Research on University Students' Organizational Activities Optimization and Decision Support System Based on Big Data

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Abstract: This article focuses on the current challenges faced by university students' organization activities, and is committed to exploring effective ways to optimize activities and build decision support systems with the help of big data. Through the in-depth analysis of big data technology, university students' development theory and decision support system theory, this article comprehensively studies the optimization and decision support system of university students' organizational activities based on big data by means of demand analysis, architecture design, functional module planning and key technology research. The system can realize accurate planning, efficient publicity, scientific implementation and comprehensive assessment of university students' organizational activities from all levels of data collection, processing and application, with the help of key technologies such as big data collection and preprocessing, activity optimization model construction and decision support algorithm. The system based on big data can effectively improve the quality and participation of university students' organizational activities, and provide strong support for the scientific and intelligent development of university students' work.

1. Introduction

In the field of higher education, student organization activities in colleges and universities play a vital role in the all-round development of students. These activities not only enrich the campus cultural life, but also provide a platform for students to exercise their comprehensive ability [1]. However, with the expansion of the scale of colleges and universities and the increasing diversification of students' needs, the traditional activity organization and decision-making methods have gradually exposed problems such as low efficiency and insufficient pertinence [2].

The advent of the era of big data provides a new opportunity for the optimization of university students' organizational activities [3]. With its powerful data collection, analysis and processing capabilities, big data technology can mine valuable content from massive information such as student behavior data and activity feedback data, and provide strong support for the planning, organization and decision-making of activities [4]. By constructing the optimization and decision support system of university students' organizational activities based on big data, we can understand students' needs more accurately, improve the quality and participation of activities, and improve the overall level of university students' organizational activities [5].

At present, many scholars have conducted extensive research on the application of big data in the field of education, and some achievements have been applied to teaching management, student assessment and other aspects [6]. However, the application of big data technology is still in the exploration stage in the specific scenario of university students' organization activities [7]. Most of the research focuses on the description of the surface phenomenon of activities, lacking in-depth and comprehensive theoretical research and technical architecture design of the system [8]. Therefore, it is of great significance to carry out in-depth research on university students' organizational activities optimization and decision support system based on big data. This study aims to fill this gap, provide theoretical guidance and technical support for the innovative development of university students' organizational activities, and promote the scientific and intelligent process of university students' work.

2. Supporting theory and technical system

Big data technology is the core supporting technology of this study. It covers data collection, storage, management, analysis and visualization. Data collection technology is responsible for collecting data related to university students' organizational activities from various channels, such as students' online registration system and on-site feedback records of activities [9]. Data storage and management technology ensures the effective preservation and convenient call of massive data. Data analysis technology extracts key information from complex data through data mining, machine learning and other methods, providing a basis for activity optimization and decision-making. Visualization technology presents the analysis results in the form of intuitive charts, which is convenient for decision makers to understand.

The theory of university students' development emphasizes students' needs in knowledge acquisition, ability training and personality development, and requires students to organize activities around their all-round development. Decision support system theory is an important theoretical basis for building a system [10]. Through the collaborative work of model base, knowledge base and database, it provides an environment for decision makers to analyze problems, build models and simulate the decision-making process, and assists decision makers to make scientific decisions, thus improving the decision-making efficiency and quality of university students' organizational activities.

3. System requirement analysis and design

The activities organized by university students involve many links, from activity planning, publicity and promotion to on-site implementation and feedback assessment. Every step needs to accurately grasp the needs of students in order to improve the quality and participation of activities. Therefore, the demand analysis and design of university students' organizational activities optimization and decision support system based on big data is very important.

(1) The current situation and demand of university students' organizational activities

At present, there is information asymmetry in university students' organizational activities. It is difficult for organizers to fully understand students' hobbies, time arrangement, etc., which leads to the theme of the event not meeting students' expectations and the number of participants is not ideal. The publicity channels of the event are scattered, lack of pertinence and poor publicity effect. In addition, the assessment method of activities is single, mainly relying on the subjective assessment of participants, and it is impossible to dig deep into the problems existing in activities.

University students expect to participate in activities that are in line with their own interests, have practical significance and are well organized. They hope that they can get information about the activities conveniently, and at the same time, they can feedback their opinions and suggestions conveniently. Organizers need a system that can integrate students' information, accurately plan activities, effectively publicize and promote activities and scientifically evaluate the effects of activities.

(2) Application requirements of big data in activity optimization and decision support

Big data can provide rich information for activity optimization and decision-making. By collecting students' social data, learning data and historical data of activities, we can analyze students' interest preferences, behavior patterns and time rules. Using these data, the system can accurately plan the activity theme and customize the activity content according to the interests of different student groups. In terms of publicity and promotion, according to the information acquisition channels commonly used by students, the publicity information of activities is accurately put in. In the activity assessment stage, combined with multi-source data, the activity effect is comprehensively evaluated from multiple dimensions such as participation, satisfaction and actual harvest.

(3) The overall architecture design of the system

The overall architecture of the system is divided into data layer, processing layer and application layer. The data layer is responsible for collecting and storing all kinds of data related to university

students' organizational activities, including students' basic information, activity history data and campus network behavior data (see Figure 1). The processing layer uses big data analysis technology to clean, mine and analyze the data and extract valuable information. The application layer presents the analysis results to the event organizers and participants with a visual interface, which provides decision support for the planning, publicity, implementation and assessment of the event.
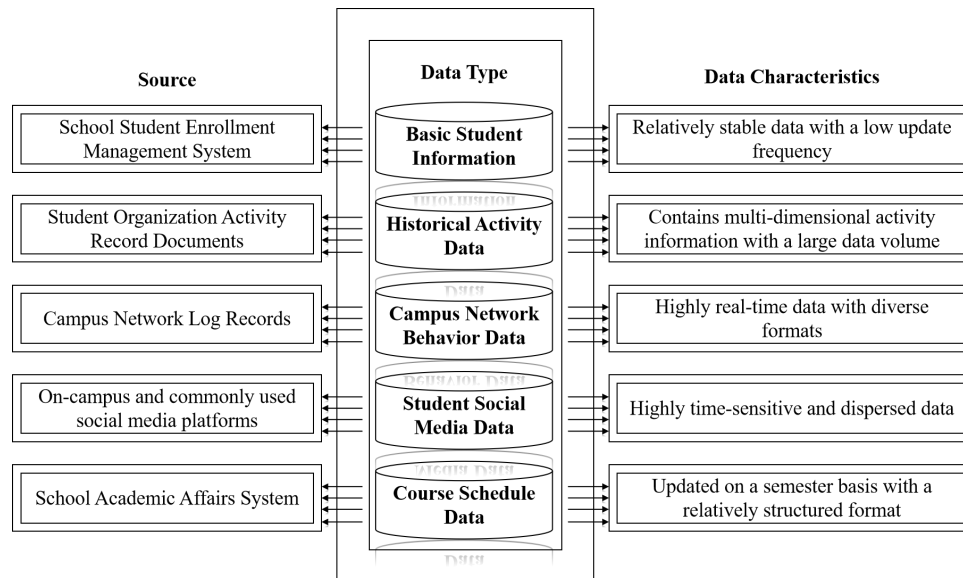

Figure 1 Data type and source of system data layer

(4) Design of system function module

The system includes activity planning module, promotion module, execution management module and assessment feedback module. Based on the results of data analysis, the activity planning module provides the organizers with suggestions on the theme of activities, time arrangement and so on. According to the students' information, the publicity module makes a personalized publicity plan and selects the appropriate publicity channels. The executive management module assists the organizer in personnel scheduling and material management at the event site. The assessment feedback module integrates multi-source data to generate a detailed activity assessment report, which provides a basis for the improvement of subsequent activities. Through the collaborative work of these functional modules, the optimization and scientific decision-making of university students' organizational activities can be realized.

4. Key technologies and implementation strategies of the system

In the process of building a university student organization activity optimization and decision support system based on big data, a series of key technologies and their implementation strategies are the core elements to ensure the effective operation of the system. These technologies run through many key links such as data processing, model construction and system security.

(1) Big data acquisition and preprocessing technology

Big data collection is the first step to obtain information about university students' organizational activities. The system needs to collect data from a variety of data sources, such as school information management system, student social platform, activity site feedback equipment and so on. The collected data often have problems such as inconsistent format, missing data and noise data, so the preprocessing technology is very important. Pretreatment includes data cleaning, data conversion and data integration.

Data cleaning aims to remove duplicate, incorrect or incomplete data records. Students may enter wrong information due to misoperation when registering for activities, and this kind of data can be corrected by setting reasonable data verification rules. Data conversion unifies data in different

formats into a standard format that can be recognized by the system, such as converting different date formats into a unified format. Data integration integrates data from multiple data sources to form a complete data set (as shown in Figure 2).
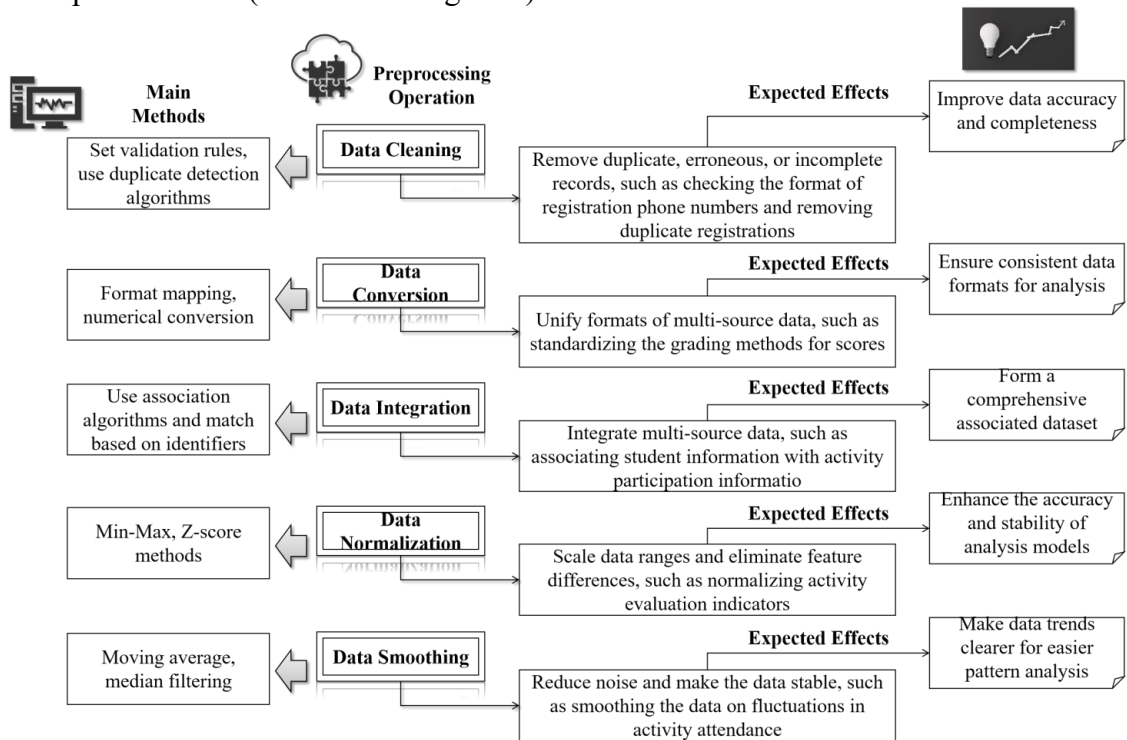

Figure 2 Big data preprocessing operation and explanation.

(2) Construction technology of activity optimization model

In order to realize activity optimization, a series of models need to be constructed. Preference analysis model is used to mine students' interest preferences for different types of activities. By analyzing the data of students' participation frequency, stay time and feedback assessment in various activities, the model is constructed by using the classification algorithm in machine learning, so as to accurately identify students' interest points. The time planning model predicts students' free time and chooses the best time for activities according to students' curriculum arrangement, daily activities and other data. The model uses time series analysis method to model historical time data, and dynamically adjusts the prediction results considering the changes of students' activities in different stages of the semester. The resource allocation model rationally allocates human and material resources based on factors such as the scale of the activity, the number of participants and the materials needed for the activity. Through the linear programming algorithm, the optimal allocation of resources is realized and the cost of activities is reduced on the premise of meeting the needs of activities.

(3) Implementation strategy of decision support algorithm

Decision support algorithm is the key for the system to provide decision-making basis for organizers. Association rule mining algorithm is used to discover the potential relationship between related factors of activities. For example, through the analysis, it is found that there is a correlation between certain activity themes and specific publicity channels, that is, activities with specific themes are better promoted on certain publicity channels. The system uses classical association rule mining algorithms such as Apriori algorithm to find frequent itemsets in the preprocessed active data set, thus obtaining association rules.

Predictive analysis algorithm helps the organizer to predict the number of participants and the effect of the activity. Using regression analysis, neural network and other algorithms, combined with historical activity data and current student group characteristic data, a prediction model is constructed. For example, taking the number of participants in past activities, publicity investment and activity theme as input variables, the number of participants in future activities is predicted by

training model, which provides data support for activity planning.

(4) System security and stability guarantee strategy

System security is very important, and multiple measures need to be taken to ensure data security and user privacy. Data encryption technology encrypts sensitive data in storage and transmission. Adopt encryption algorithms such as advanced encryption standards to ensure that data cannot be read without authorization.

The access control policy strictly limits the access rights of different users to system functions and data. Event organizers can only access the data related to their own activities, while system administrators have higher authority to maintain and manage the system. Through the role-authority distribution mechanism, the security of system data is guaranteed.

In order to ensure the stability of the system, the distributed architecture design is adopted to balance the system load to multiple server nodes. When a node fails, other nodes can continue to provide services to avoid system paralysis. At the same time, the system needs to establish a perfect backup and recovery mechanism, and back up the system data regularly, so that it can recover quickly when data is lost or damaged, and ensure the continuous and stable operation of the system.

5. Conclusions

This study focuses on the optimization and decision support system of university students' organizational activities based on big data, and deeply discusses the related theories, technologies, system design and implementation strategies.

On the theoretical level, big data technology, university student development theory and decision support system theory provide a solid foundation for system construction. The ability of data collection, processing and analysis of big data technology, the guidance of university students' development theory to students' all-round development needs, and the mechanism of decision support system theory to assist scientific decision-making are integrated with each other to jointly support the system architecture. Through the analysis of the current situation of university students' organization activities and the application requirements of big data, the importance of the system in accurately grasping students' needs and solving existing problems in activity organization is clarified. The overall architecture design of the system covers data layer, processing layer and application layer, and all layers work together to ensure the effective flow of data and value mining. Functional module design includes activity planning, promotion, implementation management and assessment feedback module, covering all aspects of activity organization. In key technologies, big data collection and preprocessing technology ensures data quality, activity optimization model construction technology provides scientific basis for activity planning, decision support algorithm helps organizers make wise decisions, and system security and stability guarantee strategy escorts the reliable operation of the system.

On the whole, the system constructed in this study is expected to solve the problems of information asymmetry, poor publicity effect and single assessment method in university students' organizational activities, and improve the quality of activities and students' participation through accurate decision-making driven by big data. Future research can optimize the system performance, promote the wider application of big data in the field of university students' organizational activities, and help university students' work to a new height.

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