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# Explore New Low-carbon Travel Routes for Beijing Residents

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## ABSTRACT

This paper breaks the traditional thinking, re-examines the "supply and demand" relationship of transportation travel, and proposes to find a new path of low-carbon travel from the "demand side". The author innovatively proposed and demonstrated the "differentiated OAO office mode", and put forward personalized suggestions for the four travel needs of school, travel, medical treatment and commuting.

## KEYWORDS

Demand Side; Differentiated OAO Office Model; Low-carbon Travel; New Path.

## 1. INTRODUCTION

At present, there are four main paths to achieve low-carbon travel:(1) It is recommended to strengthen infrastructure construction, optimize public transportation facilities, etc. For example, Jinhai liu advocates the establishment and optimization of intelligent transportation systems, public transportation facilities, transportation energy integration orientation, green travel modes, and transportation organization models to achieve the dual carbon goals[1]. (2) Suggest promoting the transformation of energy structure, etc. For example,Dequn Zhou, Wenchong Hou, and Tianlong Pu found that the low-carbon transformation of energy structure in the transportation sector is a key step towards achieving the dual carbon goal[2]. (3) Suggest improving the level of public transportation services, etc. For example, Hongxu Guo , Ying Huang , and Juncen Fan found that improving the service level of public transportation, designing personalized incentive measures, providing alternative travel plans, and guiding residents to switch from private car travel to public transportation or non motorized vehicle travel are key measures to achieving low-carbon travel[3]. (4) Strengthen government supervision and other measures. For example, Quansheng Sun suggested that the government should strengthen guidance and supervision, enhance urban traffic management, and strengthen the construction of transportation facilities, in order to improve the quality and level of urban services in the transportation field[4].

In order to achieve the "dual carbon" goal, scholars have conducted numerous studies on the influencing factors of low-carbon travel for urban residents, but most of them have put forward some suggestions from the "supply side".However, the author believes that in today's environment, Beijing's transportation system is already very well-established and there is not much room for carbon reduction. Endless expansion of infrastructure construction, development of battery or new energy technologies, improvement of car energy efficiency through technological research and development, and strengthening regulatory efforts have reached development bottlenecks. Therefore, a new technological revolution or reform is urgently needed to bring breakthrough progress to "low-carbon travel".

Therefore, the author hopes to start from the demand side and find new low-carbon travel paths.

# 2. DEMONSTRATION AND PROPOSAL OF DIFFERENTIATED OAO OFFICE MODEL

## 2.1. Background of the Proposal of Differentiated OAO Office Mode

Some scholars believe that remote work will be an inevitable trend in the future, but security issues will be a critical concern. Shufang Cui, Li Chen, and Ming Ma believe that remote work has many advantages and typical values, so remote work in industrial parks has become an inevitable development trend. However, a major obstacle to remote work at present is security issues[5]. In the next 3-5 years, it is predicted that more than two-thirds of enterprises worldwide will adopt online office models[6]. Remote work is a concept that contrasts with traditional fixed workplaces and rigid full-time employment methods[7]. With the development of the market economy and the changes in traditional employment relationships, the "remote work" that breaks through time and geographical limitations has entered a new era of development. Compared with traditional centralized office forms, remote work helps enterprises reduce costs and increase efficiency, achieve flexible management, and adapt to market changes; It also provides more employment opportunities for workers and stimulates the vitality and creativity of the labor market[7].

## 2.2. Implementation and Data Validation of Online Office Survey Questionnaire

### 2.2.1. Data Source

This study used Questionnaire Star to conduct an online office survey on five workplaces including Beijing Everbright Bank Credit Card Center, Beijing Rootnet Technology Co., Ltd., Baidu, JD.com, and China People's Property Insurance Co., Ltd.

### 2.2.2. Implementation of Questionnaire Survey

The online office survey questionnaire was conducted from June 1, 2024 to June 20, 2024, including:

(1) From June 1st to June 10th, we conducted an online office survey questionnaire test, with a total of 100 responses. After data cleaning, we found that there were a total of 91 valid questionnaires;

(2) From June 12th to June 14th, we conducted a study on these 91 survey questionnaires and found three shortcomings: ① In the survey questionnaire, there was no question about "how many antennas do you want to work under every week", which was feedback from multiple respondents, indicating that the questionnaire was not set up reasonably. ② The order of setting the questions in the questionnaire is not reasonable, which does not achieve a good survey effect. ③ Some multiple choice and Single choice question questions are confused in setting the question types, and the questionnaire is set incorrectly.

(3) From June 15th to June 20th, 100 survey questionnaires were re distributed. After data cleaning, a total of 93 valid questionnaires were obtained and their reliability and validity were tested. The inspection results are shown in section Reliability And Validity Testing.

(4) The survey questionnaire will be officially conducted from June 21st to July 10th.

The "online office" survey method adopted the Wenjuanxing online questionnaire method:

(1) Arrange 5 friends from relevant units as investigators

(2) Conduct a questionnaire survey through friend push notifications and poster QR code scanning

(3) Paste the survey questionnaire poster at the company entrance and assign a dedicated person to provide consultation.

(4) Provide economic rewards to employees who fill out the questionnaire by sending a 5 yuan red envelope. (Employees are required to provide their personal mobile phone numbers, and the questionnaire can be distributed after the staff have completed it.)

(5) You can answer by scanning the QR code on the poster, and this time we plan to interview 220 employees of the company.(Here are the links:https://www.wjx.cn/vm/YBYmlOi.aspx# )

#### 2.2.3. Data Preprocessing

Firstly, perform data cleaning and transformation on the collected questionnaires to ensure the quality of the data.

According to statistics, 220 survey questionnaires were distributed. After data cleaning, data transformation, and data aggregation, 196 valid survey questionnaires were finally obtained. These survey data were then analyzed and studied.

#### 2.2.4. Reliability and Validity Testing

During the survey and testing period, data cleaning and organization were carried out on 100 collected "online office" survey questionnaires, and it was ultimately found that 93 valid questionnaires were collected. Then conduct reliability and validity analysis on these 93 survey questionnaires.

SPSS software was used for reliability and validity testing. After running the data, it was found that the Cronbach's alpha coefficient of 93 valid survey questionnaires was 0.892, which was greater than 0.8, indicating good reliability; KMO=0.846, Greater than 0.7, sufficient sample size, sphericity test, P=0.000<0.05, consistent with sphericity test. Combining the two indicators, it can be concluded that its validity is good, and factor analysis is suitable for this case.

### 2.3. Data Organization and Analysis of Online Office Survey Questionnaire

According to the information collected , based on 196 valid survey questionnaires, we have organized and analyzed the data to obtain Table 1, Figure 1, Figure 2, and Figure 3.

The online office survey questionnaire has many questions related to "gender", "age", "salary level", "marital and child status", "travel distance" and "travel time", etc. For the convenience of statistics and research, Table 1 only lists some of the key attributes.

"Are you satisfied with the effectiveness of online work during the pandemic?" represented by A (Table 1). "How long do you think it will take to achieve large-scale online office?" represented by B (Table 1). "How many working hours would you like to have per week in the future?" represented by C (Table 1). "Do you think online office will become the main form of future office work for Internet related enterprises?" represented by D (Table 1). "Which approach do you think will be more attractive in the future?" represented by E (Table 1). "Which company do you belong to?" represented by F (Table 1). "Online office attitude" represented by G (Table 1). "Fully online office" represented by H (Table 1). "Fully offline office" represented by I (Table 1). "Combining online and offline" represented by J (Table 1). "Internet enterprise Party A" represented by K (Table 1). "Office building owners" represented by L (Table 1). "Internet enterprise outsourcing" represented by M (Table 1)."number" represented by N (Table 1).

178 Internet enterprises were surveyed for outsourcing, accounting for 91%; The number of office building owners is 7, accounting for 4%; The number of Party A of Internet enterprises is 11, accounting for 5% (Table 1). The number of Internet enterprise outsourcing, office building owners and Internet enterprise Party A who are satisfied with online office work during the epidemic accounted for 93%, 30% and 64% respectively (Table 1). The number of Internet enterprise outsourcing, office building owners and Internet enterprise Party A who hold optimistic and wait-and-see attitude towards online office accounted for 95%, 57% and 82% respectively (Table 1).

The proportion of people who hold an optimistic attitude towards online work is the highest, reaching 85% (Figure 1); The proportion of people who wish to work offline for one day per week is the highest, reaching 63%, followed by those who wish to work offline for two days per week, reaching 24%. Therefore, it can be seen that the total proportion of people who wish to work offline for one or two days per week is 87% (Figure 2); The majority of people believe that the combination of offline and online is the most attractive way of working in the future, accounting for 87% (Figure 3).

From this, we can see that online office will become a very recognized form of office for Internet related enterprises in the future, and most people believe that the combination of online and offline is the most attractive.

## 2.4. Demonstration of Differentiated OAO Office Mode

### 2.4.1. Feasibility Analysis of Online Office Mode

The Feasibility of Online Office After three years of practice during the epidemic, online office will become a trend in the future, for the following reasons:

Firstly, a change in mindset. After three years of the epidemic, most industries have experienced online office work, especially Internet related industries such as finance, insurance, funds, securities, banking, communications, and online shopping platforms. Our mindset has changed and we have gained an intuitive and firsthand experience of online work, which is a prerequisite for large-scale online work in the future.

Secondly, the maturity of technology. During the three years of the epidemic, there were some good office software, such as Zoom, Tencent Meeting, Enterprise WeChat, DingTalk, and some instant messaging tools. With the increase of research and development by the country and related high-tech enterprises, in the next 3-5 years, related technologies and supporting software will become more mature and practical, and office efficiency will be greatly improved. So, large-scale online office work in the future is not an unattainable dream.

Thirdly, the establishment of an online office ecosystem. As more and more Internet related enterprises adopt the form of online office, the digital space corresponding to the physical space will become more and more mature, and then the online office ecosystem will become more and more perfect.

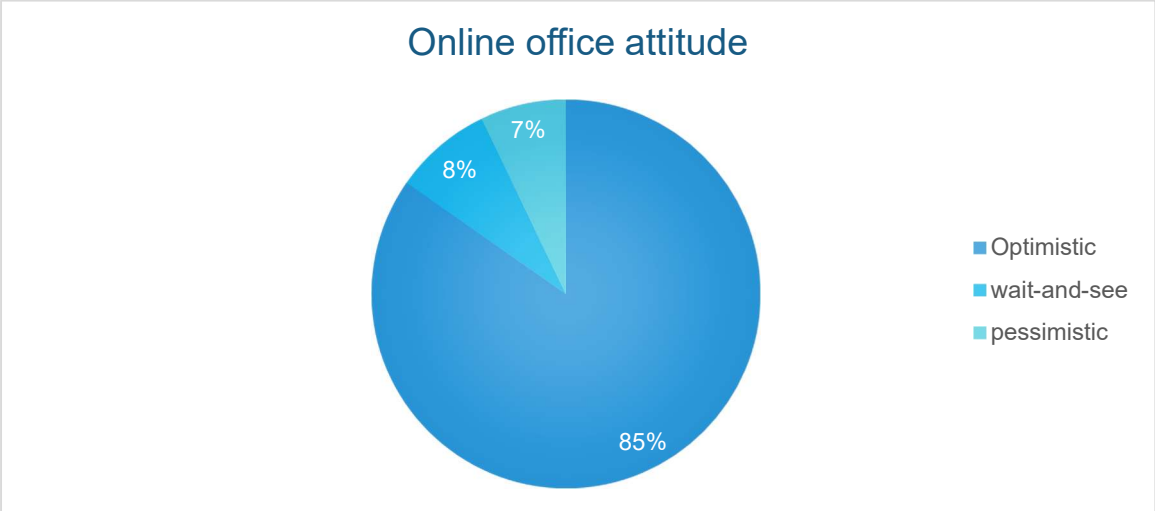


**Figure 1.** Online office attitude

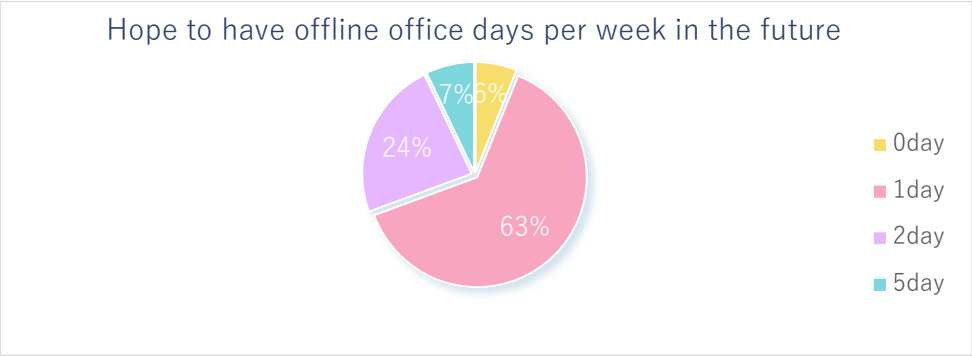


**Figure 2.** Hope to have offline office days per week in the future.

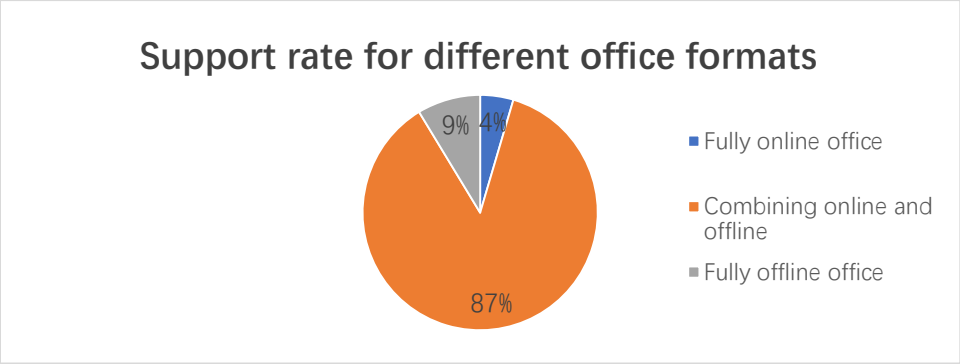


**Figure 3.** Support rate for different office formats.

**Table 1.** Online Office Survey Data

| Total | N | F | N | A | N | G | B | N | C | D | E |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 196 | 11 | K | 7 | satisfied | 4 | optimistic | 1-5 years | 2 | 0 | possible | H |
| | | | | | | | | 2 | 2 | possible | J |
| | | | | | 3 | wait-and-see | 6-9 years | 3 | 2 | possible | J |
| | | | 4 | dissatisfied | 2 | wait-and-see | 6-9 years | 2 | 2 | possible | J |
| | | | | | 2 | pessimistic | 10 years later | 2 | 5 | impossible | I |
| | 7 | L | 2 | satisfied | 2 | optimistic | 1-5 years | 1 | 0 | possible | H |
| | | | | | | | | 1 | 1 | possible | J |
| | | | 5 | dissatisfied | 2 | wait-and-see | 6-9 years | 2 | 2 | possible | J |
| | | | | | 3 | pessimistic | 10 years later | 3 | 5 | impossible | I |
| | 178 | M | 165 | satisfied | 158 | optimistic | 1-5 years | 9 | 0 | possible | H |
| | | | | | | | | 121 | 1 | possible | J |
| | | | | | | | | 28 | 2 | possible | J |
| | | | | | 7 | wait-and-see | 6-9 years | 9 | 2 | possible | J |
| | | | 13 | dissatisfied | 2 | optimistic | 1-5 years | 2 | 1 | possible | J |
| | | | | | 2 | wait-and-see | 6-9 years | 2 | 2 | possible | J |
| | | | | | 9 | pessimistic | 10 years later | 9 | 5 | impossible | I |

Pain Points Of Online Office In the three years of the epidemic, online office has undergone practical operations and is relatively mature in technology, but there are still shortcomings in the following aspects:

Firstly, data and related materials are important assets of the company. How can we ensure the security of online information?

Secondly, how to establish a reasonable performance evaluation and promotion mechanism for online office personnel?

Thirdly, how to determine responsibility for losses caused by online office data leakage?

Fourthly, how should employee work-related injuries be defined?

Fifth, how to ensure the efficiency of employees working online?

Solutions To Online Office Related Issues In order to achieve large-scale online work as soon as possible, some scholars have found solutions to the security of remote work. Some large companies have made breakthroughs in related technologies. Scholars suggest further improvement in legal systems and other aspects, as follows:

Firstly, in response to the security issues of remote work,Shufang Cui,Li Chen, and Ming Ma proposed a VPN solution for remote work in industrial parks based on a zero trust network security framework, in order to ensure data security in multi business scenarios of remote work(5).

Secondly, pay attention to the development of preface technology. With the rapid development and popularization of cloud computing, artificial intelligence, 5G networks, and virtual reality enhancement technology, online office will become more efficient and interactive (6).

Thirdly, in terms of cutting-edge technology, artificial intelligence technology can distinguish between efficient and inefficient work modes through real-time monitoring and feedback, thereby helping managers to more accurately evaluate employees' work performance when working online and promptly identify areas for improvement (6).

Fourthly, in response to potential issues or legal disputes arising from online work, it is recommended that national judicial authorities gradually improve relevant laws and regulations based on existing cases or potential possibilities.

Fifth, establish and improve relevant laws and regulations for the recognition of work-related injuries caused by remote work(7).

Sixth, enterprises should transform their thinking patterns. Enterprises have shifted from focusing on people to focusing on tasks, workload, and effectiveness. By examining the completion status of employees' tasks and work progress, performance evaluations are conducted to motivate them to improve work efficiency.

### 2.4.2. Differences on Online Office Modes

Differences In Online Office For Enterprises When it comes to finance, insurance, funds, securities, banking, communications, online shopping platforms and other Internet related industries, a certain proportion of employees can be selected for online office work. However, in the face of traditional industries such as construction, catering, manufacturing, and physical stores, the number of people participating in online office work is very small. So for companies that work online, we should treat them differently and not apply a one size fits all approach.

DifferencesIn Online Work For Employees Through the investigation and analysis of Internet related enterprises and employees, we can know their attitude towards online office. 85% of people hold an optimistic attitude towards online office work (Figure 1); 87% of people hope to implement a combination of online and offline modes in the future, and they believe it is best to work offline 1-2

days a week (Figure 2); 87% of people believe that the combination of online and offline is the most attractive form of office in the future (Figure 3).

#### 2.4.3. The Significance of Online Office

Compared to traditional office formats, online work has significant benefits in saving social costs, optimizing resource allocation, reducing traffic congestion, and reducing carbon emissions, as follows:

Firstly, for companies, online work can reduce labor costs, save expensive housing rental expenses, widely attract the world's best talents, and increase employee loyalty, thereby reducing turnover rates.

Secondly, for employees, online work can reduce daily transportation costs, increase more disposable time, improve work efficiency, and enhance their sense of happiness.

Thirdly, for the country, online office can reduce more personnel mobility, thereby reducing unnecessary waste of manpower, material resources, and related supporting resources, improving resource allocation efficiency, ultimately solving the world problem of "economic growth and carbon reduction", and achieving a "win-win" situation.

Fourthly, it is conducive to protecting the environment and achieving the "dual carbon" goal.

### 2.5. Proposal of Differentiated OAO Office Model

In summary, the author proposes the "Differentiated OAO Office Model" based on the feasibility and differentiation of online office.

Differentiated OAO mode: In the Internet and other relevant enterprises and institutions suitable for online office, the company will adopt a combination of online and offline models according to the actual situation and a certain proportion (OAO is the abbreviation of Online and Offline, and differentiation is reflected in different proportions). The company will give priority to selecting a group of employees who have long commuting distances, suitable job positions, meet the requirements for working from home, have strong self-discipline, and have data security guarantees to implement online work, and stipulate that they work offline 1-2 days a week; Offline work will still be implemented for employees who do not meet the requirements.

## 3. EXPLORING NEW LOW-CARBON TRAVEL PATHS

### 3.1. The Purpose of the Trip is to "Go To School"

When the purpose of urban residents' travel is to "go to school", the necessity of transportation is that the current education system requires centralized classes, and most primary and secondary schools have not implemented boarding systems.

The current education system in China still relies on large class teaching, which cannot promote the personalized development of primary and secondary school students.

For future education reform, the author has the following suggestions:

Firstly, for primary and secondary schools in Beijing, it is recommended to implement two models: boarding and day study. Boarding not only ensures the traffic safety of boarding students, but also reduces the transportation needs of parents to pick up and drop off their children. It can also cultivate children's independent consciousness and sense of collective responsibility from an early age, laying a good foundation for future learning and life;

Secondly, for primary and secondary schools in Beijing, the government should increase investment in education and gradually shift from a "centralized learning model in schools" to a "scattered learning model in residential areas". The specific measures are as follows: the Municipal Education Bureau

recruits a large number of teachers from different disciplines and establishes a small-scale school in each community. This small-scale chemistry school is composed of teachers from various subjects of corresponding scale and directly operates in the community. Among them, a small group of 7-8 teachers from majors such as science, humanities, and arts are formed to provide fixed and meticulous training for 5-6 children, so that students can be fully taken care of and teachers can focus more on cultivating each student.

The author believes that this not only helps to strengthen the personalized training of primary and secondary school students by the country, but also helps to reduce unnecessary commuting needs and reduce transportation carbon emissions from the source.

### 3.2. The Purpose of Travel is "Tourism"

When the purpose of urban residents' travel is "tourism", the necessity of transportation is that the current mainstream requires on-site sightseeing.

With the continuous development of technology, we should integrate technology into our lives. Therefore, the author suggests improving from the following aspects:

Firstly, it is conducive to the integration of virtual reality technology and tourism industry, and the launch of "VR tourism".

Secondly, a professional tour guide will shoot a high-definition documentary or promotional video with explanations every year and sell it.

Thirdly, tourist attractions provide a "tour guide online live streaming tourism" service, which means that the tour guide broadcasts live on the same day and leads consumers to watch real-time online tourism.

These three points provide a new mode of online tourism through technology. This model not only provides more high-quality and personalized services for travel enthusiasts, but also reduces transportation demand from the source, thereby reducing transportation carbon emissions.

### 3.3. The Purpose of Travel is "Medical Treatment"

When the purpose of urban residents' travel is "medical treatment", the necessity of transportation is that offline visits to large hospitals are currently the mainstream situation for seeking professional doctors for medical treatment.

In order to meet the medical needs of Beijing citizens, the author has the following suggestions:

Firstly, for mild patients, the hospital has launched telephone consultation services.

Secondly, break the traditional concept of all patients gathering in hospitals for treatment, and establish two models of "hospital based treatment" and "community mobile treatment" based on the severity of the illness and the severity of the illness. Firstly, the hospital has the most complete examination and laboratory equipment, as well as the best doctors, mainly targeting patients with severe illness, requiring heavy examination equipment for examination and laboratory testing, or those with special needs; Secondly, the hospital dispatched several medical teams to several residential areas in fixed areas for mobile consultations, including 4-5 doctors from routine departments, who carried conventional and simple diagnostic and treatment equipment. The medical team can provide more convenient and efficient medical services for patients with mild symptoms or those seeking consultation.

Thirdly, enhance the medical proficiency of attending physicians in major pharmacies in Beijing and strictly control their qualifications.

The two modes of "telephone consultation" and "mobile medical treatment in residential areas" are not only beneficial for improving the efficiency of hospitals, but also for providing more efficient and high-quality services to citizens. They can also reduce the demand for medical travel from the source and reduce transportation carbon emissions.

### 3.4. The Purpose of travel is "Commuting"

When the purpose of urban residents' travel is "commuting", the necessity of transportation is to go to the company site for work.

For commuting, the author suggests that the government strengthen the rule of law construction of online office, Internet high-tech enterprises increase technology research and development to break through technical bottlenecks, and strive to implement the "differentiated OAO office model" as soon as possible, so as to reduce traffic demand at the source and reduce carbon emissions.

## 4. CONCLUSION

The author breaks the traditional thinking mode and explores new low-carbon travel paths from the perspective of "demand side", and has made the following findings:

Firstly, in order to achieve the "dual carbon" goal, the country should shift its mindset from "supply side" reform to "demand side" reform.

Secondly, the author innovatively proposes the "Differentiated OAO Office Model".

Thirdly, specific measures should be proposed for the following four routine travel needs:

(1) Regarding "commuting" travel: firstly, it is recommended to promote the adoption of differentiated OAO office models; Secondly, the government provides rental subsidies to long-distance commuters; Thirdly, homeowners renovate and rent out apartments in office buildings with high long-term vacancy rates.

(2) Regarding "general education" travel: firstly, education related departments will carry out educational reforms, changing from "centralized school teaching style" to "scattered community teaching style"; Secondly, the school implements a dual mode of boarding and day study.

(3) Regarding "medical" travel: firstly, it is recommended that hospitals implement telephone consultations; Secondly, it is recommended that hospitals implement a dual model of "hospital headquarters visits" and "community mobile visits"; Thirdly, improve the level of attending physicians in each pharmacy.

(4) Regarding "tourism" travel: firstly, scenic spots are launching VR tourism; Secondly, the scenic area provides "video promotional videos" or "tour guides live streaming tours online" services.

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