On the Shortage of Resources in Study Rooms in the Era of Novel Coronavirus - the Solution of the Intelligent Management System Based on the Self-study Folding Table System

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Abstract-After the covid-19 pandemic since 2020, the number of people who need to learn to improve their competitiveness has increased significantly. The need for ample study seating is increasingly prominent. To this end, an intelligent management scheme based on the self-learning folding table system is proposed, and two sets of self-learning folding table systems are developed to solve the two problems existing in the commercial study room of the public library. The technical scheme of the utility model is as follows: the self-learning folding table is characterized in that it comprises a left box body and a right door body, and the upper part of the left box body and the right door body are connected with a folding pull plate. The box on the left is an openable bookcase with a folding table in the lower middle; the door on the right has casters at the bottom.

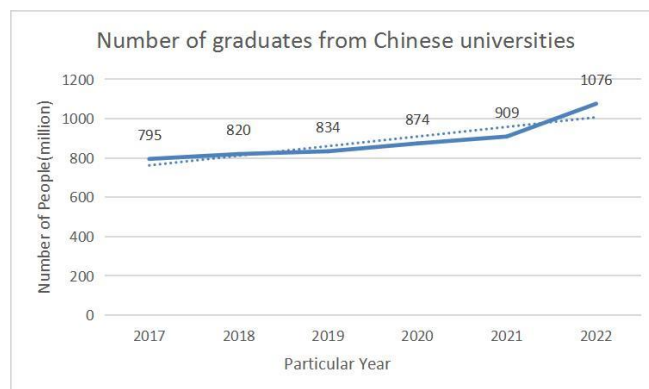**Keywords**-study room, management, epidemic intelligent, library.
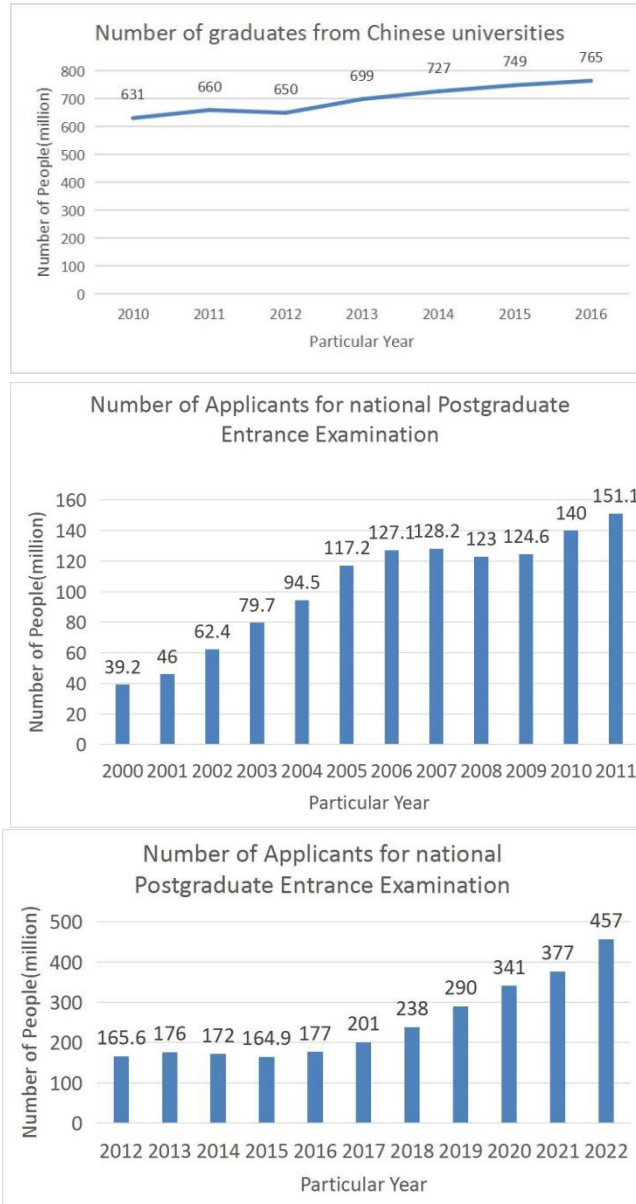
1 INTRODUCTION

The number of people who need to improve their competitiveness through learning has increased significantly after the new coronavirus epidemic in 2020-2021, and the structural problem of uneven supply and demand of space suitable for learning has gradually emerged. In limited space, improving space utilization has become a mainstream way to solve such problems. According to the above-mentioned current study room situation, the author briefly analyzed the current situation and seating requirements of the study room and developed two sets of intelligent study room management systems based on the self-study folding table system, which provide solutions to solve two problems in commercial study rooms in public libraries.

2 DEMAND FOR STUDY ROOM SEATS

In the 2020 -2021 epidemic, New Coronavirus's growth rate has slowed down both in China and abroad, which has greatly affected the overall situation of China's economy.

Under the premise of unfavorable prediction of the future market environment, many enterprises adopt the way of "breaking the tail" to survive, that is, layoffs are used to reduce the cost pressure and reduce the number of school recruits.[1] The downward pressure on the global macro economy is great, and enterprises have laid off a large number of staff; However, the number of fresh graduates in China is growing, and the number of graduates is increasing year by year, which has also caused difficulties in employment, postgraduate entrance examination and public entrance examination. According to the data released by the Ministry of education, the total number of School graduates in 2021 is expected to be 9.09 million, an increase of 350000 year-on-year, another record high.[2] This is also the first time that the number of School graduates in China has exceeded the 9 million mark. Under the background of repeated outbreaks in China, the employment problem of School graduates in 2021 has surfaced. According to the authoritative data of the 2022 postgraduate entrance examination released by the Ministry of education on December 22, the number of applicants reached 4.57 million, an increase of 800000 over last year, a record high. The number of candidates for the civil service examination and the national postgraduate entrance examination held in December 2020 has exceeded a new high, reflecting the concerns of the 2021 graduates about the future employment market. Under the background of the epidemic, the channels of studying abroad have been greatly affected. Superimposed with the returning tide of some students studying abroad, the future School students' employment market will face more severe challenges. The society has higher and higher educational requirements for employed graduates.

Figure 1. Data sources: Ministry of Education of the People's Republic of China

When the number of fresh students seeking jobs is far greater than the number of recruits, enterprises will raise the threshold, such as raising the requirements of academic qualifications, schools or skill certificates, to screen suitable candidates. Facing the more severe employment situation and employment pressure, postgraduate entrance examination and textual research have become an important way to improve self-competitiveness.

Based on the above reasons, the number of people who need to improve their competitiveness through learning is significantly increasing. It can be said that most young people, middle-aged people and even partially retired middle-aged and elderly groups are in need of self-study space.[3]

3 ON THE CURRENT SITUATION OF SELF-STUDY ROOM

3.1 self study rooms such as public libraries and school classrooms

Under the call of the enrollment expansion policy of Schools and universities, all Schools and universities have increased the number of students in recent years, resulting in the lack of resources for self-study space for students and faculty. With the advent of exam preparation month and review week, the libraries of Schools and universities will be overcrowded and hard to find. Some students even have disputes over the use right of seats in the self-study room. This also reflects the structural problem of unbalanced supply and demand of public learning space.

Seat occupation is a very common phenomenon in the self-study room of university library.[4] It refers to the behavior of obtaining the priority use of seat resources with the items placed in the seat position as the logo. Although "seat occupying" behavior is a self-interest measure those students have to take in order to study better, it also brings many management problems to schools and libraries, which is more detrimental to students themselves. In recent years, different scholars have different views and opinions on a series of problems caused by the phenomenon of "seat occupation". In his article "Reflections on the problem of seat occupation in University Libraries", Xincheng Tong believes that students' "seat occupation" should find reasons from the school library itself.[5] Then, the way to solve the problem of seat occupation is to take different measures from these three aspects. Yingjun Sun and Xiaoxi Yu in the game analysis and Countermeasures of seat occupation in

University Libraries believes that from the perspective of economics, seat occupation is actually a game behavior between readers, namely "seat occupation game".[6] "Seat occupation game" has two pure strategic Nash equilibria (seat occupation, seat occupation) and (no seat occupation, no seat occupation). This is the contradiction between personal understanding and collective rationality, resulting in the inefficient allocation of scarce resources. In the measures to solve the problem of seat occupation, they put forward the new solution of "seat matching method". Although this method is feasible, it will also bring problems, such as uncertainty about the length of time students leave their seats, and it will cost more. With the improvement of the use frequency of the self-study room, the chaos of the self-study room also continues to occur. Although various Schools and universities have corresponding rules and regulations for the management of the self-study room, it does not solve the actual needs.

The phenomenon of seat occupation in university study rooms is also a major difficulty that has plagued the library. In order to solve this kind of phenomenon, although the library has issued some rectification measures, it has not really solved the root cause of the problem, and the shortage of space resources is getting worse and worse.

3.2 commercial toll study room

In the prior art, the self-study room of commercial nature, and the desk in the self-study room is an ordinary open type. The business mode can generally be divided into traditional type and unattended type.[7] Traditional study room stores attract customers to offline stores through leaflets, online advertisements (short videos, circle of friends, etc.) and offline advertisements (elevators, car advertisements, etc.). Understand and buy the coupons and discounts of the clerk's explanation card, go to the store to check whether there are free seats, whether there are people full during the use period, traditional door locks, electrical appliances, manual timing to remind that the seat utilization rate is low, the time control is messy, and the equipment loss needs to be checked manually. Unattended stores directly forward recommendations through the front-end customer access channel applet, which displays price information, use rules and location information. Complete online reservation, location reservation, time period reservation, card and voucher exchange and other services through applet.

Administrators can complete service Q&A, negative emotion handling, consumables replenishment reminders, card and coupon discount design, community operation and event promotion online. Access control, electrical equipment, timing, socket control, connection with the Mini Program, intelligent hardware, are all fully intelligently controlled by the Mini Program. In order to improve the utilization rate, you can view the device loss in time on the mini program management end.

No matter what kind of business model, one thing that cannot be solved is that some customers may not leave and take away their personal belongings after their use time has expired, or even enter the study room to use internal tables and chairs and other resources without any payment. Such a phenomenon will directly affect the income of businesses and the sense of experience of other customers. Pure business model innovation cannot solve practical problems. It needs software, hardware, management and innovation to solve the problems.

Since 2018, self-study rooms have begun to grow in the Chinese market. By 2021, the number of self-study rooms in major cities will increase, but the growth rate will decline. Due to the outbreak of the epidemic in 2019, many shared study rooms were forced to close and were in a state of loss. With the good control of the epidemic in China, the operation of shared study rooms also recovered. Shared study room is a kind of sharing economy. Its emergence is caused by the lack of public resources. For example, the library resources are limited, the family environment is not suitable for learning, and there are no comfortable tables and chairs in outdoor public places such as parks, which can neither charge computers, mobile phones and other equipment, nor shelter from the wind and rain. Commercial study rooms solve the pain points according to these situations. The market of shared study rooms in big cities is relatively saturated and needs to be upgraded to increase competitiveness; Shared study rooms in small and medium-sized cities still have development potential, waiting to be explored.

4 INTELLIGENT SOLUTION FOR SELF STUDY FOLDING TABLE AND SELF STUDY ROOM

According to the above current situation of self-study room, the author has developed two sets
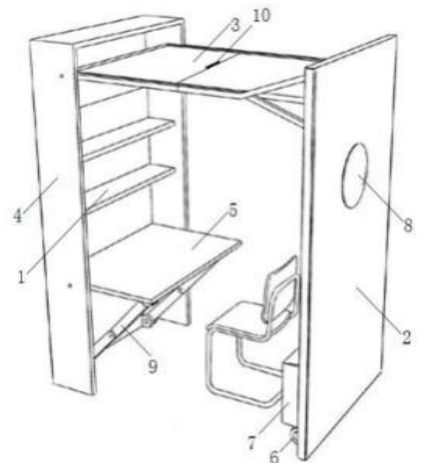
of self-study room intelligent management systems based on self-study folding table system, which provides solutions to the two problems in commercial self-study room in public library. The purpose of the new self-study folding table is to provide a self-study folding table which is convenient to control and can be used for compensation or free.

The technical solution to the utility model is : the self-study folding table is characterized in that it comprises a left box body and a right door body , and the upper part of the left box body and the right door body is connected with a folding pull plate. The left box body is an open bookcase, which is provided with a plurality of book placing partitions, and the middle and lower part is provided with a folding desktop; The bottom of the right door body is provided with casters. The above scheme also includes:
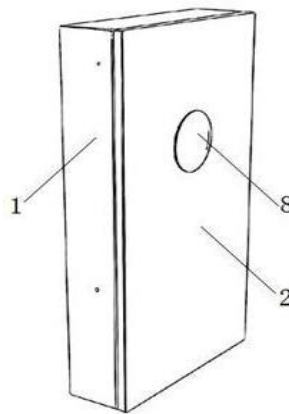
1)	*It adopts the opening and closing structure of the left*

box body and the right door body, which can be opened only when it is used, which is convenient for management and control, and realizes payment and reservation. After the adoption of intelligence, it is more conducive to code scanning, payment and reservation.

2)	*Compact structure and flexible placement.*

3)	*The amount of storage and space is sufficient, which is conducive to the comfort of the user experience.*

4)	*After the self-study folding table is intelligent, you can make an appointment for the use time. Effectively avoid people or articles without self-study needs for a long time occupying limited tables and chairs.*

5)	*The display screen (note 8 of the attached figure) can play notices or advertisements of various information.*

The embodiment of the utility model will be further described in detail below in combination with the attached drawings.

After intellectualization, the push-pull opening and closing design are adopted, and face recognition unlocking (with face recognition unlocking module) is set on the outside. Users need to make an appointment or pay online in advance. The interior is equipped with a desktop for learning and a compartment for placing books. Bright and eye protecting lights are set on the top to supplement the light. When the self-study folding table is closed, students who make an appointment through the program can open the table and chair through the face recognition system. When there is no one, the table can be pushed back to its original position, and the built-in table top can be folded together. The utility model comprises a left box body and a right door body, and the upper part of the left box body and the right door body is connected through a folding pull plate; The left box body is an open bookcase, which is provided with a plurality of book placing partitions, and the middle and lower part is provided with a folding desktop; The bottom of the right door body is provided with casters. It adopts the opening and closing structure of the left box body and the right door body, which can be opened only when it is used, which is convenient for management and control, and realizes reservation and paid use.

(a)   Expanded state

(b) Closed state

Figure 2. Design drawing of multifunctional tables and chairs

1-left box, 2-right door, 3-folding plate, 4-book partition, 5-folding table, 6-caster, 7-convex table,8-display, 9-support arm, 10-hinge.

4.1 Intelligent management solution of self-study folding table in self-study room of Public Library

Refer to figure 2 (b). In the normal storage state, multiple self-studies folding tables are arranged indoors at intervals and opened when in use 9 (see Figure 2 (a). Self-study folding tables are usually used online in advance and should be reserved. When the user makes an appointment for the use time and use duration of the online self-study folding table system, let the online app check whether the seat in the selected time period is still available. If there is any free seat, you can directly select the seat in the time period. If there is no free seat, after

making corresponding adjustment, the students can choose the expected self-study time on the app according to their own situation, according to the software programmed control system, arrange the most reasonable seats for students, and then display the seat number arranged by the system on the relevant interface of the app. In order to ensure the reasonable allocation of seat resources in the self-study room, the system will reserve the student's seat for 30 minutes when the student leaves the seat halfway. If the student returns to the self-study room to continue learning within 30 minutes, the seat will still be used by the student. If the student does not return to the study room within 30 minutes, the system will automatically leave the student's seat vacant, and notify the administrator online to sort out the seat items and disinfect the seat at this time. When students come back, they can contact the administrator to get their personal belongings. This usage mechanism can effectively avoid the unreasonable occupation of the seats in the self-study room to a certain extent, and reasonably arrange and make use of the seat resources in the self-study room.

4.2 Intelligent management solution of self-study folding table in commercial self-study room

In view of the unreasonable occupancy of seats in the above commercial self-study room, the self-study folding table system provides a solution to such problems combined with software and hardware. The self-study folding table system can make self-service reservation according to the learning time. In case of emergency, the reservation can be cancelled free of charge. The online membership system can be configured with hour card, sub card, monthly card, continuous day card and stored value card. The expiration time, scope of application and card return can be changed to meet the needs of different users. Users who do not have fixed seats can make an appointment on the commercial online self-study folding table system for use time and duration. They can view the layout of the whole room through their mobile phone and determine the free seats for the time period they choose on the online app. When the appointment period is about to end, the online app will notify the user and ask the user whether to increase the use time. When the user confirms that the seat is used and leaves, the management end of the management system will notify the administrator to clean and disinfect the desktop. For monthly cards and continuous Day cards with fixed seats, users only need to control the opening and closing state of the self-study folding table through the mobile app. When the user confirms to leave, the self-study folding table will be in the closed state. The closed self-study folding table can also help users store their personal belongings to avoid loss, so that users do not need to carry weighed books and learning tools with them.

5 SIMULATION EXPERIMENT OF INTELLIGENT MANAGEMENT SYSTEM

5.1 User Usage Steps

1). The customer uses the Mini Program to make an appointment to place an order and complete the payment

2). After the customer arrives at the store, click "Confirm to Store" to start the order and open the store

3). After the customer enters the store, find the reserved location and enjoy a good time

4). When the time comes, bring your belongings and leave the store for automatic settlement

5.2Client App operation interface

The main functions of the client-level page are self-booking and viewing card packages, etc., and can also show customers relevant information such as the layout and geographical location of the study room. After the customer clicks the "Book" button, they will be automatically redirected to the reservation page. The booking interface can be billed by hour, by time slot, per day, or by time period. It is worth mentioning that the APP adopts the principle of spatial visualization of the study room, and it is easy to observe the available empty seats when booking.
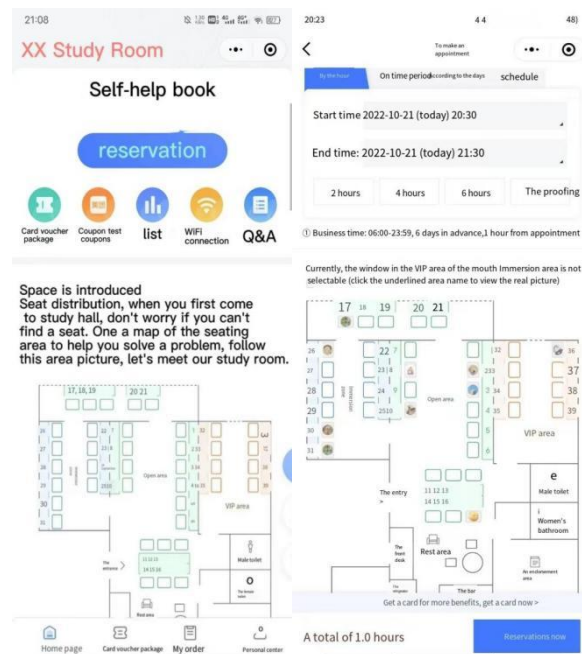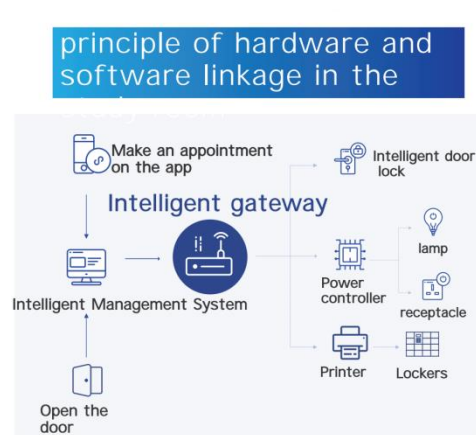

Figure 3 Client App operation interface

5.3The working principle of software and hardware linkage in the study room

The smart study room store system will transmit the customer's reservation information on the app to the smart gateway, and the smart gateway will unlock the door lock and the selected seat for the customer at the scheduled time. The 4-way power controller allows customers to freely use lights, sockets, and self-study folding table systems at predetermined times. Realize the start of the user's order, the lights and sockets on the seat are automatically powered on, and the order is over, and the power is automatically cut off. Users can also rent lockers on the Mini Program and print with printers by themselves.

Figure 4 The working principle of software and hardware linkage in the study room

6 CONCLUSION

In summary, the intelligent management system of folding self-study desk has convenient design, reasonable hardware and powerful system control, can scientifically design the use of resources and the needs of users, has good sociality and space practicality, and can show the design purpose of effective use of resources. In the computer simulation simulation, the system can achieve the expected purpose, solve the problems of public libraries, school classrooms, commercial charging self-study rooms and other self-study rooms, achieve the expected results, and provide a series of feasible solutions for the management problems of library self-study rooms and commercial self-study rooms. As a convenient and efficient technology, the intelligent management system of folding self-study desk will help further research on related space management topics in the future.

REFERENCES

[1] Dao Chi, Qi Li, Yanhui Cui, "Based on future career development needs applied undergraduate School students vocational ability improvement strategy" modern marketing: business version, 2020, pp.14-15.

[2] Tian Liu, "Research on the Implementation of Employment Policy for Graduates of Schools and Universities in Jinan", Social Sciences Series II: Economics and Management Science, 2021, pp.1-4.

[3] Huanhuan Zhou, Xiaojun Wu, "A Little Thought on the Employment Work of Schools and

Universities", Employment of Chinese School Students,2007, pp,20-21.

[4] Meixia Huang, Fengshuang Yang, Aili Zhang (2011), "A Class of Uncertain Neutral Time Delay-Related H ∞ Control", Dynamic Animation World: Educational Technology Research,2011.

[5] Xincheng Tong , Reflections on the Occupation of University Libraries, Library Information and Digital Library,2009,pp.62-64.

[6] Yingjun Sun and Xiaoxi Yu, "Game Analysis and Countermeasures of The Phenomenon of University Library Occupancy", Journal of University of Shanghai for Science and Technology, 2010, pp.38-40.

[7] Qun Zheng, "IC Card Multimedia Utility Telephone Equipment control System",2005.