Research on Optimization of College Students Management Decision Mechanism under Big Data Background

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Abstract: Under the background of increasingly refined and intelligent higher education management, how to optimize the decision-making mechanism of college students 'management with the help of big data technology has become an important topic to improve the ability of educational governance.Based on big data technology, this paper systematically combs its fusion logic in college student management, analyzes the core problems faced in current student management decision-making, such as fragmented data, subjective decision-making, weak governance system, etc., and puts forward optimization paths such as constructing unified data platform, developing scientific decision-making model, perfecting intelligent support system and strengthening data governance.Through the case study of the Student Management Intelligent System of X University, the paper demonstrates the practical application effect of student management driven by big data in academic warning, psychological identification and behavior intervention, and summarizes the key challenges of collaborative mechanism and data ethics in the implementation of the system.The research suggests that the optimization of student management decision-making mechanism needs the coordinated promotion of technology, system and management system, which provides theoretical support and practical reference for the construction of intelligent student management system in colleges and universities.

Key words: big data; university management; student affairs; decision-making mechanism; education informatization

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Introduction

With the increasing complexity and diversification of higher education system, college student management faces unprecedented challenges.At present, in colleges and universities, the number of individual students is huge, the background is diverse, and the behavior mode is complex. The task of student management has changed from administrative affairs management to more refined, scientific and humanistic management. Traditional student management decisions often rely on managers 'experience judgment and system flow, lack of perception of students' dynamic state, and it is difficult to identify and intervene early in the process of students 'growth, resulting in obvious lag of educational services.Under this background, the rapid development of big data technology has brought brand-new means and paths for college student management.By collecting, processing and mining massive data generated by students in

many aspects such as study, life and behavior, managers can realize full-cycle monitoring and personalized management of students 'status, thus greatly improving the scientificity, accuracy and foresight of student affairs decision-making.The intervention of big data technology not only helps to improve management efficiency and reduce human decision-making errors, but also provides auxiliary support in academic early warning, psychological identification, behavior analysis and other aspects, forming a modern college student management mode with data drive as the core.

1 Integration logic of big data technology and university student management

1.1 Basic connotation and key technologies of big data

Big data is an important resource in the information society, which has the characteristics of "4V" with large volume, fast speed, multiple types and low value density.In the university environment, heterogeneous data from academic affairs, books, one card, access control and other systems are increasing day by day. These data types are rich, covering structured, semi-structured and unstructured information, which puts forward higher requirements for data processing [1].The traditional information system of university is difficult to support such complicated data integration and analysis work, which needs to be handled by modern technical means.Data warehouse integrates multi-source data through ETL process to realize standardized management; data mining technology can extract patterns and rules behind students 'behavior; and the introduction of artificial intelligence, such as machine learning and natural language processing, provides behavior prediction and decision-making assistance capabilities for student management, and promotes management methods to be automated and intelligent.

1.2 Main contents and decision-making levels of student management in colleges and universities

The management of college students covers many aspects such as student status, study, psychology, thought, behavior and employment, which constitutes a comprehensive education system.Student status management is responsible for the maintenance and change of students 'basic information, academic early warning detects risks through achievement and attendance data, mental health management relies on assessment data for identification and intervention, and employment guidance focuses on ability and career matching [2].Management decision-making is divided into three levels: strategic level focuses on training quality and resource allocation, relying on long-term data support; tactical level deals with semester arrangement and development planning, paying attention to phased trends; operational level involves daily affairs, requiring real-time response and data support.Big data technology can provide targeted information support at all levels to enhance the systematicness and accuracy of decision-making.

1.3 Typical application scenarios of big data in student management

At present, big data has been widely used in key scenarios of college student management. Accurate academic early warning system constructs risk model through historical achievement, classroom behavior and online learning data, which can identify problems such

as grade decline in advance and realize early warning push.Personalized learning service recommends courses and matches resources based on student portraits to improve learning effect [3].Behavior data has also become an important basis for decision-making, such as access control frequency, library utilization, psychological counseling frequency, etc., which can reflect students 'status, assist managers to identify potential problems, and realize more temperature and initiative management.Through the implementation of these applications, college student affairs management has gradually realized the transformation from post-event treatment to pre-warning, and extended from unified mode to differentiated service.

2 Challenges Facing the Decision-making Mechanism of Students Management in Colleges and Universities

2.1 Fragmentation of decision-making information sources

Although most colleges and universities have built multiple information systems covering various fields of student affairs, due to different construction subjects, the lack of unified interfaces and data standards between systems leads to closed information and scattered data, forming a typical data island problem [4].It is difficult to share and integrate data between different systems, it is difficult to establish student portraits, and managers cannot form panoramic data support when dealing with affairs, so they can only rely on fragment information to make judgments, which affects the quality of decision-making and processing efficiency.In addition, the inconsistent definition and format of data in each system also increase the difficulty of integration, which seriously restricts the deep application of big data technology in actual management, making it difficult for colleges and universities to "use data" although they "own data", which has become the primary obstacle to the optimization of management mechanism.

2.2 The decision process is subjective.

Student affairs management in colleges and universities is still highly dependent on empirical decision-making and lacks a data-driven scientific support system.In the face of academic crisis, psychological changes or emergencies, managers mostly rely on experience to deal with, lack of quantitative basis [5].Although flexible, this approach exposes obvious shortcomings in the reality of data explosion and increasingly complex student characteristics: it is difficult to identify risks in advance and standardize processes to replicate experiences.Management mistakes can have major consequences.In addition, due to the lack of timely information, intervention measures often lag behind the development of problems, affecting the effectiveness of treatment and missing the best response opportunity.Empirical decision-making is unstable and replicable, which can hardly meet the realistic needs of fine and efficient management in modern colleges and universities.

2.3 The data governance system is not sound

While collecting and applying a large amount of data, the absence of governance system has become the bottleneck restricting intelligent management.At present, most colleges and universities are still in the exploration stage in terms of data governance, lacking neither a complete data life cycle management system nor an effective use

boundary and responsibility traceability mechanism.Student data mostly involves privacy and sensitive information. Without strict authority control and desensitization, it is easy to cause data leakage and ethical disputes.At the same time, departments have different logics in data use, lack of coordination mechanism, and are prone to data duplication, authority conflict or inefficient use.Communication barriers between managers and technicians in understanding data also make it difficult to translate data into effective management solutions.Therefore, in order to realize the intelligent transformation of college student management, we must simultaneously promote institutional governance, technical guarantee and ethical norms, construct a scientific, transparent and safe data governance system, and lay a foundation for the widespread and effective use of data.

3 Optimization Path of Student Management Decision Mechanism Based on Big Data

3.1 Building a unified data management platform

In order to promote the transformation of student management from traditional mode to intelligent mode, colleges and universities must first establish a unified and efficient data management platform to realize centralized collection, standardized integration, automatic cleaning and visual presentation of student-related data.At present, each business system in colleges and universities operates independently, and data redundancy and format conflict are common. It is urgent to break down "information barrier" and integrate student data in scattered systems such as teaching management, student affairs, logistics service, psychological counseling and book borrowing with unified data interface and standard protocol.By introducing the data middle platform architecture, universities can build a data flow system covering the bottom data access, middle analysis processing and upper business application, so that all kinds of data can be efficiently shared and cooperatively invoked on "one platform".On this basis, with the help of data visualization tools, complex data will be graphically and dynamically displayed to assist managers to realize rapid perception and accurate judgment of students 'status in daily management.In order to more clearly show the architecture design of the university data management platform, the following table summarizes the key modules and their functions of the platform:

Table 1 Functional modules and core roles of unified data management platform in colleges and universities

module name	functional description	application example
data acquisition module	Access to educational administration, logistics, access control, network behavior and other multi-source data	Collect attendance records, library information
data processing module	Data cleansing, missing completion, format conversion and standardization	Standardize student grade formats and eliminate duplicates
data storage module	Establish a unified data warehouse for structured and unstructured data storage	Store text questionnaires, video interview data
data analysis module	Provide statistical analysis, clustering modeling, anomaly detection and other analysis functions	Identifying the Academic Risk Groups and Constructing Student Portraits
data visualization module	Dynamic charts show the student status and behavior trends, enhance management intuition	Visually present psychological warning trend change chart

Data Sharing and Permissions Module	Set access, open on demand, secure and compliant use of data	Different roles assign different data viewing permissions

As can be seen from Table 1, the unified data management platform not only undertakes the basic functions of centralized data management, but also constructs advanced functions such as data analysis and permission control, providing basic support for subsequent scientific decision-making.The establishment of the platform is not only a technical task, but also a system design work, its success or failure is directly related to the overall efficiency and intelligent level of student management system operation.

3.2 Build a data-driven scientific decision model

On the basis of unified data platform, multi-dimensional and extensible student portrait system should be further constructed, supplemented by scientific risk identification and intervention model.By aggregating multi-dimensional data such as students 'achievement track, course selection behavior, Social networks, psychological assessment results, etc., the system can automatically generate student portraits with individual characteristics and group comparison analysis to assist managers in identifying potential problem groups or personality needs.Combined with machine learning algorithms, it can predict the future performance of students and recommend personalized service solutions based on the model results, such as customized counseling plans, recommended employment directions or matching psychological counseling resources, thus promoting the transformation of student management from "unified processing" to "precise support".

3.3 Perfecting decision support system and intelligent platform construction

In order to deal with students 'affairs quickly, intelligently and efficiently, DSS should be superimposed on the existing information system. DSS can realize assistant judgment and self-adaptive regulation by transforming data analysis results into management strategy suggestions.DSS should integrate student portrait module, rule engine, knowledge base and intelligent feedback mechanism, and support real-time alarm and intervention trigger mechanism.The introduction of artificial intelligence technology, especially natural language processing and expert systems, can simulate the judgment logic of senior counselors, intelligently diagnose and dynamically respond to student behavior, thus improving student management efficiency without increasing the burden on managers.

3.4 Strengthening data governance and ethics

While big data is widely used in student management, data security and ethical governance must be highly valued.Colleges and universities should establish a data authority allocation mechanism based on the principle of "hierarchical authorization, audit accountability and minimum necessity" to ensure that different departments and different management roles use data in compliance with their responsibilities and prevent data abuse or unauthorized access.At the same time, security technical measures such as data anonymization and desensitization should be implemented in the process of data life cycle management to effectively reduce the risk of students 'privacy exposure.In addition, it is necessary to construct a data ethics standard system in colleges and universities from the institutional level, clarify the scope of data

collection, the boundary of use and the obligation of information disclosure, enhance the transparency and standardization of data management, and ensure that the educational service attribute of data technology will not be abused.Only by realizing the double guarantee of technology and system can we really promote the sustainable optimization and healthy development of student management in the data age.

4 Case Study: Practice of Intelligent Decision System for Student Management in X University

4.1 Project background and system structure

As a comprehensive key university, X University has continuously increased investment in informatization construction in recent years. In the process of promoting the modernization of educational governance, it has gradually realized the great potential of big data technology in improving the efficiency of student affairs management.Faced with the increasing number of students, increasingly diverse needs and increasingly complex affairs, the school launched the construction project of "Student Intelligent Management Decision System", aiming to build a comprehensive management platform with data as the core driving force and student development as the center.The whole system adopts the structure of "data center + application foreground". The back end gathers data resources from several systems such as educational administration, psychology, logistics, one-card, network behavior, etc. The front end provides real-time decision support for managers through functional modules such as academic warning, behavior monitoring, psychological analysis, etc.In order to better show the technical composition and core functions of the system architecture, the following table summarizes the main functional modules.

Table 2 X Core function modules of university student intelligent management system

module name	technical support	brief introduction of the function
data integration module	API interface, data middle station	Standardized integration of multi-source data to build a unified data view
study early war module	Decision tree algorithm, logistic regression model	Automatically identify students with academic risks and push early warning information
Behavior Analysis module	Cluster analysis, anomaly detection	Analysis of attendance, borrowing, consumption and other behavioral characteristics
psychological identification module	Affective analysis, questionnaire factor analysis	Determine the risk of psychological state and assist in the intervention work
decision support module	knowledge map, rule engine,	Intelligent recommendation of management measures to support refined decision-making

It can be seen from Table 2 that the system functions cover multiple dimensions of student affairs, forming a closed-loop management system based on data analysis, problem identification as the main line and intervention implementation as the goal.Especially in academic warning and psychological recognition, the embedding of algorithm model significantly improves the timeliness of problem discovery and the accuracy of decision-making.

4.2 Data acquisition and modeling process

In terms of data collection, X University synchronously collects key behavior data of students during school period from multiple business systems based on unified data platform, including grade change, course selection, book borrowing, access control, consumption records,

Internet behavior, psychological evaluation, etc., and carries out data cleaning and standardization processing through ETL technology.In the process of modeling, the school adopts hierarchical model strategy. Firstly, the students are grouped by cluster analysis to mine the risk characteristics of different groups. Secondly, the academic early warning and psychological risk prediction model is constructed on this basis. In order to optimize the accuracy and interpretability of the model, various algorithms such as decision tree, logistic regression and neural network are combined for comparison and selection.The following table shows the main data types used for modeling in the system and their application areas.

Table 3 Modeling data types and applications of student management system

data type	data sources	Examples of Primary Variables	application area
Academic Data	Educational Administration system	Grades, course difficulty, failing rate	academic early warning modeling
behavior data	Access control/all-in-one card system	Attendance frequency, late return record	abnormal behavior recognition
reading data	BMS	Borrowing frequency, professional relevance	judgment of learning enthusiasm
psychological data	Psychological assessment and interview	Stress scale scores, frequency of counseling	mental state prediction
consumption data	campus card system	Consumption in canteen, average monthly expenditure	life pattern analysis

It can be seen from Table 3 that the modeling foundation of the system covers many aspects of students 'learning, life and psychology, and constructs an analysis model of multi-dimensional data cross-fusion, which makes students' management decisions change from "people finding problems" to "data finding problems", greatly improving foresight and accuracy.

4.3 Management application and effectiveness evaluation

Since the system was put into use for more than one year, it has achieved remarkable results in many key indicators.The academic warning module identifies high-risk students through the model, and notifies the counselor to intervene in advance, which reduces the make-up examination rate by about 15%; the psychological identification module successfully detects multiple psychological abnormalities, and relevant departments intervene in time to avoid adverse consequences; the activation of the overall system improves the transaction processing efficiency by about 30%, and the satisfaction of students with management services increases significantly.The system also provides a dynamic update and push mechanism for data charts, enabling managers to make immediate response decisions based on data, improving the scientificity and transparency of work.

4.4 Practical experience and existing problems

Although the system has achieved phased results in the implementation process, it also exposes some problems worthy of reflection.On the one hand, the communication and coordination mechanism between the data department and the student affairs management department is not perfect, which leads to the failure of rapid implementation of some management suggestions; on the other hand, there is an understanding deviation between the technicians and the front-line managers in the data interpretation and application logic, which affects the full release of the data value.In

addition, some students and teachers have privacy doubts about data collection, which shows that colleges and universities still need to strengthen data ethics education and system guarantee in the process of promoting the implementation of technology.On the whole, although the practice of X University is not perfect, it has provided a replicable sample path for colleges and universities to build a data-driven student management decision-making mechanism.

5 Conclusion

The rapid development of big data technology provides a brand-new perspective and thinking mode for college student management, which enables managers to dynamically and accurately analyze and serve students based on multi-source heterogeneous data, thus realizing the deep-level transformation from empirical decision-making to data-driven and intelligent auxiliary decision-making.By constructing a unified data management platform, developing a multi-dimensional portrait model and building an intelligent decision support system, colleges and universities have significantly enhanced their abilities in students 'academic early warning, psychological recognition and behavior intervention.However, in order to realize the systematic optimization of student management decision-making mechanism, it is far from enough to rely on technical means only. We must take technology as the foundation, system as the guarantee, management as the core, and the three coordinate and manage together.On the one hand, it is necessary to perfect the data standard, ensure the data security and ethical standard, on the other hand, it is necessary to construct the cross-department coordination mechanism, improve the sharing and application ability of data resources, so as to promote the college student management to stride forward towards the direction of intellectualization, refinement and scientification.

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