang[1, c], Bo Tang[1, d], Yuanyuan Zhang[1, e]

[1] School of Resources and Planning, Guangzhou Xinhua University, Guangzhou 510520, China

[a] fjl1900218120@gmail.com, [b]793680789@qq.com, [c]1422628654@qq.com, [d]465614428@qq.com, [e]zsu.zyy@163.com

Abstract

Rapid urbanization not only brings economic prosperity but also gives birth to various urban diseases. Tianhe District, as the innovation center of Guangzhou, is potentially restricted by the imbalance of regional development at the educational level. The situation is presented by mapping the regional distribution and inter-regional density differences of POI in kindergartens and urban villages in Tianhe District, as well as the coverage and accessibility of service areas. The number of kindergartens in Tianhe District is numerous, but the distribution is not balanced. The density and number of kindergartens in the south are much larger than those in the north. The coverage of the service area of the kindergarten is suitable as a whole. The accessibility of kindergartens in the north is generally worse than that in the south. The distribution of kindergartens in Tianhe District of Guangzhou dramatically affects the local urban village children's regular preschool education. The uneven distribution of material resources is the dominant influencing factor.

Keywords

GIS; Education equity; Urban villages; Education resource.

1. Introduction

As one of the cities with the highest human development index in southern China, it has an urbanization rate of 86.46 percent and a fantastic total gross domestic product(GDP), with a per capita GDP of more than $22,000 in 2019[3]. However, the incredible speed of urbanization has also brought a series of issues of great concern to the city in the past few decades, including the significant regional differences in economic level[11], the severe problem of villages in the city[13], the uneven allocation of educational resources[1]. What is not optimistic is that the past research has not been interested in the education of this city, and the international academic circles should pay more attention to the research in this area.

The purpose of the study is: (1) to investigate the spatial distribution of kindergartens in Tianhe District. (2) to explore the influence of this situation on children's access to educational resources in local urban villages. This study will provide a scientifically targeted program for local authorities to implement policies that balance economic and social benefits in urban development.

2. Literature Review

In the international academic circles, many scholars have conducted in-depth research on the balanced allocation of preschool education resources, such as the scholars represented by Bainbridge J[6] pay attention to the regulation and control means of public finance. Swenson

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202210_5(10).0095

K[7] is bundled based on a large number of resources and capital under the background of a foreign market economy, so in order to narrow the gap between urban and rural preschool education resources, it is necessary to reduce service costs and put forward measures to establish a distributed micro preschool education center. Due to the progress of information technology, geographic information system technology has been popularized and is increasingly used to assist in solving the facility location problem—for example, Richard. Morrill[8], an American scholar, uses geographic information system technology to balance efficiency and fairness in the location and allocation of public service facilities. Raymond. G. Taylor[10] and others rely on GIS technology to solve the problem that the education department of a county in North Carolina often adjusts the school service area, resulting in much waste of resources. Sara Hershkovitz[4] connects urban population change with school layout and uses GIS technology to explore the relationship between school layout and population change.

3. Materials and Methods

3.1. Study Area

Guangzhou is located in the center of Guangdong-Hong Kong-Macau Greater Bay Area, the most populous Great Bay area in the world (Figure1). It is also a significant research and innovation center in the Asia-Pacific region. Among them, Tianhe District, the district with the highest level of economic development in Guangzhou, is also the center of the region in the fields of science, research and development, and finance and is more representative of the issue of education, so it is the area of this study.

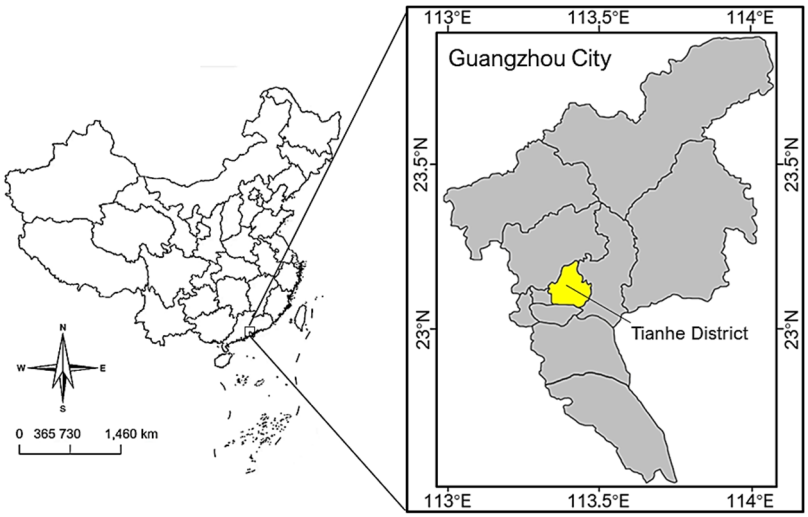

Figure 1. Study Area: Tianhe District, Guangzhou City

3.2. Data Collection and Processing

The geographical location of the research object comes from the public service information platform of social organizations in Tianhe District of Guangzhou City. After the geographical location is transformed into WGS-84 geographic coordinates, the geographical registration is carried out using the Georeferencing tool in ArcGIS. The spatial point layer is generated by importing it into ArcGIS. In addition, according to the nature of kindergarten, kindergarten is divided into "private management" and "state-owned" and further divided into two categories: "profit" and "inclusive."

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202210_5(10).0095

3.3. Kernel Density Estimation

Kernel density estimation is often used to directly express the spatial agglomeration characteristics of point elements[17]. The kernel function used in the study is based on the quartic kernel function described in Silverman's book[9]. The density of point or line elements is estimated with the help of a regular moving cell. At a given sample point x_i, the core estimation is used to simulate the distribution of attribute variables. The function formula[16] is as follows:

$$f_h(x) = \frac{1}{nh}\sum_{i=1}^{n} k\left(\frac{x-x_i}{h}\right) \quad (1)$$

In the formula: $f_h(x)$is the kernel function, the larger the value is, the denser the distribution of elements is; k is the spatial weight function; h is the bandwidth, and the bandwidth is the free parameter that defines the amount of smoothing; n is the number of points in the analysis range.

3.4. Service Area Aanalysis

By using the service area analysis function of ArcGIS, we can analyze the actual service area covered by public service facilities under a given passage cost. According to the analysis results, the spatial distribution characteristics of public service facilities can be analyzed and evaluated. The service area solver used traverses the network based on the Dijkstra algorithm. In this study, the kindergarten's service range interruption value is set to 1000m, 1500m, and 2000m.

3.5. Accessibility Analysis

Accessibility analysis can show how easy it is for parents to commute to and from kindergarten. In this study, "facility point" is set as the kindergarten, "impedance" is set as "distance" and "travel time ."The reachability graph is drawn by ArcGIS10.8 based on the Dijkstra algorithm.

4. Results

4.1. The Distribution of Kindergartens

A total of 367 kindergarten outlets are distributed in various areas of Tianhe District. However, there are 24 urban villages in Tianhe District, and these children, as a vulnerable group, will compete with many well-off families in the area for this small share of school places. Frustratingly, the distribution of kindergartens is not so uniform that large areas in the central and northern regions are even vacant.

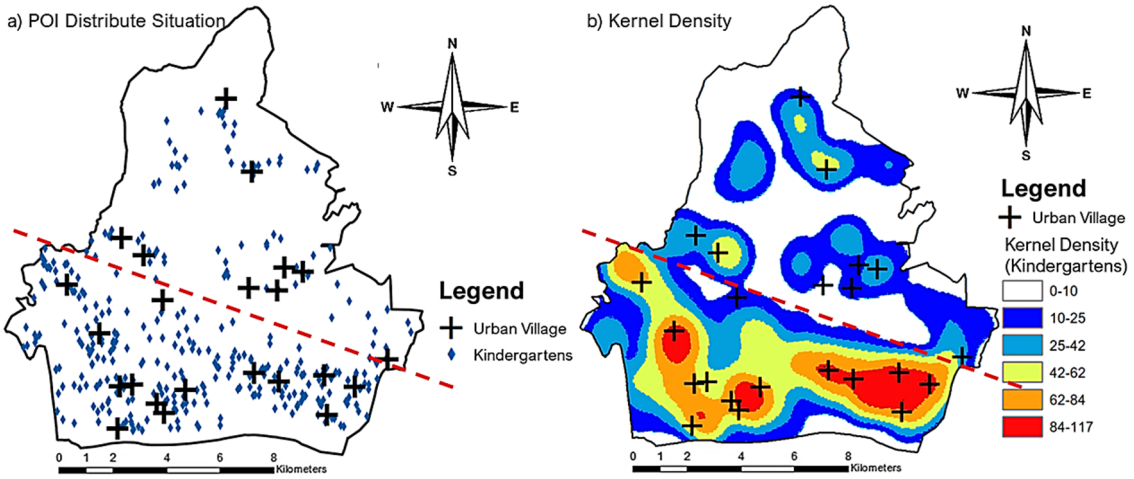

Figure 2 (a) The distribution of villages and kindergartens in Tianhe District. (b) The kernel density grade of the kindergarten network.

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202210_5(10).0095

Figure 2a shows that the kindergartens in Tianhe District are fewer in the north and more in the south. Many kindergarten outlets are distributed in the south of Tianhe District, and the distribution pattern is uneven, which is reflected in figure 2b: the regional difference in kernel density grade is very significant. In addition, this study found that the Tianhe District area can be divided into two areas with roughly the same area according to the red dotted line, which shows the uneven distribution of kindergarten outlets in Tianhe District. The area located south of the dotted line is about 45% of the total area, but it is concentrated in 75% of the kindergartens. In comparison, the area north of the dotted line is about 55%, but only 25% of the kindergartens are distributed here. It is not difficult to find that the urban village network in the north of Tianhe District is located in the lower density of kindergartens. Even in the area south of the dotted line, the urban villages here are located on the edge of plots with high kindergarten density. Generally speaking, the preschool education resources in Tianhe District are rich in total, but the distribution is not balanced enough. At the same time, for children living in urban villages, it is relatively complex for them to obtain educational resources here.

4.2. Service Area Analysis

There is no doubt that although the spatial analysis of the distribution of kindergartens can quickly and intuitively understand the overall situation, there are still many obstacles for local urban village children to enter these kindergartens, such as uneven road network density and relatively long distances, which brings them many inconveniences.

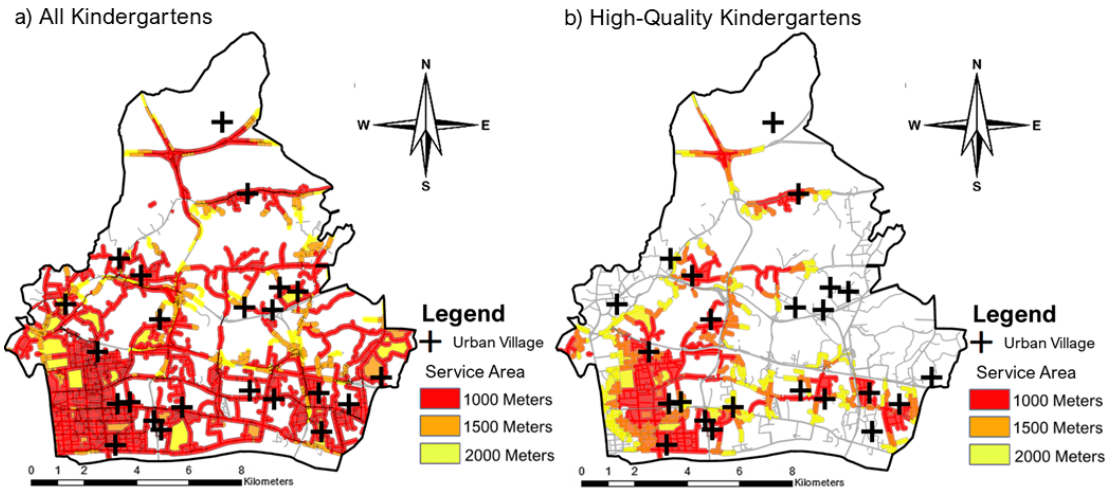

Figure 3 a) Service area coverage of all kindergartens under different radii. b) High-quality kindergartens, known as first-level (provincial or municipal, or district) kindergartens based on the local government's assessment, cover service areas under different radii.

The "facility point" field in figure 3a was set to "all kindergartens in Tianhe District" when making the map, with 367. The map shows that in Tianhe District, all the urban villages are within the coverage of the three-grade service areas of the kindergarten. What is surprising is that most of the urban villages are within the 1000-meter radius service area. The "facility point" field in figure 3b was set as "the first-level kindergarten in Tianhe District" when making the map, with a total of 28. This term comes from the documents made public by the local government after a comprehensive evaluation based on many factors such as teaching level. The map shows that most of the urban villages in the north of Tianhe District are outside the service area of high-quality kindergartens, while the urban villages in the south are the opposite. Overall, the service area of the kindergarten in Tianhe District covers a wide area, and the children in the village in the city can get the primary educational resources. However, the children in the village in the north are generally far away from the kindergarten network, and

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202210_5(10).0095

it is not easy to obtain enough high-quality educational resources, which should be paid attention to.

4.3. Accessibility Evaluation

In essence, the accessibility of public service facilities is the degree of individual differences in citizens' access to public resources, which will lead to unequal opportunities for citizens living in different areas to access public resources [14].

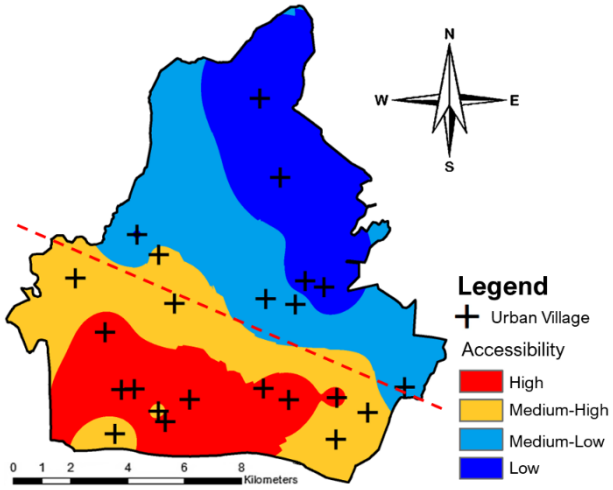

Figure 4. Accessibility to different areas in Tianhe District

Figure 4 shows that the urban villages in the south of Tianhe District, those located in the south of the red dotted line, are distributed in high or medium-high accessibility areas, which is undoubtedly lucky for local children. Most of the urban villages in the north of the red dotted line are located in low or medium-to-low accessibility areas. As mentioned earlier, these areas not only have a small number of kindergartens and low density but also lack the coverage of high-quality kindergarten service areas. For children in the north, it is not only difficult for them to get a degree but also more challenging to get to kindergarten. This is caused by the unreasonable distribution of kindergarten outlets in Tianhe District and the uneven allocation of road traffic resources.

5. Conclusion

As an important innovation center of Guangzhou, Tianhe District has some potential hidden dangers at the educational level, mainly reflected in the lack of educational resources and the relative lack of traffic accessibility in the north. Kindergartens are so concentrated in the south that children in the north generally need higher travel costs to go to the nearest kindergarten and are in a weak position to get a degree. Even if the general kindergarten service area covers a large area so that most of the urban village children in the north are located, the number of high-quality kindergartens and the coverage of service areas in the north is still insufficient. Generally speaking, these problems are more affected by material factors, and the local government is continuously improving the situation. Although there is no doubt that it requires more capital investment, the situation will continue to improve over time.

6. Discussion

With the help of the relevant modules in ArcGIS to process and analyze the POI data of urban villages and kindergartens and draw a map, this study puts forward some suggestions for

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202210_5(10).0095

solving this problem in the future from four angles: teacher rationing, financial support, resource implementation, and garden system.

Attract more foreign teachers to work to solve the problem of local teacher shortage. As the core of the operation of the kindergarten, first of all, we need a sufficient and stable number of teachers to make the kindergarten usually operate. However, in the context of the government's advocacy of "the universal two-child policy," more and more newborns are bound to make it more and more difficult for kindergartens already short of teachers to operate[12]. To alleviate the problem of shortage of teachers, it should be carried out from two aspects: increment and stock. First, colleges and universities' enrollment scales should be expanded appropriately. Secondly, encourage people in other areas of society who want to be teachers in the future to learn relevant theoretical knowledge and make more stringent regulations on their practical learning. Finally, we should fully use the surplus teachers in middle and primary schools to help them transfer to kindergartens after professional training.

Increase financial support for the operation of kindergartens. Even if some kindergartens are "inclusive" in nature, institutions can not do without funds and profits to maintain normal operations and improve the quality of running schools. We should not ignore the material premise of giving full play to the public social welfare of non-profit kindergartens and provide help in tax relief and economic subsidies, which can effectively avoid the discrepancy between the title and actual operation of universal kindergartens[2].

There are strict regulations on how kindergartens use the subsidy funds they receive. The fund allocation of many kindergartens has been seriously out of balance in allocating material equipment and teachers for a long time[5], one-sidedly pursuing the advanced physical facilities while neglecting the deficiency in the allocation of teachers. We should standardize the resource allocation structure, focus on the output results, and strengthen the weak links. The government must evaluate the benefit after the resource subsidy, and from the perspective of input-output, focus on the actual benefits brought by the resource subsidy and evaluate the improvement of the quality of education.

Give full play to the role of the market economy. For a long time, state-owned kindergartens have been focused on by the local government and given priority to the allocation of resources. Although this can significantly improve the quality of individual kindergartens, it also leads to a growing gap between most private kindergartens and state-owned kindergartens, showing a significant "Matthew effect"[15].

Acknowledgments

Supported by the Special Funds for the Cultivation of Guangdong College Students' Scientific and Technological Innovation(pdjh2021B0662), and Guangdong Province Undergraduate Innovation and Entrepreneurship Training Programs (S202113902036) and Guangzhou Association of Social Science Societies (2021GZYB22).

References

[1] C.S. Zhou, X.M. Tong, J.H. Wang and S.L. Lai: Spatial differentiation and the formation mechanism of population aging in Guangzhou in 2000–2010, Geographical Research, Vol. 37 (2018) No.1, p.103-118.

[2] C. Wei, Y.Y. Wang, H.Y. Wang: Why the appearance is not in line with the reality in the choice of whether private kindergartens are profitable or not: based on a nationwide empirical survey, Journal of the Chinese Society of Education, 2021 No.7, p.29-34.

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202210_5(10).0095

[3] Guangzhou Statistics Bureau: Guangzhou Statistical Yearbook(2019)(China Statistics Press, China 2020).

[4] H. Sara: Socio-spatial Aspects of Changes in Educational Services: Tel Aviv and Jerusalem, 1970–88, The Service Industries Journal, Vol. 11(1991) No.2, p.137-153.

[5] J.C. He: The Study of Cost-sharing Theory in Preschool Education, Early Childhood Education(Educational Sciences), 2015 No.3, p.36-41.

[6] C.T. Kulik, H.T.J. Bainbridge, C. Cregan: Known by the company we keep: Stigma-by-association effects in the workplace, Academy of Management Review, Vol. 33(2008) No.1, p.216-230.

[7] LGH, G.E. Magnuson, B. Kritzberg, J.A. Kerr, S.Y.Rayford, G.K. Swenson, A. Kantar, K.J. Lindblom: Censorship : A Continuing Proble, The English Journal, Vol. 79(1990)No. 5, p.87-89.

[8] R.L. Morrill, J. Symons: Efficiency and Equity Aspects of Optimum Location, Geographical Analysis, Vol. 9(1977)No. 3, p.215-225.

[9] B.W. Silverman: Density estimation: For statistics and data analysis(CRC Press, America 2018).

[10] R.G. Taylor, M.L. Vasu, J.F. Causby: Integrated planning for school and community: The case of Johnston County, North Carolina, Interfaces, Vol. 29(1999)No.1, p.67-89.

[11] G.J. Tian, Z. Qiao: Modeling urban expansion policy scenarios using an agent-based approach for Guangzhou Metropolitan Region of China, Ecology and Society, Vol. 19(2014)No. 3: 52.

[12] W.X. Shi: The Supply and Demand Situation of Chinese Preschool Education Resource and Its Policy Advice under the Universal Two-child Policy:Based on the Quantity Prediction of the Preschool Children in Kindergarten from 2017 to 2026, Vol. 33(2017)No. 4, p.82-89.

[13] J.H. Wu, Z.Y. Zhao, S.J. Jiang, L. Tao: The Research on Spatial Accessibility to Healthcare Services Resources in Tianhe, Guangzhou, International Conference on Smart Health (Shenzhen, China, July 1-2, 2019), p. 96-105.

[14] X.Z. Wang, L. Wang, L.J. Xie, Q.K. Wang, R. Yang, X.J. Zeng, L. Liao: The Status And Trend of Researches on Deprivation of Space And City Community Resources Abroad, Human Geography, Vol. 23(2008)No.6, p.7-12.

[15] X.M. Hong, W.T. Zhu, B.L. Zhong: Comparison of educational quality of inclusive kindergartens with different kindergarten management systems, Journal of the Chinese Society of Education, 2019 No.8, p.39-44.

[16] Y.L. Fang, Z.F. Huang, J.L. Li, F. Wang: Spatial distribution of characteristic towns and their industrial characteristics in China, Journal of Natural Resources, Vol.34(2019)No.6, p.1273-1284.

[17] Y. Zhou, W. Wang, N. Tang: Influence of Multidimensional Closeness on Strength and Centrality of Urban Land Price Spatial Correlation Network, Areal Research and Development, Vol.39(2020)No.3, p.76-82.