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Analysis of Regional Differences in Teacher Resources in Secondary Vocational Schools in the Context of Beijing-Tianjin-Hebei Synergy

-- The Example of Secondary Vocational Schools in Beijing, Tianjin and Hebei

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Abstract: Under the background of beijing-Tianjin-Hebei coordinated development, the allocation of secondary vocational education resources has been deeply affected.Firstly, based on the relevant data of teachers' educational resources in Beijing, Tianjin and Hebei secondary vocational Firstly, based on the relevant data of teachers' educational resources in Beijing, Tianjin and Hebei secondary vocational schools in 2020, this paper defines each index of resource allocation in Beijing, Tianjin and Hebei secondary vocational schools. Secondly, the coefficient of variation method is used to calculate and analyze the related factors that affect the educational resources of secondary vocational schools. Finally, optimization strategies are proposed for the unbalanced resource allocation of teachers in Beijing-Tianjin-Hebei secondary In addition, the Joint Committee also recommends that the Government of the Republic of China (RDC), in cooperation with the Ministry of Education of the Republic of China and the Ministry of Education of the People's Republic of China (MEC), should consider the possibility of establishing a new system of education for teachers. reference for the establishment of modern vocational education system and optimization of resource allocation in first-class vocational education in The aim of this study is to provide a comprehensive overview of the development of vocational education in the Beijing-Tianjin-Hebei region.

Keywords: Secondary vocational education; Teacher resources; Regional differences; Coefficient of variation.

1. Introduction

On 22 September 2020, General Secretary Xi Jinping presided over a forum for representatives of experts in the field of education, culture, health and sports and delivered an important speech, pointing out that: "We should base ourselves on serving national regional development strategies, optimise the allocation of regional education resources, accelerate the formation of a spatial pattern of education development that combines points, lines and surfaces, and echoes between the east and the west, and enhance the level of education to serve regional development strategies ". At the same time, General Secretary Xi Jinping pointed out that "the coordinated development of Beijing, Tianjin and Hebei is of great significance, and the understanding of this issue should be raised to the level of national strategy. Vocational education is an important part of the national education system and human resources development, and is an important way for the majority of young people to open the door to success and success, and is responsible for cultivating diversified talents, passing on technical skills, and promoting employment and entrepreneurship It is an important part of the national education system and human resources development. The allocation of vocational education resources needs to be adapted to regional development needs. In the context of the Beijing-Tianjin-Hebei cooperative development, the allocation of vocational education resources will be profoundly affected, and how to optimize the allocation of resources will become an urgent and important research topic. In this paper, by making a definition of each indicator of resource allocation in secondary vocational schools in Beijing, Tianjin and Hebei, applying the coefficient of variation method, the relevant factors affecting the education resources of secondary vocational schools are calculated and analysed, and finally, optimisation strategies are proposed for the problems of unbalanced distribution of teachers' resources in secondary vocational schools in Beijing, Tianjin and Hebei, to synergise the advantageous resources of Beijing, Tianjin and Hebei, to ensure the strategic objectives are implemented, and to provide a basis for Beijing, Tianjin and Hebei to establish a modern vocational education system and This study provides a reference basis for decisions related to the optimisation of resource allocation forces in first-class vocational education.

2. Resource Allocation for Secondary Vocational Education in The Beijing-tianjin-hebei Region

2.1. Total industry development limited

The implementation of the Beijing-Tianjin-Hebei Synergy Development Strategy has made vocational education a restricted sector in Beijing.

The "Catalogue of Prohibited and Restricted New Industries in Beijing" stipulates that "the scale of secondary vocational schools will not be expanded", "no new secondary vocational schools will be established", "no new floor space will be added to secondary vocational schools". ""No more expansion of the scale of higher education" "No more new general higher education schools" "No more new floor space for higher education schools" "No new general higher education schools will be established or newly upgraded" "No new general training institutions for national enrolment will be prohibited". This policy has affected the understanding and decision making of the relevant authorities on the development of vocational education, and there is an urgent

need to establish a unified understanding of vocational education in terms of "subtracting from the total, increasing and decreasing locally, and collaborating with regional division of labour".

2.2. Imbalance in human resource allocation

Firstly, there are differences in the intrinsic drivers of talent mobility. The economic benefits that labour can obtain or create are intrinsic to talent mobility and therefore the most direct driver of talent mobility is economic benefits. Compared to Hebei province, Beijing and Tianjin have higher levels of economic and cultural development, more opportunities for job seekers to develop and higher levels of remuneration. Secondly, the social security system and urban infrastructure in Beijing and Tianjin are more complete and provide more convenient conditions for living. High-level talents, in particular, tend to seek more development opportunities in Beijing or Tianjin, thus leading to a growing gap in the distribution of talent resources between Beijing, Tianjin and Hebei, with Hebei Province once experiencing an oversupply of talent resources. Finally, education is also a key factor in widening the development gap between the three regions. Take the number of 211 universities as an example, Beijing has 24, Tianjin has 3 and Hebei has only 1. There is a big gap in talent at the root, which inevitably leads to an imbalance in the distribution of human resources.

Therefore, Beijing, Tianjin and Hebei have not done a proper job of coordination and co-ordination in their development. There is no effective integration of human resources in accordance with the actual situation and realistic differences of each region, poor information flow, inability to establish a talent sharing mechanism, and the market is not complete enough to truly build a human resources supply and demand system covering the three regions of Beijing, Tianjin and Hebei, which has led to the inability to achieve a dynamic balance of human resources among the three regions and an uneven distribution of teacher education resources.

2.3. Insufficient integration of industry and education

The degree of fit between the professional structure of vocational education and industrial development needs to be further improved. The professional structure, which mainly serves the tertiary industry but not enough new industries, can hardly adapt to the capital's need for high-quality technical and skilled talents to build a highly refined economic structure. The phenomenon of duplication and lack of distinctive features still exists, and the degree of branding and high-end is not enough. The cooperation between schools and enterprises in educating students is not deep and stable enough, the training of technical and skilled talents is not refined enough, and students' professionalism, practical ability and innovation and entrepreneurship are not enough. The inadequate integration of industry and education is mainly due to the uneven cooperation dynamics between schools and enterprises. Schools and enterprises still rely mainly on private or traditional relationships to establish cooperation, and enterprises in industries where the supply of talent exceeds demand especially lack the initiative to participate in school-enterprise cooperation, making it difficult for schools and enterprises to achieve equal dialogue and a mutually beneficial and sustainable development pattern has not yet been generally formed.

2.4. Weak cross-regional collaboration

The lack of cross-regional collaboration in secondary vocational education is mainly reflected in two aspects: firstly, the collaboration in vocational education development among different districts in Beijing is weak, and the allocation of resources is too scattered, so that the overall effect of "high input and high output" is not brought into play. Secondly, the collaboration within the Beijing-Tianjin-Hebei region is not effective. The reason for this is the existence of a policy restriction "wall" and the lack of a co-ordination mechanism. In terms of the collaborative development of vocational education in Beijing, Tianjin and Hebei, apart from the need for a reasonable layout of vocational education facilities and majors (clusters), financial and taxation policies and personnel policies are "walls" that are difficult to break through in terms of resource allocation. For example, the establishment of excellent teachers across the region, household registration and the various benefits linked to this. At the same time, the vocational education authorities and vocational institutions in Beijing, Tianjin and Hebei have different interests in the collaborative development of Beijing, Tianjin and Hebei, coupled with cross-regional institutional barriers, the State Council and the governments of Beijing, Tianjin and Hebei at the three provincial and municipal levels have not yet established a co-ordination mechanism for the collaborative development of (vocational) education in Beijing, Tianjin and Hebei in the past three years, and the organisational leadership system has not yet been improved --The Ministry of Education's vocational education department has not intervened, nor has a joint meeting or regular consultation mechanism for vocational education in Beijing, Tianjin and Hebei been established.

3. Study Variables and Study Area

Given that the collaborative development of Beijing, Tianjin and Hebei was elevated to a national development strategy in 2015, this paper takes the allocation of resources for secondary vocational education in Beijing, Tianjin and Hebei and the allocation of educational resources for vocational secondary schools in Beijing as the object of study. Based on the data related to teacher education resources of secondary vocational schools in Beijing, Tianjin and Hebei in 2020, a definition of each indicator of the resource allocation of secondary vocational schools in Beijing, Tianjin and Hebei was made, and the construction of its indicator system This study selected relevant indicators from the existing public literature and materials to establish an indicator system for the evaluation of the power of optimal allocation of secondary vocational education resources, including three primary indicators and 12 secondary indicators (as shown in Table 1). The data were collected through the China Education Statistical Yearbook, Beijing Education Yearbook, Annual Report on the Quality of Secondary Vocational Education in China, Beijing-Tianjin-Hebei Education Development Research Report, Annual Report on the Participation of Beijing-Tianjin-Hebei Enterprises in the Training of Talents in Secondary Vocational Education, Annual Report on the Quality of Secondary Vocational Education in Beijing Vocational Secondary Colleges and Universities, as well as public materials such as vocational education websites and the official websites of relevant vocational secondary colleges in Beijing, Tianjin and Hebei. .

Table 1. Table of indicator coefficients

Tier 1 indicators	Secondary indicators	Explanation of indicators	Calculation method
Number of school staff	Student-teacher ratio	Reflects the adequacy of the number of teachers in secondary vocational schools	Total number of students enrolled / Total number of staff enrolled
	Percentage of full-time teachers	Reflects the extent to which teachers in the subject of their specialism in secondary vocational schools meet the standards	Number of full-time teachers on campus / Total number of staff on campus
	Percentage of administrative staff	Reflects the extent of administration in the various departments of secondary vocational schools	Number of administrative staff on campus / Total number of staff on campus
	Percentage of teaching and support staff	Reflects the adequacy of the number of professional staff in secondary vocational schools	Number of teaching and support staff on campus / Total number of staff on campus
Teachers' technical positions	Percentage of positive senior	Reflects the quality of teachers in secondary vocational schools	Number of full senior faculty/Number of full-time faculty on campus
	Percentage of associate senior		Number of Associate Faculty / Number of Full-time Faculty on Campus
	Intermediate share		Number of middle-level staff / Number of full-time teachers on campus
	Primary share		Number of junior teaching staff / Number of full-time teachers on campus
Teacher qualifications	Percentage of doctoral students	Reflects the extent to which the quality of teachers in secondary vocational schools meets standards	Number of faculty members with doctoral degrees / Number of full-time faculty members on campus
	Percentage of Masters students		Number of faculty members with master's degrees / Number of full-time faculty members on campus
	Percentage of undergraduates		Number of teaching staff with undergraduate degrees / Number of full-time teachers on campus
	Percentage of specialties		Number of teaching staff with specialist qualifications / Number of full-time teachers on campus

(Source: China Education Statistical Yearbook and other sources)

4. Research Methodology

4.1. Relative Gaps

This study uses the coefficient of variation (cv) as an analytical method to analyse whether secondary vocational schools in Beijing, Tianjin and Hebei have a balanced allocation of teachers by calculating the coefficient of variation for the three provinces. The coefficient of variation is the ratio of the standard deviation to the mean of the secondary indicators. When the unit of measure and the mean are different, it can better reflect the degree of variation of the data. The specific calculation formula is:

$$CV = SD/M \times 100\%$$

Where cv represents the coefficient of variation of each secondary indicator between provinces, SD represents the standard deviation of each secondary indicator between provinces, and M represents the mean of each secondary indicator between provinces.

4.2. Absolute gap

The study also uses the extreme difference ratio as auxiliary data to provide a comprehensive and objective picture of the differences in the allocation of secondary vocational school teachers between Beijing, Tianjin and Hebei provinces and cities. The extreme difference ratio is the ratio of the maximum value to the minimum value of each secondary indicator, which can, to a certain extent, reflect the degree of dispersion of resource input in Beijing, Tianjin and Hebei provinces and cities, and thus the degree of equity in the input of teacher resources in secondary vocational schools. When the extreme difference ratio is equal to 1, it means that the allocation of teacher resources is absolutely fair; the larger the extreme difference ratio is, the more unfair it is. The specific calculation formula is

$$R=Imax/Imin$$

Where R represents the extreme rate of difference in the input of each secondary indicator between provinces for

secondary vocational schools, Imax represents the maximum value of the secondary indicator input, and Imin represents the minimum value of the secondary indicator input.

(For statistical purposes and comparison, all figures below are retained to two decimal places)

5. Research Findings and Analysis

5.1. Inter-provincial comparison of the number of teaching staff

Table 2. Statistics on the number of teaching staff in Beijing, Tianjin and Hebei in 2020

Region	Student-teacher ratio	Full-time teachers	Administrative staff	Teaching and support staff
Beijing	5.19:1	64.57%	18.38%	10.83%
Tianjin	10.40:1	73.20%	16.62%	5.95%
Hebei Province	1.33:1	79.98%	7.93%	7.00%
Coefficient of variation	80.7%	10.6%	39.09%	32.39%
Margin of error	7.81	1.24	2.32	1.82

(Source: Ministry of Education 2020 China Education Statistics)

In terms of inter-provincial comparison of the number of teaching staff, the coefficient of variation for the student-teacher ratio indicator is 80.7, with the highest ratio in Tianjin being 7.8 times higher than the lowest ratio in Hebei Province, indicating that the number of teachers and teacher utilisation rates vary considerably between the three provinces and cities of Beijing, Tianjin and Hebei, and are relatively unbalanced. The coefficient of variation for the indicator of full-time teachers is 10.60%, and the extreme difference rate is 1.24, and the ratio is above 64%, indicating a more balanced allocation among the three provinces and cities. The coefficients of variation for administrative and support staff indicators were 30.09 and 32.39% respectively, with administrative staff accounting for the highest percentage in Beijing at 18.38% and the lowest in Hebei at 7.97%, suggesting that secondary vocational schools in Beijing are doing better at the school management level, while Hebei Province needs to focus on this indicator.

5.2. Inter-provincial comparison of the number of full-time teachers in teaching positions

Table 3. Statistics on full-time teachers in teaching positions in Beijing, Tianjin and Hebei in 2020

Region	Full Senior	Associate Senior	Intermediate	Junior
Beijing	1.74%	25.21%	42.49%	22.17%
Tianjin	0.62%	34.32%	42.11%	19.37%
Hebei Province	0.92%	21.30%	33.36%	20.07%
Coefficient of variation	53.19%	24.79%	13.13%	7.09%
Margin of error	2.81	1.61	1.27	1.14

(Source: Ministry of Education 2020 China Education Statistics)

In terms of inter-provincial comparisons of the number of full-time teachers in teaching positions, the proportion of full-time teachers in senior positions varies considerably, with a coefficient of variation of 53.19%, with Beijing having the highest proportion at 1.74% and Hebei having the lowest at 0.92%, indicating that there is a gap between the two provinces and cities in terms of senior talent. The proportion of full-time teachers in junior positions is relatively balanced, with a coefficient of variation of 7.09%. In terms of cross-sectional comparison, the full-time teacher positions in Beijing, Tianjin and Hebei provinces and cities are mainly concentrated above the divisional level and below the deputy senior level, with a relatively low proportion of senior teachers and above, which indicates a relative imbalance in teacher resources and relatively few talents in secondary vocational schools.

5.3. Inter-provincial comparison of teachers' qualifications

Table 4. Statistics on teachers' qualifications in Beijing, Tianjin and Hebei in 2020

Region	PhD students	Master's degree students	Undergraduate	Specialties
Beijing	1.63%	31.96%	61.90%	3.88%
Tianjin	0.16%	17.51%	80.16%	2.02%
Hebei Province	0.09%	8.91%	77.11%	13.65%
Coefficient of variation	138%	59.85%	13.38%	95.81%
Very poor	18.11	3.59	1.29	6.76

(Source: Ministry of Education 2020 China Education Statistics)

The coefficient of variation is 138% and 95.81% respectively, with 1.63% of teachers in Beijing and only 0.09%

in Hebei Province, indicating an extreme imbalance in the allocation of human resources between the two provinces. The proportion of teachers with a bachelor's degree is relatively balanced among the three provinces and cities, with a coefficient of variation of 13.38%, and the proportion is above 60%.

6. Conclusions and Recommendations

Suggestions for optimising the allocation of resources for secondary vocational teacher education in the context of Beijing-Tianjin-Hebei synergistic development should be profoundly adjusted and repositioned, with the overall goal of serving a new positioning and strategy for secondary vocational education and forming a new pattern of secondary vocational education, the key to which lies in promoting a balanced allocation and rational transformation of teacher resources in secondary vocational schools and actively promoting the synergistic development of secondary vocational education in Beijing, Tianjin and Hebei.

6.1. Development of an incentive system for continuing education in Beijing, Tianjin and Hebei

Continuing education is an educational activity for all members of society, especially adults, after school education, and is an important part of the lifelong learning system. In the context of the synergistic development of Beijing, Tianjin and Hebei, there is a need to develop an incentive system for continuing education in Beijing, Tianjin and Hebei. The system related to teachers' continuing education in China does not describe specific measures for teachers' continuing education, resulting in poor operability of continuing education. The lack of a close relationship between CPD and assessment and promotion has resulted in a lack of enthusiasm and motivation for CPD, which has often led to the existing CPD in China being due to 'external demand' rather than 'internal demand'. Inspired by foreign teachers' continuing education, the Beijing-Tianjin-Hebei teacher continuing education system should link continuing education to teachers' daily assessment, title evaluation and the treatment of teachers who receive continuing education, so as to motivate teachers to receive continuing education, and to assess the effectiveness of continuing education, and to motivate teachers to study seriously when receiving continuing education, and to apply the knowledge they have learnt in continuing education flexibly afterwards This will help to improve the effectiveness of teachers' continuing education and narrow the gap between the resources of teachers in the three regions.

6.2. Develop a system of mutual recruitment of teachers from Beijing, Tianjin and Hebei

In 2014, Guangdong Province took the lead in piloting the mutual appointment of teachers between universities and primary and secondary schools, which has already achieved good results. Mutual appointment of teachers refers to the mutual appointment of staff between units, which can take the form of "full-time appointment" or "part-time appointment". The length of appointment can be "short-term" and "long-term", "short-term" refers to a semester, "long-term" for one academic year or across academic years. The mutual appointment of teachers in secondary vocational schools in Beijing, Tianjin and Hebei can be between schools in the three regions, as well as between schools in the three regions, enterprises in the three regions and government departments in the three regions. Mutual employment between schools in the three regions is between teachers and researchers of the same subject in the three regions; mutual employment between schools in the three regions and enterprises in the three regions is when teachers from schools go to enterprises for theoretical instruction and also for practical learning with enterprise personnel, and enterprise personnel go to schools to teach or instruct practical courses; mutual employment between schools in the three regions and government departments in the three regions is when certain professional teachers who train talents for government departments can go to The mutual employment between the schools and the government departments of the three places means that certain teachers who train talents for the government departments can go to the government departments for practice, combine with practical problems and conduct theoretical seminars with the government department personnel. The government department personnel can go to the schools to teach students with case studies on some documents and policies actually implemented by the government. During the period of mutual employment of teachers in the three places, the workload and performance of the candidates will be certified in writing by the employing unit and sent to the candidate's unit, which will serve as the basis for the candidate's assessment, promotion and selection of advancement.

6.3. Develop a regular rotation and mobility system for teachers in Beijing, Tianjin and Hebei

The French Education Act of 1984 provides for a system of teacher mobility, stipulating that new recruits, teachers returning from secondment and teachers returning from long-term absence must participate in teacher mobility, while other teachers apply voluntarily. The country has also introduced a system of regular teacher mobility, which was introduced to reduce the disparity in teacher qualifications between schools and to enable students from different regions to have balanced access to education. The introduction of a regular rotation and mobility system for teachers is an effective way to promote the balanced development of teachers and the overall improvement of the quality of education in schools in the region. The regular mobility system developed for Beijing, Tianjin and Hebei needs to set out the principles that need to be mastered for rotational exchange, provide a policy basis for confirming the performance of rotating teachers, and provide preferential policies for promotion and merit assessment for rotating teachers. In the implementation of the regular rotation and mobility of teachers, different policies and approaches need to be adopted and implemented in a step-by-step manner, taking into account the actual situation of schools and teachers in the three regions, so that teacher education resources in secondary vocational schools in Beijing, Tianjin and Hebei are gradually equalised.

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