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Post-Graduate Geographical Education in China: Can Talents Meet the Need of Sustainable Development?

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Abstract: As widely acknowledged and targeted in Transforming Our World: The 2030 Agenda for Sustainable Development, talents education and training is an important measure to systematically solve the problem of economically, societally, resource, and environmentally sustainable development, and so as the post-graduate geographical talents education and training. Whether post-graduate geographical talents education and training can meet the need of sustainable development is an increasingly significant issue in geography science. Therefore, from the perspective of population scale, education quality, and education input, taking Chinese post-graduate geographical education as an example, the paper empirically investigated the spatial differentiation and talents production mechanism. With the support of spatial analysis tools by ArcGIS and GeoDa software, the strong inter-regional differentiation and imbalance characteristics of post-graduate geographical talents education were detected, outlining a general east-west geographical pattern in China. Moreover, the spatial production mechanism of post-graduate geographical talents has its own global and national scale, regional comprehensive and province-related characteristics, and production of the talents education and training in human geography, physical geography, and cartography. GIS also has its own focuses and demands.

Keywords: post-graduate geographical talents education; sustainable development; degree authorization; talent education and training; quality education

1. Introduction

Due to different advantages and demands, different countries and organizations have their different cultivating and training curricula and developing directions for geographical talents to meet economically, societally, resource, and environmentally sustainable development under the background of globalization. German geography began to emphasize the strengthening of systematic geography in the 1970s, and its basic structure of the spiral geography curriculum was formed [1]. Meanwhile, German geography paid attention to strengthening the understanding of geopolitics [2]. France geography is no longer confined to the field of geography, but transcends disciplinary boundaries to form a multidisciplinary and integrated trend, while emphasizing the development of students' abilities and achieving sustainable educational development [3]. Korean geography will pay more attention to regional geography in the future [4]. Japanese geography pays attention to sustainable development and to forming one axis of the main content of the subject "Chiri Sogo" [5].

Indonesian geography has integrated the environment and sustainable development into the social science, natural science, geography, and biology in the modern times [6].

Since the reform and opening up in China, the post-graduate geographical education has educated and trained a number of research-oriented talents for the sustainable utilization of national or local resources and the environment, territorial spatial planning and management, and economic and social construction. The smooth implementation of the Fourteenth Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Outline of the Long-range Goals to 2035 and China's National Plan on Implementation of the 2030 Agenda for Sustainable Development calls for the establishment of a sound land–sea coordination system for territorial spatial planning, natural resource assets, and ecological environment governance. Therefore, geography science has been endowed with a new task and responsibility for its regionality and comprehensiveness [7]. The key task is to educate and train different types of post-graduate geographical talents that can solve the problems of economically, societally, resource, and environmentally sustainable development in China's land–sea surface system. Therefore, the main goal of geographical post-graduate education with innovative ability is to provide excellent talents for the sustainable development of the country and the coordinated development of the local economy, society, and resources and environment [8]. The optimization of the layout and quality of post-graduate geographical education institutions have become the academic focus in China [9,10].

Scholars' research on the post-graduate geographical education remains in its overall development period in China, and because of the primary stage of development, there is a gap among the current situation of geographical education in China. Moreover, there is no systematic study of the common and different geography science education in China and there is no study of their distribution characteristics. Therefore, the aim of the paper is to reveal the regional characteristics of post-graduate geographical talents by sorting out the orientation of education in Chinese institutions. Furthermore, this paper also aims to reveal the nature of geographical distribution through the coupling between the distribution of geographical education institutions and the distribution of natural allocation to help optimize the spatial production pattern and characteristics of post-graduate geographical education in Chinese institutions, and provide references for similar countries.

2. Literature Review

In recent years, international scholars' research of geographical talents education mainly focused on European and American countries. In 2011, W. Brian Whalley et al. studied British and American geographical traditions and emphasized the universality of geography and related skills training [11]. In 2017, M. Duane Nellis argued that the impact of new technologies, changes in curriculum structures, and local policies contributed to the new learning model in the United States [12]. In 2008, Ron Johnston studied the research achievement of the ACC, the largest group of academic geographers in the United States. They mainly focused on a defined subset of the discipline and undertook relevant academic activities. Their goal was to show the most important work done by American geographers in the past decade [13]. In 2008, Hay studied the role of the International Network for Learning and Teaching in Geography for Higher Education (INLT) in the production of geographical knowledge; introduced British and American educational models; and strengthened existing unequal social relations [14]. In 2006, Henry Wai-Chung Yeung studied the approach to shape the economic geography of higher education institutions in the unique development environments of China and Singapore, arguing that the economic geography approach requires the localization of the curriculum [15]. In 2002, after the systematic study of tourism geography in Chinese universities conducted by Baosteel, there was still a large gap between Chinese scholars and those in North America [16]. In 2018, Mitchell studied the professional development direction of GIS talents and emphasized the importance of building a well-structured professional development [17]. In 2019, Liu

R et al. argued that GIS has become a universal tool in geography and other fields, and studied the impact of GIS on human geography students [18].

However, the time spent on research concerning Chinese geography is still very short. In 2021, Junxi Qian studied the development of geography from the period of reform and opening up [19]. Different from the geographical paradigm of English-speaking countries, China has identified two kinds of tension: between natural science and social science orientations, and between applied knowledge and critical/reflexive knowledge [20]. In 2019, Sun et al. discussed the development of the geography of higher education in China during 1904–1949, and summarized the differences in geography in China and the special role of geographers studying abroad by taking geography institutions, curricula, and teachers as indicators [21]. In 2015, Guosheng Han studied the current teaching situation of tourism geography in Taiwan, China, based on the content analysis of 60 teaching syllabuses, which is helpful for international tourism geography circles to have a better understanding of China's tourism geography education [22]. In 1982, Chunfen Li studied the progress of university geography education in the People's Republic of China from 1949, which made achievements in establishing professional geography institutions, training teachers and geographers, and publishing geography textbooks [23]. In 2007, Xiaojian Li, Yunfeng Kong, and Baoyu Peng, combined with data and a survey of 20 geographical universities, elaborated on the characteristics of the development of geography in higher education in China since 1980, and the development was very optimistic [24]. Although the development of several fields was unbalanced, the overall trend was expanding. In 2019, Ran Liu et al. conducted a standardized spatial thinking ability test (STAT) and found that Geographical Information System (GIS) has become a common problem-solving tool in the field of regional research [18]. In addition, Chinese students performed better in spatial reasoning ability and showed higher spatial cognition in problem solutions and Boolean logic [25]. In 2006, Ada Lo studied the tourism geography and reviewed the history of hospitality and tourism higher education in Hong Kong [26].

3. Materials and Methods

Spatial autocorrelation is generally used to express the heterogeneity and spatial cluster characteristics of spatial elements, and positive spatial autocorrelation is the propensity for regions or locations that really are close together to have comparable values, which is most typically found in practical circumstances [27]. In order to explore the spatial characteristics of post-graduate geographical education institutions, the GeoDa, whose version is 1.16 by Dr. Luc Anselin and his team from America in 2013, bivariate spatial autocorrelation analysis method exists to analyze the spatial correlation of post-graduate geographical education institutions.

3.1. Data Collection

According to the affiliation, post-graduate geographical education institutions can be divided into three categories: regular university affiliated to a certain government, the University of Chinese Academy of Sciences, and a research-institution-affiliated certain unit of the government from the China Post-Graduate Admission Information Network (https://yz.chsi.com.cn/) (accessed on 20 August 2020). There are a total of 89 post-graduate geographical education institutions. The map of China was geo-coded from the Baidu Map (https://map.baidu.com/) (accessed on 2 September 2020). The attribute data, mainly including the name of each province, and the number and structure of geographical post-graduate talents, the scale of population, the quality of population, and the input of education were added to province in ArcGIS, whose version is 10.2 by Environmental Systems Research Institute, Inc. from America in 2013.

3.2. Spatial Weight Matrix Construction

The spatial weight matrix is the spatial arrangement between different spatial objects, which usually defines a binary symmetric spatial weight matrix W to express the interde-

pendence relationship in the space [28], and GeoDa is used to construct the spatial weight matrix for population scale, education quality, and educational input. The calculation method is shown in Formula (1).

$$W = \begin{vmatrix} w_{11} & w_{12} & \cdots & w_{1n} \\ w_{21} & w_{22} & \cdots & w_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ w_{n1} & w_{n2} & \cdots & w_{nn} \end{vmatrix} \tag{1}$$

Among them,

$$w_{ij} = \begin{cases} 1, & \text{When district county I is adjacent to district county I} \\ 0, & \text{When district county I is not adjacent to district county I} \end{cases}$$

Special note: when I = j, $w_{ij} = 0$.

It is not hard to find that the matrix W is symmetric, that is, $W^T = W$.

3.3. Bivariate Spatial Autocorrelation Analysis

Spatial dependence, spatial correlation, or spatial autocorrelation between spatial statistics and geolocation-related data can compensate for the deficiency of traditional quantitative statistical analysis [29]. Therefore, the bivariate spatial autocorrelation method was adopted to study the correlation between the distribution of geography education institutions in universities and the population scale, education quality, education input in different provinces, and the coupling was analyzed.

$$\text{I} = \frac{n \times \sum_i^n \sum_j^n W \times (x_i - \bar{x})(y_j - \bar{y})}{\left(\sum_i^n \sum_j^n W_{ij} \right) \times \sum_i^n (x_i - \bar{x})^2} \tag{2}$$

where n is the number of sample lattices, x_i, y_j are the attribute values of i or j or region, $\bar{x}$ is the mean of all the points, and W_{ij} is the weight matrix to measure the relationship between spatial things, which is a generally symmetric matrix.

* Data for Hong Kong, Macao, and Taiwan are missing, and the figure is gray and blank.

4. Results

4.1. The Type and Scale of Post-Graduate Geographical Talents Education

According to the China Post-Graduate Admission Information (https://yz.chsi.com.cn/) (accessed on 20 August 2020), there are three types of post-graduate geographical talents education institutions in China: (1) The first type is regular university which is affiliated to a certain government, which can be divided into the university under the ministry of education (or other ministries), the university under the provincial people's government, and the university under the local government in accordance to the affiliation relationship. Meanwhile, the affiliation relationship determines the funding channel to universities as well as its belonging. Moreover, by the end of 2020, 85 Chinese universities can grant the master degree in geography, and 33 of them can grant the doctor degree in geography. (2) The second type is the University of Chinese Academy of Sciences, which is characterized by the integration of science and education, and aims at educating and training high-level and high-quality innovative and entrepreneurial talents with less than a thousand of admitted masters and doctors annually. This includes the Institute of Geographical Sciences and Natural Resources Research, Nanjing Institute of Geography and Limnology, Northeast Institute of Geography and Agroecology, Institute of Mountain Hazards and Environment, Northwest Institute of Eco-Environment and Resources, Xinjiang Institute of Ecology and Geography, Institute of Soil Science, Guangzhou Institute of Geochemistry, Institute of Tibetan Plateau Research, Yantai Institute of Coastal Zone

Research, Aerospace Information Research Institute, Innovation Academy for Precision Measurement Science and Technology, College of Resources and Environment, and School of Future Technology. (3) The third type is a research institution, which is affiliated to certain unit of the government, that includes the Chinese Academy of Forestry, Beijing Research Institute of Uranium Geology, and Chinese Academy of Meteorological Sciences. These institutions educate and train post-graduate talents in geography in the industrial field with less than a hundred of admitted masters and doctors annually.

4.2. The Spatial Distribution of Post-Graduate Geographical Talents Education

In 2020, there are 85 universities authorized to grant the master degree in geography (Table 1). Beijing has eight of them, and Hubei, Jiangsu, and Shanxi each has six of them. Meanwhile, Shandong, Jilin, Guangdong, Henan, and 12 other provinces and cities each has 3–5 of them. Moreover, Anhui, Shanghai, Hainan, Heilongjiang and other 14 provinces and cities each has 1–2 of them. However, Tibet has no university authorized to offer post-graduate programs in geography. Among the 85 universities, 79 of them have first-level disciplinary authorization for the master degree in geography, and the other five universities have second-level disciplinary authorization for the master degree in geography, which include Huaqiao University, China University of Mining and Technology, Shanxi University, Xi'an International Studies University, and Sichuan Agricultural University. There are four universities in Beijing with authorization for the doctor degree in geography (including the University of Chinese Academy of Sciences). Meanwhile, there are two universities in Jiangsu, Hubei, Guangdong, Shaanxi, Yunnan, Gansu, and a university in Hunan, Shandong, and 17 other provinces with authorization for the doctor degree in geography. However, there is no university in Shanxi, Sichuan, Zhejiang, Guangxi, Hainan, Ningxia, and Xizang provinces with authorization for the doctor degree in geography.

Table 1. Spatial distribution of geographical education institution authorization for the master degree or the doctor degree in geography in China, excluding Hong Kong, Macao, and Taiwan regions.

Region	Institution Authorization for the Master Degree	Institution Authorization for the Doctor Degree	Region	Institution Authorization for the Master Degree	Institution Authorization for the Doctor Degree
Beijing	8	4	Hunan	2	1
Jiangsu	6	2	Anhui	2	1
Hubei	6	2	Xinjiang	2	1
Shaanxi	6	2	Tianjin	2	1
Shandong	5	1	Hebei	1	1
Sichuan	4	0	Guizhou	1	1
Jilin	4	1	Heilongjiang	1	1
Henan	3	2	Guangxi	1	0
Guangdong	3	2	Inner Mongolia	1	1
Yunnan	3	2	Liaoning	1	1
Gansu	3	2	Shanghai	1	1
Zhejiang	3	1	Hainan	1	0
Shanxi	3	2	Ningxia	1	0
Fujian	3	1	Qinghai	1	1
Jiangxi	3	1	Xizang	0	0
Chongqing	3	1			

Data Sources: https://yz.chsi.com.cn/ (accessed on 20 August 2020).

4.3. The Bivariate Spatial Autocorrelation Analysis of Post-Graduate Geographical Talents Education

Spatial autocorrelation is an analysis method to study whether the value of a certain position in space is related to the value of its adjacent position and the degree of correlation. The local spatial autocorrelation measure (LISA) can reveal the spatial autocorrelation of adjacent regions within a local region. The LISA cluster diagram and significance map were obtained by GeoDa software 1.16 (20 October 2020) for 64-bit Windows. The Figures 1–6

show that there were three clusters between population scale, education quality, education input, and post-graduate geographical talents education in China, which showed significant spatial similarities and differences.
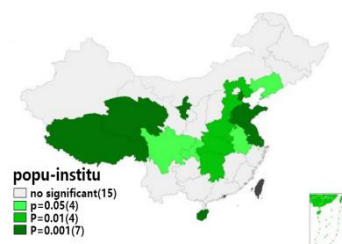

Figure 1. Local significance of population scale. (Data Sources: China education statistical yearbook, statistical yearbooks of provinces and cities, the sixth national census.)

Figure 2. Local significance of education quality. (Data Sources: China education statistical yearbook, statistical yearbooks of provinces and cities, the sixth national census.)

Figure 3. Local significance of education input. (Data Sources: China education statistical yearbook, statistical yearbooks of provinces and cities, the sixth national census.)

Figure 4. Local incremental clustering of population scale. (Data Sources: China education statistical yearbook, statistical yearbooks of provinces and cities, the sixth national census.)
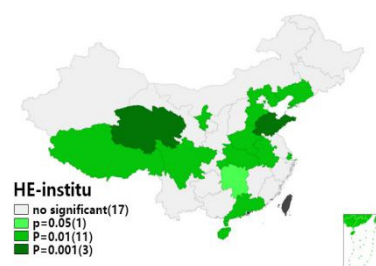

Figure 5. Local incremental clustering of education quality. (Data Sources: China education statistical yearbook, statistical yearbooks of provinces and cities, the sixth national census.)
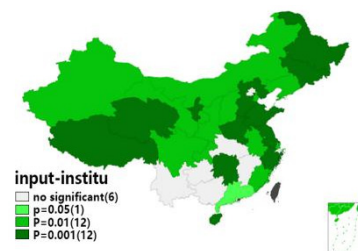
Figure 6. Local incremental clustering of education input. (Data Sources: China education statistical yearbook, statistical yearbooks of provinces and cities, the sixth national census.)
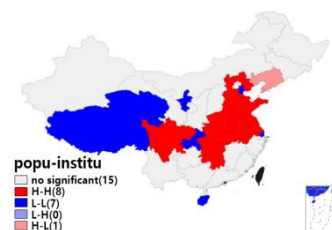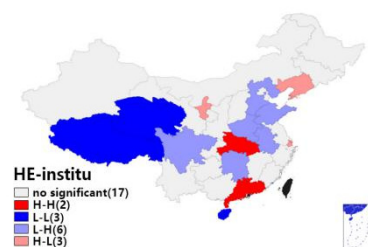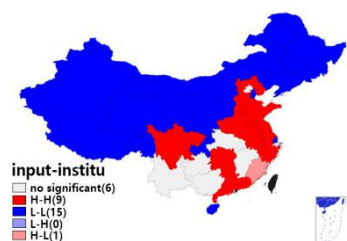
4.3.1. The Significant East-West Difference between Population Scale and Education

According to the analysis of the population scale of each province and the post-graduate geographical talents education institutions in China (Figures 1 and 2), it shows significant east-west difference.

There is an H-H cluster which means a large population with high education levels around Hebei, Shandong, Jiangsu, Henan, Anhui, Hubei, Hunan, and Sichuan province in the east of China. There is a significant correlation between population scale and geographical education institutions, among which Shandong and Jiangsu province are the most significant. Meanwhile, post-graduate geographical education in Shandong and Jiangsu province is well developed, and there are high-level talents education and training centers and basic conditions for professional research, allowing independent education and training of talents to meet the needs in economically, societally, resource, and environmentally sustainable development. Furthermore, there was an L-L cluster having less population and poor educational levels around Ningxia, Chongqing, Qinghai, and Tibet in the west of China. Although it has the support of national policy, the population scale is still in the low levels and cannot meet the basic conditions of high-level education and training, and the research direction is limited.

4.3.2. The East-West Difference between the Education Quality and Education

According to the analysis of the education quality of each province and post-graduate geographical talents education in China (Figures 3 and 4), it shows east-west differences.

There is an H-H cluster with a large population and high education levels around Guangdong and Hubei province in the east of China. Guangdong province has been developing rapidly in recent years and is located in the coastal region, bordering Hong Kong and relying on Hong Kong's education advantage to attract a large number of talents to promote the concentration of talents. Meanwhile, Hubei province has 66 colleges and universities, relying on Xiangyang, Yichang, Huanggang, Enshi, and other cities to establish a sound education network, forming its own advantages in talent attraction. Moreover, there is an L-H cluster that has a smaller population, but there are relatively good educational resources around Hebei, Shandong, Henan, Anhui, Hunan, and Sichuan province. Among them, Shandong provinces is the representative, whose number of net outflows of population has a certain impact on the quality of young people. Under the great pressure of exam-oriented education in Shandong province, students choose to study in the other province, leading to a large number of brain drains, which also caused the Shandong talents dilemma now. In recent years, economic development ranked in first place, but the development of education has not been fully planned, resulting in weak overall talents education and training and a fragile ecological environment and the need for professional talents to serve local sustainable capacity construction. Furthermore, there is an LL cluster with a smaller population and poor educational resources in Qinghai and Tibet in the west of China, whose geographical location is one of the main influences.

4.3.3. The Southeast-Northwest Difference between Education Input and Education

According to the analysis of the education input of each province and the post-graduate geographical talents education in China (Figures 5 and 6), it shows south-north differences and east-west differences.

There is an H-H cluster which means a large population with high education levels around Hebei, Shandong, Henan, Anhui, Jiangsu, Zhejiang, Guizhou, Guangdong, Sichuan province in the east of China. These have developed economies with a high investment in education, and have a sound education system. Moreover, there is an L-L cluster with a smaller population and poor educational resources around Heilongjiang, Jilin, Liaoning, Inner Mongolia, Shanxi, Shaanxi, Chongqing, Ningxia, Gansu, Qinghai, Xinjiang, Tibet, Tianjin, Shanghai, and Hainan province, generally in the north and west of China, with lower education investment. Although, in recent years, the north and west region of education investment has showed a rising trend among regions, the spatial pattern of education investment does not change its situation, and its input is still at the lower level in China with low attraction to talents, low population cluster ability, and few geographical education institutions [30].

5. Discussion

5.1. The Characteristics of Post-Graduate Geographical Talents Education

The educating and training orientation of post-graduate geographical institutions in China has its own characteristics, which are influenced by factors such as geography teacher's capability, resources and environment location, history of human activities, and laboratories and field observation stations.

5.1.1. The Global and National Scales' Characteristics in the Universities Directly under the Ministry of Education

A total of 22 universities directly under the Ministry of Education in China are authorized to grant post-graduate degrees in geography, of which 11 are authorized to grant doctor degrees in first-level disciplines (Table 1) and nine are authorized to grant master degrees in first-level disciplines. To sort out the post-graduate programs of geography in universities directly under the Ministry of Education, the education and training direction of master/doctoral students in the same university is the same. Therefore, the three second-level geography disciplines of physical geography, human geography, and geographic information system are used to compare the master/doctoral degrees in different universities, to summarize the overall characteristics of the education and training of post-graduate geographical talents in universities directly under the Ministry of Education of China.

The educating and training direction of physical geography post-graduate talents in universities directly under the Ministry of Education mostly focuses on the evolution of the physical geography environment on a global scale (Table 2). Meanwhile, universities also maintain the research characteristics of China's regional resources, environment, and disaster management. Beijing Normal University, Lanzhou University, and Shaanxi Normal University, as representatives of universities in northern China, focus on the research of landform and soil, water and soil conservation, and environmental changes in arid areas; southern universities such as Nanjing University and Sun Yat-sen University focus on hydrology, water resources, water environment, and drainage basin or coastal zone resources and environment; East China Normal University (ECNU) takes the physical geographical process of delta cities as the core direction, forming the research characteristics of the relationship between cities and estuaries and coasts; Southwest University has formed a world-class karst research system.

Table 2. The direction of geographical post-graduate education in universities directed by the Ministry of Education.

University	Physical Geography	Human Geography	Cartography and GIS
Peking University	Land science and resource management, global environmental change and ecosystems, resource and environmental information systems, river basin comprehensive planning and managing	Urban Geography, Economic Geography, Urban and Regional Planning, Tourism Geography and Urban Recreation Space Planning, Landscape Planning and Design	GIS structure and technology, Spatial data distributed computing, Intelligent Processing and Understanding of Spatial Information, GIS Modeling, Digital Earth/Cities, Spatial Information Engineering, Theory and Method of Spatial Information Mobile Application
Nanjing University	Surface process and global ecological environment evolution, land hydrology and water resources utilization, soil and land resource utilization	Land Planning and Management, Tourism Geography and Planning Culture, and Landscape Geography	Geography and GIS Theory, Digital Map and Applied Map Science, Planning and Resource Environmental Information Engineering, Virtual Reality Project
Lanzhou University	Geomorphology, environmental archaeology and historical climate, the present environmental processes, soil and geochemistry, tree ring climate and ecology, use of natural resources, ecological environment impact	Human Activities and Environmental Changes, Ecological Economy and Resource Environment Management, Urban Environment and Urban Planning, Tourism resources' employment and program	Mechanism remote sensing, Land Surface Processes, Hydrologic remote sensing, Quantitative Remote Sensing, GIS Environment Modeling, Space-time modeling theory and application of atmospheric environment remote sensing
Sun Yat-sen University	Environmental change and natural disasters, environmental assessment and planning, evaluation and utilization of natural resources	Regional and Sustainable Tourism Development, Regional Development and Urban and Rural Planning, Land resources exploit	Spatial Analysis and Intelligent Understanding, High performance geo-computation, Digital Earth and Smart City, Modeling and Application of Geographic Information System
Wuhan University	Water resources and water ecology, river-basin development, climate change and its environmental effects, surface processes and environmental evolution	Urban Geography and Urban Research, Economic Geography and Industrial Planning, Regional Development and Urban and Rural Planning, Resource Environment and Sustainable Development	GIS Software Development and Engineering Application, geographic information visualization and virtual reality technology, Digital Map Engineering, Digital Areas and Cities, Massive Spatial Data Access Technology, Earth-observing technology
Southwest University	Karstology and environmental change, urban landscape and disaster landscape, land use and soil environment	World Economic Geography, Land Use and Land Planning	Remote sensing of ecological environment, Urban remote sensing, Mapping Technology and Method
Beijing Normal University	Climate change and eco-environment response, natural geography in arid areas, environmental evolution, regional disaster	Urban geography and planning, regional analysis and planning, Globalization and Geo-Setting, Cultural Geography	Remote Sensing Mechanism, Remote Sensing Quantitative Retrieval, Analysis and Application of Remote Sensing Information, Geographic information analysis
East China Normal University	Urban landscape and environment, natural risk assessment and prediction, delta process, environmental evolution, global change	Economic Geography and Regional Innovation, Urban geography and urban economy, World Geography and Geopolitics, Political geography and administrative divisions, Cultural Geography and Local Development	Remote sensing science and application, GIS, Geo-computation, Map mapping and Visualization

Table 2. *Cont.*

University	Physical Geography	Human Geography	Cartography and GIS
Northeast Normal University	Synthetic physical geography, biogeography, climate change and regional responses, soil geography	Regional Economic Geography, Urban Geography and International Economic and Trade Geography of Urban and Rural Planning	Remote Sensing Information Analysis and Application Model, GIS theory and application development, Hyperspectral and Polarized Light Remote Sensing, Quantitative geography, Modern Cartography
Central China Normal University	Natural Resource Exploitation and Utilization, Ecological environment, Tourism Resources and Environment	Historical Geography and Healthy Sustainable Development, Regional Development and Urban and Rural Planning, Land resources exploit	Geographic Information Engineering, Geographic Information Science, Geographical simulation
Shaanxi NormalUniversity	Environmental evolution and man-land relationship, Global change and natural disasters, Land resources and land price assessment, Wind-blown sand dynamics	Population and health geography, Tourism Geography and Scenic Area Planning, Urban and Regional Research	Thematic Mapping, Resource and environment remote sensing, Digital Map and Geographical Modeling

Data Sources: https://yz.chsi.com.cn/ (accessed on 15 September 2020).

The educating and training direction of human geography post-graduate talents in universities directly under the Ministry of Education mostly focus on economic geography, urban geography, tourism and cultural geography, and land use planning technology and methods (Table 2). Peking University, East China Normal University, Sun Yat-sen University, and Northeast Normal University have formed their own characteristics in the fields of economic geography and urban geography. Beijing Normal University has strong capability in cultural geography and financial geography, while Nanjing University has advantages in land resources and land planning. The international influence of ECNU in world geography is becoming increasingly significant. The post-graduate education of human geography in universities directly under the Ministry of Education focuses on the theory and method of human-economic geography and its application in economic and social construction and attaches great importance to the contribution of geography to urban and rural planning, land use planning, tourism planning, population policy, and community governance.

The education and training direction of the geographic information system post-graduate talents in universities directly under the Ministry of Education attaches great importance to interdisciplinary integration with surveying and mapping, remote sensing, ecological environments, computers, and other disciplines and has been applied to social and economic construction, ecological and environmental change monitoring, and other fields of daily life. Wuhan University was the earliest research institution engaged in geographic information system, remote sensing, and surveying and mapping in China. It has leading advantages in this discipline, with rich research directions and strong practicability (Table 2). Peking University highlights the principles, methods, and applications the of geographic information system, Beijing Normal University focuses on remote sensing and geographic information system based on resource and ecological data, Nanjing University highlights the application of remote sensing in the ecological environment and territorial spatial planning, and Lanzhou University attaches great importance to the study of arid areas based on GIS. In general, the disciplines of geographic information science of each university are different, and the advantages of their respective theories, regions, and industries are highlighted to educate and train information geography post-graduate talents actively to meet future needs.

5.1.2. The Regional Comprehensiveness Characteristics in Provincial Normal Universities

Provincial normal universities are funded by the local financial support of the provinces under their administration. As an important part of China's higher education system, they aim to serve the economic and social development of the region and focus on educating and training high-quality talents for the region. There are 32 provincial normal universities in China with doctoral programs in geography, and 11 universities have doctoral programs in geography, including Nanjing Normal University, Capital Normal University, and Fujian Normal University. Except for Anhui Normal University, all of them are first-level doctoral programs. Combining with a provincial normal university geography graduate education scheme, the Nanjing Normal University, Capital Normal University, Capital Normal University, and Harbin Normal University geography are selected to summarize subject characteristics of provincial normal university graduate education in geography (Table 3).

Table 3. Main orientation of geography post-graduate education in provincial normal universities.

University	Physical Geography	Human Geography	Cartography and GIS
Nanjing Normal University	Quaternary Geology, Environmental Change and Global Change, Ground process and geomorphology simulation	Rural Geography and Urban and Rural Development, Tourism Geography, Resource and energy development, utilization and sustainable development, Geopolitics	Spatial Structure and Mechanism of Geographic Information; The acquisition, modeling, processing, processing, expression and application of geographic information; Spatial cognition theories, Simulation of Cognitive Law of Geographical Space
Capital Normal University	Water and soil environmental process and restoration, Ecological Environment and Regulation	Industrial development and spatial layout, Urban Development and Its Spatial Structure, Regional and Urban Planning	3D spatial information acquisition and expression, Water Resources Management Information System of Remote Sensing Technology and Geoscience Application
Hunan Normal University	Mechanism of River—Lake Interaction in Dongting Lake Basin, Sustainable Utilization of Land Resources in Typical Subtropical Areas, Environmental Geochemistry and Ecological Restoration	Urban Geography and Regional Sustainable Development, Regional Development and Urban and Rural Planning, Regional Economy and Regional Planning	Resource and Environment information system, Geospatial Modeling and Analysis, Remote Sensing Monitoring and Assessment of Resources and Environment
Harbin Normal University	Synthetic Physical Geography, Biogeography and Ecological Restoration, Soil Ecology	Regional Economic Geography, international economic geography, region and urban development	Quantitative Remote Sensing, Spatial Analysis and Environmental Remote Sensing, intelligent information mining

Data Sources: https://yz.chsi.com.cn/ (accessed on 15 September 2020).

The post-graduate Program of Physical Geography in Provincial Normal University focuses on local resources and environmental conditions. Fujian Normal University and Hunan Normal University focus on regional characteristics, which focus on the geographical advantages of Fujian and Taiwan as well as the regional characteristics of humid subtropical zone, subtropical climate, and the mechanism of river and lake action in the Dongting Lake basin. Meanwhile, Harbin Normal University focuses on black soil and forest ecology. Moreover, Capital Normal University focuses on environment and water resources management in urban and urbanized areas, and Nanjing Normal University focuses on land surface processes and resource utilization in monsoon environments. In general, the education and training of physical geography post-graduate talents in provincial normal universities focus on the background conditions of local resources and environment, focus on the sustainable utilization of provincial resources and environment, and focus on the evolution of important natural elements (rivers/lakes/seas), soil, water and forest and their externality governance. Compared with the target of physical geography graduates in universities directly under the Ministry of Education, the focus of physical geography

graduates in provincial normal universities on the breadth and scale of physical geography elements is less, and they are more inclined to focus on local comprehensive research.

The post-graduate education of Human Geography at Provincial Normal University focuses on the economy, tourism, land use, and transportation of the province and its adjacent regions, with particular emphasis on urban industrial development, land use planning, tourism planning, and population policy. Compared with the research of human geography in universities directly under the Ministry of Education, the research fields of cultural and social geography, administrative regionalization, and geopolitics are lacking. The deep reasons are as follows: firstly, there is a lack of scientific and educational personnel in the corresponding fields; secondly, taking education as the main task leads to difficulties in opening or elective courses in some fields, which leads to the closed structure of the malignant accumulation cycle and fails to promote the overall progress of human geography.

There are significant differences in the orientation of GIS education in provincial normal universities. The discipline of Maps and Geographic Information System in Nanjing Normal University is the most mature with a wide range of research scopes, and its overall strength is inferior to Wuhan University, Institute of Geographic Science, and Natural Resources Research, CAS, and Chinese Academy of Surveying and Mapping. Shanghai Normal University concentrates on urban remote sensing and urban GIS application, while Hunan Normal University focuses on spatial big data acquisition and application, and Capital Normal University focuses on land subsidence data processing, 3D data acquisition and analysis, and the water resources management information system.

5.1.3. The Provincial Characteristics in Provincial Comprehensive Universities

The education and training of post-graduate geography talents in provincial comprehensive universities focuses on provincial characteristics. It indicates that the development level of geography in provincial comprehensive universities is general, and there is a big gap compared with the universities directly under the Ministry of Education and the provincial normal universities. The education and training schemes of geography graduates in provincial comprehensive universities were sorted out, and the characteristics of the education and training of geography graduates among different universities in the secondary discipline of geography were compared (Table 4).

The regionality of post-graduate geographical education in provincial comprehensive universities is very significant. Through the comparison of the educating and training direction of physical geography, it is found that the research characteristics of desertification and soil and water conservation, arid and semiarid, and loess plateau physical geography in Northwest University and Xinjiang University are distinct; Yunnan University's focus on international rivers and the confluence of the three rivers is remarkable in its natural and cultural features; Henan University focuses on resources and environmental issues in the middle reaches of the Yellow River. There is little difference in the orientation of human geography post-graduate education, which generally concentrates on the fields of land use and urban and rural planning, industrial geography and regional development, tourism geography, and tourism planning. The orientation of GIS education is mainly based on the comprehensive application of 3S technology in the study of physical and human geography in specific regions, with general emphasis on GIS spatial analysis, remote sensing data processing, and the development of special GIS platforms, etc. Compared with the research contents of universities directly under the Ministry of Education, it lacks in-depth innovation.

Table 4. Characteristics of geographical post-graduate education in provincial comprehensive universities.

University	Physical Geography	Human Geography	Cartography and GIS
Northwestern university	Land use change, relationship between changes in natural environment and human activities, Natural Geography of Loess Plateau, water resources and watershed water environment, natural disasters and prevention	Urbanization and its Resource and Environmental Effects, Urban and Rural Planning and Management, Regional Development and Planning of Industrial Development and Spatial Structure, Tourism Geography and Tourism Impact	Surface Information Detection Technology, Geospatial Information Management and Processing Technology, GIS Spatial Analysis, remote sensing digital image processing, Digital Terrain Analysis and Modern Surface Process Simulation
Henan university	Environmental planning and management, Sustainable use of regional natural resources, Landscape Ecology and Biogeography	Integrated urban development, the tourism development and the plan, Urbanization and Urban Sustainable Development, Urban and Rural Planning and Design	Regional Simulation and Urban Information System, Resource Environment and Ecological Remote Sensing, Virtual Geographical Environment and Geovisualization, spatial data analysis and sharing services
Yunnan university	Karst Environment, plateau mountain disasters, sustainable use of natural resources, International Hydrological and Water Resources	Territorial Spatial Planning, Natural Resource Management and Land Use Planning, international rivers and regional cooperation, mountain disaster risk management	Geographic Information System for Mountain Resources and Environment, Method and Application of Remote Sensing Technology, Development of Land Resource Management Information System
Ningbo University	Coastal Zone Development and Wetland Protection, Resource Environment and Regional Sustainable Development, Global change and natural disasters	Urban and Rural Development and Regional Planning, urban cultural and creative industries, Seaport Traffic and Urban Habitat Environment	Land resource management 3S application, Intelligent Interpretation and Typical Application of Coastal Zone Remote Sensing

Data Sources: https://yz.chsi.com.cn/ (accessed on 15 September 2020).

5.2. The Spatial Difference of Post-Graduate Geographical Talents Education

The economic development of China is divided into three regions: the eastern region (13 provinces/autonomous regions), the central region (nine provinces/autonomous regions), and the western region (10 provinces/autonomous regions). The number of universities with authorization for a master/doctor degree in geography in the three regions show: (1) there are 35 and 14 universities in the eastern region, 25 and nine in the central region, and 24 and 10 in the western region, respectively. These results indicate that the spatial distribution of post-graduate geographical education institutions in China is unbalanced, and the main talent education institutions are concentrated in the eastern developed provinces. High-level talent educating and training centers in regional geography, such as Wuhan, Xi'an, Lanzhou, and Kunming, have taken shape in the central and western regions, but the overall strength is weak, and the discipline influence is low. The education and training of post-graduate geography talents in eastern provinces has improved, with Beijing, Nanjing, and Guangzhou forming three major educating and training centers for geography doctoral students. However, there are no doctoral centers in geography in colleges and universities in Zhejiang, Hainan, and Guangxi, where the economic development level is better in the eastern region. (2) The vast central and western regions of China have fragile ecological environments, as well as the headwaters of the Yangtze River and the Yellow River and Mount Qomolangma. The talent base for resource and environment utilization and sustainable economic and social development is weak. Therefore, it is urgent for geographical institutions to produce a large number of talents to serve local sustainable capacity construction. At the same time, facing the implementation of the national "One Belt and One Road" initiative and the maritime power strategy,

eastern coastal provinces such as Zhejiang, Hainan, and Guangxi need more land–sea coordinated geographical researchers to solve the practical problems of marine ecological civilization, marine territorial governance, and national maritime rights and interest protection [31]. However, Ningxia, Xizang, Shanxi, Sichuan, Zhejiang, Hainan, Guangxi, and other provinces/regions have not been approved by the state to set up geography doctor authorization centers, and a high-level geography personnel education system has not been formed, making them the weakest provinces in the development of higher geography education in China [32,33]. This has formed a significant talents demand and the lack of institution for spatial dislocation characteristics.

5.2.1. The Spatial Imbalance of Post-Graduate Geographical Talents Education

The number of post-graduate geographical education institutions is an important aspect of the development quality of geography in the region. The distribution of post-graduate geographical education institutions in Chinese universities is unbalanced, which significantly clusters in the mega-central cities and have characteristics of regional gradient distribution. Beijing, Nanjing, Lanzhou, Xi'an, Wuhan, Guangzhou, Kunming, and Changchun, as the central cities of higher education in China, also take a leading position in the geographical post-graduate talents, and the authorized number of master/doctoral programs is far more than that of other provinces. Shandong, Hunan, Henan, and 17 other provinces belong to the second tier, which merely has a university authorization for the doctor degree and 2–5 universities with authorization for the master degree. Sichuan, Zhejiang, Guangxi, Hainan, Ningxia, Shanxi, and Tibet belong to the third tier, whom have no university authorization for the doctor degree, and Tibet even has no university authorization for the master degree. These provinces have slower geography development of post-graduate education, and post-graduate education capacity lags behind, seriously affecting the sustainable development of the talents supply and leading to a significant spatial imbalance.

5.2.2. The Significant Spatial Stratification of Post-Graduate Geographical Talents Education

A total of 22 universities directly under the Ministry of Education in China are authorized to educate and train geographical post-graduate talents, 11 of which are authorized to educate doctoral students. Their talents education and training directions are broad, ranging from global scale to national scale or urban scale research, and the research content is relatively comprehensive. Provincial normal universities are the main body of post-graduate geographical education in China, and there are 32 universities with geography authorization. Compared with the universities directly under the Ministry of Education, the research scale and research content of post-graduate geographical education in provincial normal universities focus on the province as a whole, forming a geography discipline system with local characteristics. As a whole, the geography graduates in provincial comprehensive universities are similar to those in provincial normal universities in terms of field and content, but they pay more attention to application. The education level of geography graduates in the three types of colleges and universities directly affiliated with the Ministry of Education, provincial normal universities, and provincial comprehensive universities presents significant hierarchical characteristics. The direction of geography graduates in universities directly under the Ministry of Education focuses on all three-level disciplines of geography at global and national scales, which are the most comprehensive. Provincial normal universities and provincial comprehensive universities aim to educate and train geographical post-graduate talents who serve the ability of local sustainable development, and the direction focuses on the local: the ability of local comprehensive development and the regulation of the core shortcoming elements of local sustainable development.

5.2.3. The Increasing Prominence of Comprehensive Regional Characteristics of Post-Graduate Geographical Talents Education in Provincial Universities

Regional and local comprehension is the difference between other subjects and is one of the essential characteristics of geography. China attaches great importance to the local resources of post-graduate education in geography environment background conditions associated with human activities and the evolution law. Vigorously, developing China can solve the geography of the local economic and social development and resources and environment conservation research talents. The education and training of geographical post-graduate talents in universities directly under the Ministry of Education attaches great importance to the evolution of natural or human factors at the global or national scale and the mechanism basis of their interaction with other factors and tries to explore global sustainable development goals and explain their regional capacity differentiation. For example, Southwest University has established a series of courses in karst science, and East China Normal University has established delta science and global city studies. The education and training of geographical talents in provincial normal universities and provincial comprehensive universities focus on educating and training high-quality talents for the local areas, and the regional comprehensiveness of the training of talents is more significant. For example, the confluence of the Three Rivers in Yunnan University, the desertification and soil and water conservation in Xinjiang University and Ningxia University, and the coastal resources and wetland protection in Liaoning Normal University and Ningbo University all reflect the regional characteristics of the education and training of geographical talents in local universities.

6. Conclusions

The study found that post-graduate geographical talents education has strong inter-regional differentiation and imbalance. A series of challenges should break through during the transition between post-graduate geographical talents education and the work of serving local resources and environmentally friendly utilization and sustainable development capacity. To optimize the spatial production pattern and characteristics of geographical post-graduate education, it is urgent to take a series of measures to balance the spatial production of geographical post-graduate talents and further improve the quality of geographical post-graduate education. At the same time, after globalization and the knowledge-based economy, the mobility of international talents is increasing. Facing the uneven distribution and development of geographical education resources between regions, how to cultivate post-graduate geographical talents for a more comprehensive development is currently a problem that needs to be solved.

6.1. Coordination with Degree Authorization for Regional Post-Graduate Geographical Talents

To match the production of geographical talents with the governance needs of China's ecological environment and territorial space, authorization for a master and doctor degree for regional geographical post-graduate talents should be balanced. The central and western regions of China lack geographical post-graduate education institution. Meanwhile, these regions are rich in natural resources and fragile in ecological environment, which are of high research value. To realize the linkage development of the Higher Education System of Geography and Economic and Social Construction, Resource and Environmental Protection, and Territorial Spatial Planning, the authorization for a geographical master and doctor degree should be balanced in China.

6.2. Consideration with Multi-Disciplinary Construction to Educate and Train Geographical Talents

In the era of information geography, multi-disciplinary areas should be paid attention and actively adapted to the education mode of geographical post-graduate talents. The geographical post-graduate education should strengthen the ability of inquiry-based learning, project study, field observation, investigation, and analysis. With the vigorous development

of the new knowledge-based economy, talent competition and cross-regional flow of talent have become increasingly fierce around the world. The geographical post-graduate education should organically combine talents education and training with scientific research, and strengthen discipline critical thinking and theoretical construction ability education and training. Moreover, the structure of multi-disciplinary graduate courses should be constructed, while the content of courses should be optimized. Reformation of the management system of enrollment and training and graduation of multi-disciplinary graduates to provide a sound atmosphere for the education and train of innovation ability of geographical post-graduate talents are important.

6.3. Cooperation with World-Class Universities or Neighboring Countries to Educate and Train International Geographical Talents

Local universities in China should be based on the regional construction of geography, actively strengthen the global perspective of post-graduate education and the global learning ability of advanced technology, and solve the organic integration of local synthesis and globalization in the talents education and training process. Therefore, it is necessary to educate and train the integrity, diversity, spatial thinking, global, and local vision and general quality of prospective geographers, increase national and world geography-related courses, strengthen the application of multi-scale remote sensing and geographic information technology in daily scientific research, and form the characteristic direction of geography majors in provincial universities.

The development of science and technology has led geography into a new era. In the new era, geography has become interdisciplinary, regional, and comprehensive, which is very consistent with the sustainable development goals. Facing the requirements of the sustainable development goals, it is necessary for countries around the world to strengthen high-level talents in geography education, and pay attention to the regional differences and imbalances of geography education. The government should use a series of means such as capital regulation, resource redistribution, and education strengthening to reduce the differences between regions, adjust the geography professional training system, and optimize its curriculum structure and training mechanism to alleviate the unreasonable flow of high-level talents.

Finally, this research has potential room for improvement, and there is an urgent need for further research. Theoretically, equal accessibility to post-graduate geographical talents education and training should be proposed in the next step, which includes more detailed demographic and spatial data, by which we can identify the spatial differentiation more accurately. Equal accessibility to post-graduate geographical talents education and training can further solve equal distribution, which results from incomes, age structures, education levels, and other complicated conditions, and can lead to social injustice. In future research, questionnaires and social surveys should be carried out urgently, in order to reveal injustice in the accessibility of post-graduate geographical talents education and training. Methodologically, the previous research was limited by demographic and spatial data, and the data of different situations, which would be improved in the future research. Therefore, the next research will incorporate more complicated situation data into the model in order to gain more accurate results, and thereby could more effectively reflect the spatial differentiation.

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