

# Design and Research of College Students' Psychological Crisis Management System Based on ISM\*

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**Abstract**—The psychological problems of college students have been widely concerned by the society. In order to grasp the timeliness of college students' mental health education, this paper discusses the way of using information management system to assist college administrators in the early warning and intervention of college students' mental crisis. Based on Interpretative Structural Modelling Method and the scenario analysis method (PEST), this study conducts a comprehensive analysis of the influencing factors of college students' psychological crisis, extracts of 10 typical factors, discusses the logical relationship between various factors, establishes college students' psychological crisis factors interpretative structural model, and through the Analytic Hierarchy Process to calculate the weight of the underlying influencing factors. According to the structural model, the information architecture of the psychological crisis management information system is designed and provided to university administrators. This study provides a real-sensitive decision support system for the early warning and timely intervention of college students' psychological crisis.

**Keywords**—psychological crisis; interpretive structural modeling; system analysis; hierarchical structure; information management system

## I. INTRODUCTION

People are living in an increasingly complex and changing world. And college students in the moratorium period are prone to various psychological problems when facing changes. Without timely social support and intervention, college students may find it difficult to deal with these psychological problems and even take some extreme actions. In the management practice of colleges, the service coverage of students is low due to the limited number of administrators and the relatively small number of administrators who have knowledge of psychology. On the other hand, students often lack the initiative to seek help because they do not know how to get psychological counseling or do not trust university administrators. These factors make it difficult for mental health education in

colleges to be timely. Against the background of smart campus, the development of "Internet +" has achieved the informatization and intensive development of student management, making the management handling more efficient and the coverage of information statistics more comprehensive. This provides a new idea for the work of mental health education in colleges, which is to explore the correlation between the daily data produced by college students and their mental health through data mining with the help of campus management system, so as to build a psychological crisis warning system.

## II. ANALYSIS OF COLLEGE STUDENTS' PSYCHOLOGICAL CRISIS FACTORS

Recently, the frequent occurrence of college students' psychological problems has posed higher challenges to the college management. In 2018, the ministry of education released the guidelines for mental health education for college students, which requires colleges to strengthen the prevention and intervention of psychological problems. Colleges have also successively established corresponding crisis emergency plans and mental health counseling measures, etc.

In view of the psychological health education work in colleges, Wang Jianguo [1] proposed three strategies for college students' psychological crisis intervention, including the establishment of the information feedback system, the establishment of the crisis prevention system and the improvement of the social psychological environment. At present, there are few researches on psychological crisis information feedback system. Shen Qinggui [2] analyzed the learning behavior data of students through data mining algorithm and cloud computing technology, obtained the implicit and explicit learning behaviors of students behind the data, and realized the visual evaluation of education quality and prediction of students' future learning performance. Huang Yujiao [3] was designed and developed a set of psychological evaluation, psychological learning remote, psychological counseling function module of the management information system of college students' psychological education and comprehensive counseling.

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Although this system can manage psychological crisis to a certain extent, it has its limitations in predicting psychological crisis due to the single information source. Therefore, it is a meaningful direction to explore and build a management system of college students' psychological problems, which can be used by college administrators and obtained from the data analysis of college students, so as to overcome the difficulties of few administrators and small service coverage.

There are many kinds of management business systems in colleges. And most of the data generated by students' activities on campus can be acquired and stored. However, in practical work, managers have higher and higher requirements for data exchange between systems, because of the crossover of management business. The connection between campus data can reduce the repeated collection of data, promote the simplification of management process and the high efficiency of business management, and at the same time provide relevant system data for support when making decisions. The development of big data technology and the establishment of data sharing platform have overcome the barriers of data exchange between different management platforms and made the exchange of campus data possible. Therefore, the next part of this paper combines the types of campus data to analyze the factors affecting the psychological crisis of college students.

#### A. Definition of Psychological Crisis

G. Caplan was the first scholar to put forward the concept of psychological crisis intervention. He believed that psychological crisis is a temporary state of psychological imbalance when people face more difficulties than their current ability [4]. According to the source of crisis stimulus, Long Di divides the psychological crisis into two types: one is the growth crisis when something happens that exceeds the psychological preparation corresponding to people's development stage at that time; the other is the psychological crisis caused by external stimuli, namely the situational psychological crisis [5].

College students are in the stage of physiological relative maturity and delay the social responsibility and obligation of adults. In this stage, college students constantly think and try to determine the outlook on life, values and seek self-unity. Due to their relatively immature psychology, when they are dealing with personal growth problems and sudden events in the outside world, they are more likely to suffer from psychological setbacks. If they do not get timely intervention, they are likely to have some extreme behaviors. With the increasing conflicts and pressures in the fields of ethics, learning pressure, interpersonal communication, behavioral style, job-seeking and employment, the possibility of psychological crisis among college students increases.

#### B. Psychological Crisis of College Students

This paper analyzes the relevant factors of college students' psychological crisis from three perspectives: their characteristics, on-campus behavior and on-campus environment. On the premise of fully protecting students' privacy, the campus data that can be obtained are sorted out.

1) *Characteristics of college students:* Generally, college students are between 18 and 25 years old, have little social experience, and their self-consciousness development is not fully mature. They are in a stage of self-exploration, self-denial and self-development. They will encounter many unique problems, such as new environment adaptation problems, learning pressure, interpersonal difficulties, etc., once these problems beyond the ability of students to deal with, it is easy to cause a psychological crisis.

2) *The influence of college students' behavior on their mental health:* College campus provides a broad platform for the growth of college students. According to the daily behaviors of college students, the behavioral data of campus consumption, learning, employment preparation, interpersonal communication, Internet access and extracurricular activities can be obtained. Such as get the frequency of students' consumption in the canteen from the campus one-card system; obtain the learning progress, failing grades and attendance of students from the educational administration system; obtain the employment status, Internet access status and activity participation frequency of students from the student management system; evaluate the interpersonal communication of students from a variety of data analysis (high frequency next to consumption record information, access to library information, etc.) , etc.

3) *The influence of campus environment on college students' mental health:* The campus environment provides a good closed loop for students' needs of study, life, entertainment and work, including dormitory area, teaching area, activity area and experimental area. Among them, the places that have auxiliary effect on psychological counseling or intervention are mainly those used for relaxation, physical exercise and professional psychological counseling for students. The available student data information generated in the campus environment includes: obtaining the data of students entering and leaving the physical exercise place from the access control system; obtaining the data on students' participation in psychology courses from the online course selection system; getting the talk frequency from the student management system; obtaining basic data of students' psychological assessment, individual psychological counseling, group psychological counseling, Sandbox Game participation and relaxation training participation from the data collection of psychological counseling center, etc.

### III. AN EXPLANATORY STRUCTURAL MODEL OF COLLEGE STUDENTS' PSYCHOLOGICAL CRISIS FACTORS

ISM is a method developed by American professor Warfield in 1973 to analyze the structural problems of complex systems, which can determine the relationship between the basic elements in complex systems [6]. By extracting the components of the problem, using tools such as directed graph and matrix and computer technology, the method processes the information of the elements and their mutual relations, clarifies the level and overall structure of

the problem, and improves the understanding of the problem. After a long period of development, ISM has been applied not only in the economic field, but also in product development and information construction. SHEN et al. [7] analyzed the related factors of carbon emissions through the ISM method, and conducted a hierarchical structure analysis of the carbon emission trading management system, which was used to assist the formulation of policies. Shi Yanmin [8] applied this method to the construction of product green design scheme and formed a set of evaluation model, so that enterprises have a feasible comparison method in terms of environmental friendliness when developing products. Zhang Ruiqiu et al. [9] used ISM to conduct qualitative and quantitative analysis of the influencing factors in the Internet product development system, so as to obtain the optimized product development process. Therefore, the hierarchical analysis of the factors leading to the psychological crisis management system of college students by ISM is conducive to the construction of the information architecture of the psychological crisis management system of college students.

A. Definition of System Elements

From the perspective of campus data collection, the psychological problems caused by students' psychological development and personal growth are difficult to be obtained in the form of data, while the campus management system is easy to record students' activities and emergencies. Therefore, this study focuses on students' situational psychological crisis.

There are two main ways to deal with psychological crisis in college management: prevention and intervention. This study USES scenario analysis method (PEST) to sort out the policy, economic, social and technical support factors related to students' psychology in school (see "Table I"). Based on the analysis of the above factors, 10 main typical factors are extracted by combining the same type of factors: Education policy, Family finances, Student's academic performance, Interpersonal communication, Individual employment, Surfing record, Activity participation, Psychological prevention, Psychological intervention, Psychological evaluation.

TABLE I. SYSTEMATIC FACTORS LIST OF PSYCHOLOGICAL CRISIS FACTORS OF COLLEGE STUDENTS

Mold	Influencing Factor	Mold	Influence Factor
Policy	Policy of the ministry of education	Society	Surfing record
	Policies of higher education institutions		Activity participation
Economics	Family finances		Physical activity record
	Canteen consumption records	Psychological prevention	
	Delivery status	Psychological intervention	
Society	Student's academic performance	Technology	Individual counseling
	Interpersonal communication		Group counseling
	Individual employment		Psychological evaluation
	Counselor's talk		Relaxation training
	Mental health courses		Sandbox Game

B. Establishing the Adjacency Matrix of the System

These 10 typical psychological crisis factors of college students were defined as S<sub>1</sub>=Education policy, S<sub>2</sub>=Family finances, S<sub>3</sub>=Student's academic performance, S<sub>4</sub>=Interpersonal communication, S<sub>5</sub>=Individual employment, S<sub>6</sub>=Surfing record, S<sub>7</sub>=Activity participation, S<sub>8</sub>=Psychological prevention, S<sub>9</sub>=Psychological intervention, S<sub>10</sub>=Psychological evaluation. The system structure composed of the above 10 factors is defined as set expression S = {S<sub>1</sub>, S<sub>2</sub>, ..., S<sub>10</sub>}. According to the nature of each factor, the purpose of the study and the actual work of the impact of the factors were analyzed (see "Table II").

TABLE II. TABLE OF BINARY RELATION OF PSYCHOLOGICAL CRISIS FACTORS OF COLLEGE STUDENTS

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
S1	0	0	0	0	0	0	0	1	1	1
S2	0	0	0	0	0	0	0	0	0	1
S3	0	0	0	0	0	0	0	0	0	1
S4	0	0	0	0	0	0	1	0	0	1
S5	0	0	0	0	0	0	0	0	0	1
S6	0	0	0	0	0	0	0	0	0	1
S7	0	0	0	1	0	0	0	1	0	0
S8	0	0	0	0	0	0	0	0	1	0
S9	0	0	0	0	0	0	0	0	0	0
S10	0	0	0	0	0	0	0	1	1	0

According to the relation of various factors, the directed representation method of the system structure (see "Fig. 1") is obtained, and the matrix expressions A (see "Fig. 2",

Formula 1) and the identity matrix I (see "Fig. 2", Formula 2) of the system structure are defined.

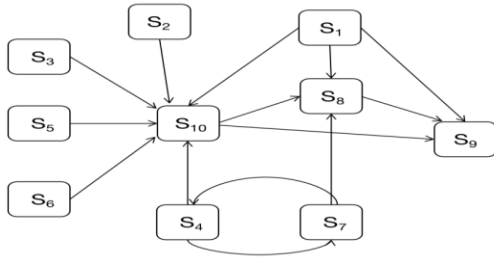


Fig. 1. Directed graph of influencing factors of psychological crisis.

$$A = \begin{bmatrix} 000000111 \\ 000000001 \\ 000000001 \\ 0000001001 \\ 0000000001 \\ 0000000001 \\ 0001000100 \\ 0000000010 \\ 0000000000 \\ 0000000110 \end{bmatrix} \text{ Formula 1} \quad I = \begin{bmatrix} 1000000000 \\ 0100000000 \\ 0010000000 \\ 0001000000 \\ 0000100000 \\ 0000010000 \\ 0000001000 \\ 0000000100 \\ 0000000010 \\ 0000000001 \end{bmatrix} \text{ Formula 2}$$

Fig. 2. Matrix expression of system structure.

C. Calculating the Reachable Matrix

According to the Boolean matrix algorithm, the accessible matrix of system elements can be obtained by computing the adjacency matrix A, which is  $(A+I)^2=(A+I)^3=M$  (see "Fig. 3", Formula 3).

$$A+I = \begin{bmatrix} 000000111 \\ 000000001 \\ 000000001 \\ 0000001001 \\ 0000000001 \\ 0000000001 \\ 0001000100 \\ 0000000010 \\ 0000000000 \\ 0000000110 \end{bmatrix} \quad (A+I)^2 = \begin{bmatrix} 100000111 \\ 010000111 \\ 001000111 \\ 000100111 \\ 000010111 \\ 0000010111 \\ 0001001111 \\ 0000000110 \\ 0000000010 \\ 0000000111 \end{bmatrix} \quad (A+I)^3=M \text{ Formula 3}$$

Fig. 3. Calculate the accessibility matrix of system elements.

D. Interstage Decomposition

Decompose reachable matrix, and define reachable set  $R(S_i) = \{S_j | S_j \in S, m_{ij}=1, j=1,2,...,n\}$   $i=1,2,...,n$ , antecedent set  $A(S_i) = \{S_j | S_j \in S, m_{ji}=1, j=1,2,...,n\}$   $i=1,2,...,n$ , and collective set  $C(S_i)=R(S_i) \cap A(S_i)=\{S_j | S_j \in S, m_{ij}=1, j=1,2,...,n\}$   $i=1,2,...,n$ , as shown in "TABLE III". According to the  $R(S_i) \cap A(S_i)=R(S_i)$  condition, when  $i=9$ ,  $R(S_9) \cap A(S_9)=R(S_9)$  satisfies the condition, indicating that S9 is the top layer (the first layer) of the system, namely, S9 is the final goal of the system. When  $i=8$ ,  $R(S_8) \cap A(S_8)=R(S_8)$  satisfies the condition, indicating that S8 is the second layer of the system. Finally, four levels can be obtained by analogy, as shown in "Table III".

TABLE III. TABLE OF REACHABLE SET AND ANTECEDENT SET AND THEIR INTERSECTION

i	R(S <sub>i</sub> )	A(S <sub>i</sub> )	R(S <sub>i</sub> )∩A(S <sub>i</sub> )
1	1,8,9,10	1	1
2	2,8,9,10	2	2
3	3,8,9,10	3	3
4	4,7,8,9,10	4,7	4,7
5	5,8,9,10	5	5
6	6,8,9,10	6	6
7	4,7,8,9,10	4,7	4,7
8	8,9	1,2,3,4,5,6,7,8,10	8
9	9	12,3,4,5,6,7,8,9,10	9
10	8,9,10	1,2,3,4,5,6,7,10	10

Psychological intervention(S<sub>9</sub>) is the ultimate goal, and there are seven factors at the bottom of the system, including Education policy(S<sub>1</sub>), Family finances(S<sub>2</sub>), Student's academic performance(S<sub>3</sub>), Interpersonal communication(S<sub>4</sub>), Individual employment(S<sub>5</sub>), Surfing record(S<sub>6</sub>), Activity participation(S<sub>7</sub>), which is the root cause that causes system information to change. Therefore, the structural relationship model diagram of this system can be sorted out as shown in "Fig. 4".

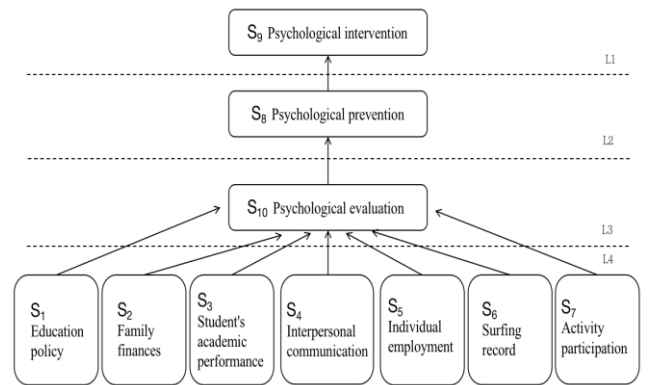


Fig. 4. Schematic diagram of the relationship among the influencing factors of psychological crisis.

E. Analysis of the Weight of Underlying Factors

Since there are 7 underlying influencing factors, the AHP [10] is applied to compare each influencing factor pairwise to obtain the weight of each factor. Corresponding scores are assigned to these 7 influencing factors (see "Table IV"), and then the judgment matrix is formed, which is  $B=(S_{ij})_{n \times n}$ ,  $i=1,2,...,7, j=1,2,...,7, n=7$ . The dimensionality and dimensionality units are removed from the data standardization, and the eigenvectors can be obtained at the same time, which is  $W=\{0.385, 0.025, 0.054, 0.180, 0.107, 0.080, 0.160\}^T$ .

TABLE IV. COMPARISON ON THE IMPORTANCE OF EVERY TWO ELEMENTS

	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>4</sub>	S <sub>5</sub>	S <sub>6</sub>	S <sub>7</sub>
S <sub>1</sub>	1	7	7	5	7	7	5
S <sub>2</sub>	1/7	1	1/3	1/7	1/3	1/3	1/5
S <sub>3</sub>	1/7	3	1	1/3	1/3	1/3	1/3
S <sub>4</sub>	1/5	7	3	1	3	3	1
S <sub>5</sub>	1/7	3	3	1/3	1	3	1/3
S <sub>6</sub>	1/7	3	3	1/3	1/3	1	1/3
S <sub>7</sub>	1/5	5	3	1	3	3	1

According to the principle of analytic hierarchy process, consistency test is carried out, and the average eigenvalue of matrix B is calculated, which is  $\lambda_{max} = 7.778$ ; and Indicators of the degree of inconsistency of the matrix B are calculated, which is  $CI=0.130$ . Referring to the RI value table of the average random consistency indicator used internationally,  $RI=1.32$  when  $n=7$ . According to the formula given by professor Satty, the random consistency ratio of matrix B can be calculated, which is  $CR=CI/RI=0.098 < 0.1$ , so matrix B satisfies the consistency requirement. After calculation, the weight of the bottom 7 influencing factors (Education policy, Family finances, Student's academic performance, Interpersonal communication, Individual employment, Surfing record, Activity participation) is respectively 0.385, 0.025, 0.054, 0.180, 0.107, 0.080 and 0.160. This weight plays a role in the subsequent evaluation of the system.

#### IV. THE DESIGN OF COLLEGE STUDENTS' PSYCHOLOGICAL CRISIS MANAGEMENT SYSTEM

According to the analysis of ISM, the psychological crisis management system should include basic data, data processing, result visualization and prevention and intervention functions. This management system is used to capture the following data from the campus data: Education policy, Family finances, Student's academic performance, Interpersonal communication, Individual employment, Surfing record, Activity participation, Psychological prevention, Psychological intervention, Psychological evaluation and other data. According to the management requirements, a positive and negative limit is set for the above data, and the difference between the obtained data and the positive and negative limit is compared. The data exceeding the positive and negative limit is defined as abnormal data. Based on the results of the AHP analysis, these abnormal data were weighted to predict whether the student was in early warning of psychological crisis. Then this part of the students in the early warning of psychological crisis are arranged to accept psychological tests, which can help to obtain more accurate and scientific judgment, so the administrators can implement psychological prevention for students, and when the situation of students is serious, the administrators can carry out psychological intervention.

In order to achieve the above functions and let managers obtain information intuitively, the interfaces of the college students' psychological crisis management system are designed, as shown in "Fig. 5".

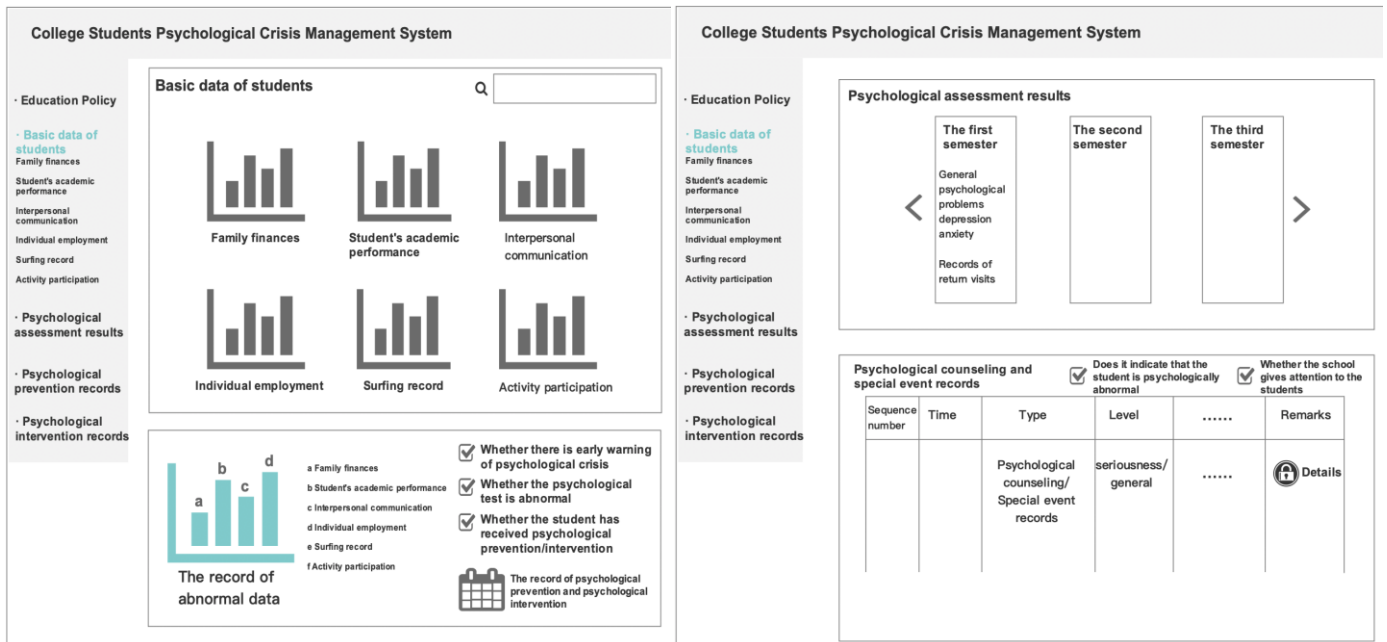


Fig. 5. Interface design of college students psychological crisis management system.

#### V. CONCLUSION

The construction of smart campus makes it possible for administrators to serve students in a way that is time-sensitive and closer to students' needs. The analysis of a

large number of constantly updated campus data to obtain the influencing factors related to the psychological crisis of students is of great significance for the assistant managers to detect, participate in the prevention and timely intervene in the possible psychological problems of college students. This

study uses the method of Interpretative Structural Modelling Method and the Analytic Hierarchy Process, to explore the influence factors of psychological crisis hierarchy and weight calculation, and set up a college students' psychological crisis management system used by managers, which makes the students' psychological warning visualization and be discovered earlier. It provides a new way for the psychological health education work. Due to the continuous introduction of Internet of Things, Cloud Computing and other technologies into campus management, the types of student data generated are constantly updated. Although this study analyzes and obtains campus data related to students' psychology from the political, economic, social and technical aspects, there is still room for in-depth exploration.

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