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Spatial Statistical Analysis of Social Relationship and Seat Distribution

Based on Electronic Campus Seat Selection and Check-in System

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ABSTRACT
The psychological problems of college students are becoming more and more serious, and social relationship, as an important factor affecting psychological problems, contains a lot of information about students. Based on the intelligent seat selection and sign-in system of coupled electronic campus card, with the help of spatial statistical analysis method, the spatial distribution of classroom seats is taken as the research object, and the mathematical analysis course of 2019 statistics major in the second semester of 2020-2021 academic year in Wuhan University of Science and Technology is taken as an example to analyze the correlation between seats and social relations. A clear spatial correlation was found that students with close social relationships tended to sit in groups.

Keywords: *social relationship, electronic campus seat selection and check-in system, spatial correlation.*

1. INTRODUCTION

In recent years, more and more attention has been paid to the psychological problems of college students, and social relations are an important part of mental health. Therefore, how to effectively explore students' social relationships to help solve their psychological problems is an important topic. Psychologist Hall believes that distance is a concept of personal space, which represents the degree of interpersonal relationship. Therefore, this paper hopes to guess the relationship between students according to the spatial seating distribution. College students' social relationships mainly come from the campus, so mining the relationship between the distribution of seats in the classroom and social relationships is conducive to in-depth exploration of the important factors affecting students' social relationships.

Some scholars have used questionnaires to study the factors affecting the seat distribution. Zhao [1] (2016), Ji [2] (2013), Ren [3] (2011) all adopted the stratified ensemble sampling method. Although the study has a certain characterization of the display, the questionnaire survey has a long cycle and a low recovery rate, which is also not suitable for complex questionnaires [4].

Therefore, it is timely to explore the factors related to seat distribution by using statistical methods under the background of big data. Zhang[5] proposed for the first time to study the correlation between students' scores and seating order distribution through spatial statistics. The statistical relationship between the data is established through the spatial geographical location to explore the internal relationship between the variables. Gong [6] proposed a sign-in system coupled with an electronic campus card and a student classroom information database, which gives the first-hand real and effective data information of students, making the statistical analysis of the factors related to seat distribution more real and comprehensive.

In this paper, based on the student seat and information given by the coupled electronic campus card check-in system, a correlation study is carried out.

2. BRIEF INTRODUCTION OF THE COUPLED ELECTRONIC CAMPUS CARD CHECK-IN SYSTEM

2.1. Technical Background

The system is based on students' classroom performance, psychological management and home-school communication, including the following eight considerations.

(1) It is common for students to sign for skipping classes and leaving early; (2) Teachers find it difficult to interact in class; (3) It is time-consuming and inefficient to call the roll and sign in the class; (4) There is no data to support the results in peacetime, which is prone to controversy; (5) The number of students is large, the workload of counselors is heavy, and it is time-consuming and laborious to fully understand; (6) It is difficult for teachers to find psychological problems and to guide students' psychology in advance; (7) The problem of the transition from high school to college life; (8) Problems of communication between parents and schools.

To sum up, it is necessary to develop an intelligent check-in system that can replace the teacher's roll call check-in and obtain the student's seat information at the same time.

2.2. Technical Content

The construction method of the intelligent seat selection and check-in APP coupled with the electronic campus card and the student classroom multi-dimensional information base comprises the following steps:

The first step is that before class, the teacher opens the check-in APP, and the software automatically generates a two-dimensional code. Students use mobile phones as authentication carriers and use the "sweep" function to sign in. When the bell rings, the teacher can close the check-in channel and end the student's one-time check-in. Secondly, after the first check-in, the APP page will jump to a seat selection page. After the students choose their seats, the APP starts the countdown (the default countdown time is one class). Automatically positioning the position after the countdown is over. Lastly, when the course is over, the system will automatically locate. At this point, the whole check-in process is over. Therefore, the check-in situation will be conveyed to the educational administration system as the basis for a series of inspections.

2.3. Relevant Data

The coupled electronic campus card sign-in system displays a sign-in screen on the student page, but displays the seat distribution of students in the classroom, the sign-in situation and some related basic information on the terminals of teachers and the Academic Affairs Office. Take the attendance of 78 students of Grade 2019 majoring in statistics in the mathematical analysis course in the 2020-2021-1 semester as an example. The seat distribution of the classroom obtained by the intelligent seat selection sign-in system is shown in Figure 1.

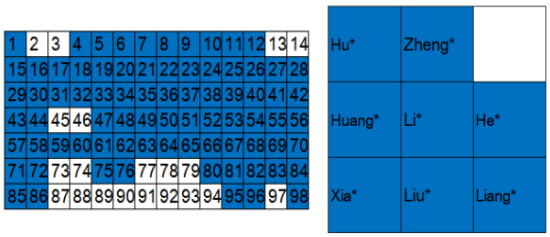

Figure 1 The seat distribution and partial seat-name distribution map of 78 students obtained by the intelligent check-in system

The numbers in Figure 1 are the numbering of the seats. The top row (1 to 14) is the front row of the classroom, and the bottom row (85 to 98) is the last row of the classroom. A total of 98 seats are divided into 14 columns and 7 rows (without considering the impact of the podium, doors and windows, and corridors on the distribution). Blue indicates that students are seated and signed in, while white indicates that seats are empty.

Teachers can obtain the distribution of students' seats and names of the course through the Academic Affairs Office, and the partial effect is shown at the left end of Figure 1. Each student given by the intelligent check-in system corresponds to a 9-dimensional data (name, student number, college, professional class, telephone, QQ, dormitory number, seat row number, seat column number). The purpose of this study is to mine the relationship between seat distribution and student performance through these data by using relevant statistical analysis, and to provide effective reference for schools to improve the quality of teaching management.

3. THE ANALYSIS IDEAS AND PRINCIPLES OF THIS PAPER

This paper studies and analyzes the original data according to the five-step process: (1) Get the dormitory number and other related data by coupling the electronic campus card intelligent check-in system; (2) Index the student seat distribution map; (3) Empirical analysis of the related index map; (4) The conclusion of the correlation study.

4. THE CORRELATION BETWEEN STUDENT' SOCIAL RELATIONSHIP AND SEATING DISTRIBUTION

4.1. Profile of Study Subjects and Data Sources

In this study, 78 students of Grade 2019 majoring in statistics were selected as the subjects. The correlation between seat distribution and social relationship is analyzed through the relevant information given by the check-in system, such as seat distribution, dormitory number and so on.

4.2. Research Assumptions

According to the research hypothesis, this paper puts forward the following hypothesis: there is a spatial correlation between the seating distribution and social relations. That is to say, the seats of students with better relationship are clustered.

4.3. Empirical Analysis

The following is an analysis of the relationship between social relations and seating order. Among the social relations of college students, dormitory relations are undoubtedly the most representative. The following is to verify the correlation between social relations and seating distribution through dormitory relations.

According to the dormitory number of 78 students and the distribution of seats in the classroom, the students in the same dormitory are marked with the same color and number (21 dormitories in total), and finally the map of dormitory and seat distribution is obtained (blank means empty seat). In the mathematical analysis course of the academic year 2020-2021, the distribution of dormitories and seats on September 7, September 13, September 28, October 14, October 28, November 18, December 9 and December 28 is shown in Figure 2.

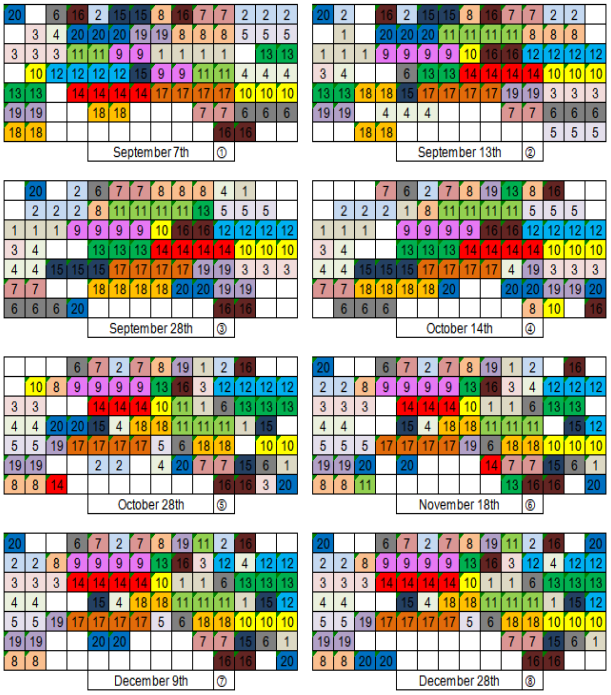

Figure 2 Room numbers and seat distribution maps for the eight days selected

It can be seen from Figure 2 that the distribution of each dormitory can be roughly divided into 4-person type, 3-1 type, 2-2 type, 2-1-1 type and individual scattered type (as long as the seats have adjacent edges, they are regarded as aggregated distribution). In order to explore the distribution law, the distribution quantity of each scattered type in each period was statistically analyzed and the trend chart was drawn by Excel, as shown in Table 1 and Figure 3.

Table 1.Statistical table of dormitory distribution Type

Dormitory distribution type / Data	September 7th	September 13th	September 28th	October 14th	October 28th	November 18th	December 9th	December 28th
4-person type	7	7	10	8	4	3	3	3
3-1 person type	5	6	7	6	2	5	4	4
2-2 person type	6	4	2	0	1	1	1	1
2-1-1 person type	2	3	1	5	11	8	10	10
Separate scattered type	0	0	0	1	2	3	2	2

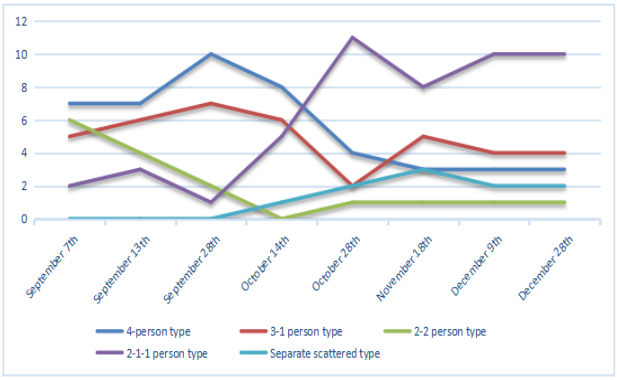

Figure 3 Change trend of dormitory distribution type and number of people

From Table 1 and Figure 3, it can be seen that the number of dormitories distributed in 4-person type, 3-1 person type and 2-2 person type has a decreasing trend with the passage of time. However, the number of dormitories with 2-1-1 person and single scattered distribution has a gradual increasing trend. This shows that at the beginning of the semester, everyone's basic social circle is confined to the dormitory. As the semester progresses, people may expand new social circles outside the dormitory. It is also possible that because of different living habits, they quit the small group of dormitories, seek new groups, or even come and go alone. It is further inferred that the relationship between students in the four-person dormitory is more intimate. One of the students in the dormitory of 3-1 type may be different from others in personality and learning attitude, and may even have a boyfriend and girlfriend relationship. The students in the 2-2 dormitory are divided into two small groups. The 2-1-1 type means that there is a small group of two people, and the other two people will sit alone for some reason. The dormitory relationship of students who are alone and scattered may not be very harmonious, for example, there are great differences in learning attitude, personal personality, living habits and so on.

The following is a more accurate proof of the close relationship between each student and the students sitting next to him. The students on September 7 were numbered 1-78 from left to right, and then their seat changes in the remaining seven days were tracked, as shown in Figure 4.

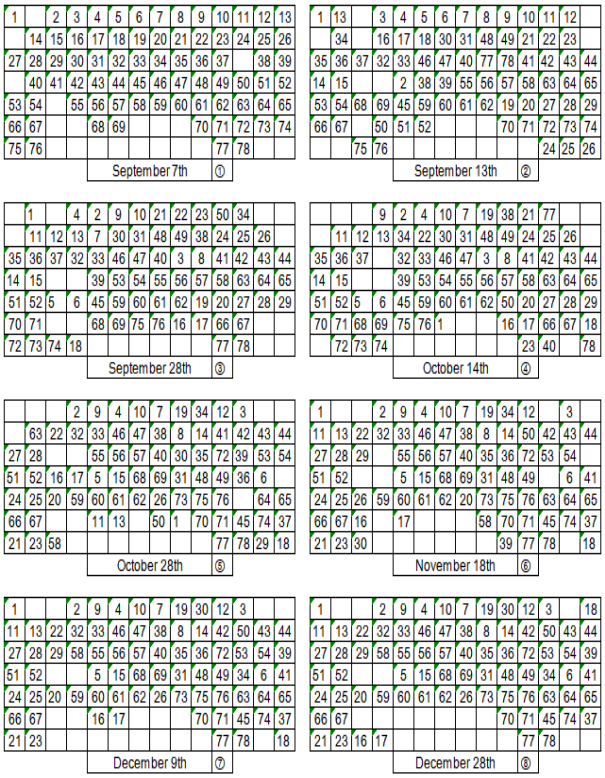

Figure 4 Figure of seat change of 78 students selected for eight days

Ten students were randomly selected from 78 students, namely No.2, No.11, No.18, No.24, No.32, No.45, No.56, No.58, No.73 and No.77. Java software was used to count the numbers of the 10 students who had adjacent relations in the seats of the 8 days (adjacent relations refer to the adjacent edges in the seat distribution and the left, right, front and back of the seats). It is found that at the beginning of the semester, the seat distribution changes greatly. At this time, social circles of students are prone to change. With the progress of the semester, the seats are relatively fixed and the social relationship of students is relatively stable. According to the statistics of 10 students in 8 days, the number of students with the most frequent adjacent position relationship is shown in Table 2.

Table 2.Statistical table of frequent adjacent numbers of 10 students

Number	Number of the most frequent adjacent location
2	9 (right) 32 (behind)
11	13 (right) 1 (front) 27 (behind)
18	37 (front)
24	25 (right) 51 (front) 66 (behind)
32	22 (left) 33 (right) 2 (front)
45	71 (left) 74 (right) 78 (behind)
56	55 (left) 57 (right) 3 (front) 62 (behind)
58	57 (left) 63 (right) 41 (front) 20 (behind)
73	26 (left) 75 (right) 31 (front)
77	78 (right) 71 (front)

From the data in Table 2, we can guess that there is a close social relationship among them, so we verify it in the form of a questionnaire. We found that nearly 71%

of the relationships were close, specifically referring to the three relationship modes of lovers, roommates and learning partners. And nearly 70% of all affinities are from left-right adjacencies.

After the above analysis, it can be concluded that students who usually attend classes together in groups and have relatively fixed positions can roughly infer that they have close interpersonal relationships, such as roommates, study partners, lovers and so on.

5. CONCLUSION

Based on the students' seating order distribution data given by the check-in system, combined with the above statistical analysis process, it can be found that there is a strong correlation between social relationship and seating distribution. That is to say, those who have a good relationship tend to sit together, while those who usually gather in class and have a relatively fixed position can also infer that they have a close social relationship. Therefore, teachers can observe the changes of students' relations and guess students' psychological activities according to the seat distribution presented by the check-in system, so as to prevent and deal with their adverse psychological problems.

This paper uses the data given by the check-in system to analyze, which undoubtedly has the advantages of intuitive, concise and accurate data sources. However, its own data security is low, and the richness of the data needs to be further expanded. For example, it can include "adjacent seat information", "classroom effective seat block" and so on. In addition, the correlation between social relationship and other variables besides seat distribution, such as gender, needs to be further explored.

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