Research on the application of data middle platform technology in the construction of smart campus in Vocational Colleges

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Abstract. With the continuous development and popularization of information technology, educational data governance has become a major trend to promote the development of college informatization. This paper takes data middle platform technology as the core to carry out research, takes "data empowerment, service integration" as the construction concept of a new generation of smart campus, takes data governance as the core, deeply excavates the value of data, and explores the path of upgrading and construction of smart campus in vocational colleges. This paper first gives the concept of data middle platform, then analyzes the main problems and countermeasures in the information construction of vocational colleges, and then expounds the construction system of smart campus with the core of data middle platform technology, and explains the path to support the construction of smart campus through the depth of data governance and global service governance. Finally, this paper summarizes the importance of carrying out data application and service scene construction, emphasizes the importance of top-level design, application and service empowerment and data asset application in smart campus construction, and gives an effective path for smart campus construction.

Keywords: vocational education; Data governance; Data assets; Digital transformation.

1 Introduction

With the incessant advancement and widespread adoption of information technology, The governance of education data has emerged as a pivotal factor in driving the advancement of college informatization, representing a prevailing trend. In the pursuit of high-quality institutional progress, it is paramount to seamlessly integrate, share, and extensively exploit the data resources from diverse departments within the institution to furnish robust data support for achieving excellence.

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2 Concept of data middle platform

The theory of data middle platform originates from the traditional front-end and back-end structures. Because of the differences in the use environment in various fields, there is no consistent view on the definition of data middle platform[1]. In the field of vocational education, the key points of the data middle platform include the integration, connection and display of educational information. Through in-depth exploration of data value, we can make full use of the potential of digital elements to enable the development of vocational education.

3 Analysis of key issues and corresponding strategies for information construction

3.1 The current state of informatization in Vocational Colleges

In recent years, extensive research has revealed that the majority of higher vocational schools have successfully implemented a comprehensive management information system encompassing education, scientific research, and administrative management. Furthermore, an integrated identity authentication and login system based on an information portal has been established. Although some higher vocational schools have also established data centers, there is still room for improvement in terms of data quality. The effectiveness of data sharing and business integration between systems remains suboptimal as the current data center fails to meet the requirements for real-time data exchange, thereby perpetuating the issue of information silos.

3.2 The primary challenges in the construction of informatization

3.2.1 Enhancement of top level design and coordination is imperative for improvement.

Although information technology has provided impetus for the progress of schools, there is a need for improvement in the overall strategy formulation and design. Some business units have adopted their own approaches to information construction without considering the overall perspective, resulting in uneven data distribution, low data quality, limited data sharing and reuse capabilities, as well as resource wastage. Furthermore, the existing software system lacks clear technical standards and requirements, leading to difficulties in integrating data and services and escalating system maintenance costs. Insufficient understanding of informatization among some teachers and managers further exacerbates high communication costs between departments. The absence of specialized business information system managers and comprehensive evaluations poses new challenges at lower levels during the secondary development phase due to changes in upper-level systems.

3.2.2 The existence of data islands persists, necessitating enhanced data sharing capabilities.

Currently, numerous challenges persist in the import and export of offline management data forms. Due to a lack of unified planning and design, as well as information standards and specifications, redundant data across various application systems hinders interconnection, interoperability, and sharing within schools. Simultaneously, non-standardized data poses inconveniences for downstream data sharing departments, resulting in low business system efficiency or even rendering the data essentially unused.

3.2.3Business system construction overlay, lack of data center.

Continuous development of the business system is necessary, as the business department's processes are not fixed and data quality is lacking. Without a centralized data center, effective access and sharing of new business system data is limited, resulting in information silos.

3.2.4 insufficient data integration design and incomplete integration.

Due to the lack of unified planning and management, each business system fails to share data, resulting in independent information system resources. Consequently, ensuring data consistency becomes a challenge. This issue significantly hampers cross-departmental collaboration and creates "information" islands that impede the comprehensive accumulation, integration, reanalysis, and extraction of valuable information. Addressing this urgent problem requires leveraging advanced information technology and methods to enhance the overall efficiency of services for teachers and students[2]. It also necessitates transitioning from mere "management" to effective "governance," eliminating the gap between data and services while improving governance capabilities. These efforts aim to enhance management service efficiency as well as teachers' and students' access to information.

3.3 Primary methodologies for problem-solving

Based on the current state of information construction in vocational colleges, and drawing upon data governance, smart campus construction ideas, as well as enterprise affairs experience from relevant units, this paper proposes the following strategies to address the issue.

3.3.1 Establishing a comprehensive information resource planning and data standardization system.

The information resource planning encompasses a comprehensive strategy for the acquisition, processing, transmission, and utilization of information resources within the college. Key challenges to address include establishing functional models, user perspective models, business data models, and external interface models that encompass the core operational logic of the entire institution. This ensures seamless data exchange

and integration across various systems. The second objective is to establish standardized data sharing and information exchange protocols at the school level, including data standards, information classification, and coding standards. This will address issues such as inconsistent global data standards and the inability to exchange data due to heterogeneous system standards[3]. The construction of data standards primarily involves the establishment of unified data standards, development of standardized data interfaces, and creation of comprehensive data flow diagrams.

3.3.2 The construction of a data center with four tiers.

Scientifically constructing the data architecture of the data center and implementing hierarchical planning and management are crucial for meeting the actual requirements of data integration, management, quality monitoring, application services, as well as facilitating traceability of original data, formation of a robust data chain, quality monitoring, efficient data mining and analysis. Firstly, it is imperative to establish an initial data layer (ODS layer). The data engineer can systematically load the data from each system into the ODS layer based on the interface specifications and configure historical logging mechanisms to monitor data quality and ensure its accuracy. Furthermore, establish a comprehensive data layer for the specific topic (TDS layer) to facilitate centralized management of fundamental data in the core database. Additionally, adhere to standardized rules when constructing a data mart, enabling detailed topic queries for effective data analysis and addressing challenges related to visualizing and managing data. Thirdly, it is essential to establish an integrated statistical data layer (SMY layer) that can cater to diverse requirements of data analysis by providing comprehensive summary statistics. Additionally, this layer can facilitate detailed data inspection and serve as the source for statistical analysis data. Consequently, this approach not only circumvents the need for constructing a standardized data analysis model in traditional methods but also enables unified management of models. The fourth point is to establish the application data layer (SER layer), which can create a standardized external service interface based on the business requirements of third-party entities, thereby achieving interface openness. This approach not only addresses the issues of non-standard and unmanageable database external service interfaces in traditional modes but also facilitates unified definition and management of external interfaces while ensuring data security[4].

3.3.3 The integration and harmonization of heterogeneous data.

In the process of data governance, the integration and harmonization of heterogeneous systems emerge as pivotal factors. The crux lies in establishing robust data channels to dismantle information silos, enabling seamless data sharing and collaboration. Moreover, scalable design for data integration is imperative to cater to diverse business requirements or temporal demands. Regrettably, traditional construction approaches lack dedicated visual integration tools, resulting in ineffective system integration during successive development phases and exacerbating the issue of isolated islands. Key considerations for effective implementation encompass: firstly, integrating heterogeneous systems/databases to ensure data integration openness; secondly, amalgamating various

business service formats and designing operational processes that align with specific contextual needs for data integration; thirdly, ensuring excellent scalability capable of accommodating long-term growth prospects by enhancing system performance and expanding functionality.

3.3.4 Implementing quality monitoring measures to ensure the integrity of data.

The monitoring of data quality is conducted upon the arrival of data from the business system. A comprehensive detection framework, encompassing five meta rule detections including integrity, completeness, effectiveness, consistency, and timeliness, is flexibly combined to cater to various data application scenarios. This approach facilitates the generation of effective quality reports for data management purposes, enabling problem identification and resolution while ensuring the seamless flow of high-quality data to downstream applications.

3.3.5 Establishing open data services.

The data center-based information technology and service mechanism offers a public platform for school business owners, developers, students, and other data demanders to share and connect data in accordance with user requirements. Business owners can directly upload data and practical applications onto this platform, granting access to specific users based on their unique needs. By establishing direct connections with users in the most optimal manner possible, the aim is to maximize the value of the shared data.

3.3.6 The construction of a large-scale data analysis platform.

As a crucial asset of the institution, data alone cannot fully realize its value and potential. It necessitates integration with real-world business scenarios and leveraging technical means to transform data into actionable knowledge and value, thereby facilitating management and decision-making processes. Hence, employing data visualization techniques becomes imperative for converting the index system into valuable insights based on the underlying data model, identifying issues through the data portal in a timely manner, enabling prompt identification and diagnosis, assisting decision-making endeavors, as well as fostering scientific and rational choices. Furthermore, it provides pertinent data analysis for leaders, business managers, and educators.

4 Intelligent infrastructure development framework for educational institutions

The schematic representation of an integrated smart campus construction system is illustrated in Figure 1.

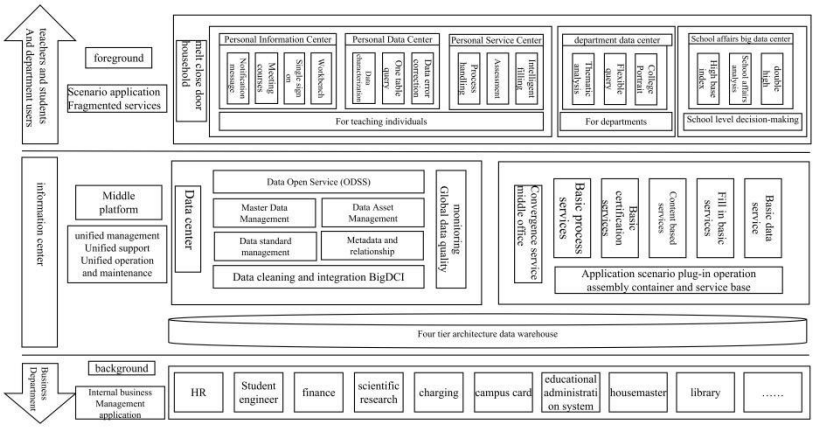

Fig. 1. Smart campus construction system

Establish a comprehensive data governance ecosystem for smart campuses driven by data value and three-level linkage of front, middle, and rear components to achieve unified management across the entire chain and maximize the fusion of chains[5].

The focus of this paper lies in the pivotal role played by the data middle platform within the smart campus system, thereby facilitating the construction of a smart campus through comprehensive data governance and global service management.

5 Comprehensive data governance

5.1 "data governance" and "deep data governance"

The objective of "data governance" is to identify and address issues, primarily focusing on resolving challenges related to information management, synchronization of data islands, management of data standards, detection of data quality, collection and exchange of data, as well as processing big data. On the other hand, the aim of "deep data governance" is to realize and create value by reducing administrative burdens, conducting precise analysis, enabling intelligent services, leveraging data for business expansion, supporting educational reforms, and harnessing the potential value generated by data.

5.2 Internal and external circulation of data governance

The purpose of data governance is to facilitate the internal and external circulation of data, enabling effective utilization of data assets and unlocking their value[6]. Internal circulation refers to traditional data governance practices that involve standardizing and integrating data, as well as ensuring accountability for maintaining data quality.

Establishing a comprehensive data governance framework creates an external ecosystem that promotes open sharing, fosters new business opportunities, and facilitates the collection of novel data. The primary objective is to prioritize real data producers, namely teachers and students, as key beneficiaries of data services. Firstly, by transcending traditional departmental boundaries, we can integrate diverse services and timelines to fully unlock the value of existing data. Secondly, leveraging a unified platform system and various interfaces, we actively cultivate and guide innovative scenario-based micro-applications that enhance existing business datasets while continuously expanding into new domains. Ultimately, this approach enables the formation of a sustainable data ecology.

5.3 Comprehensive data governance framework

The comprehensive data governance framework [7]can be categorized into "five data specification systems" and "three support systems". The detailed governance system is illustrated in Figure 2.

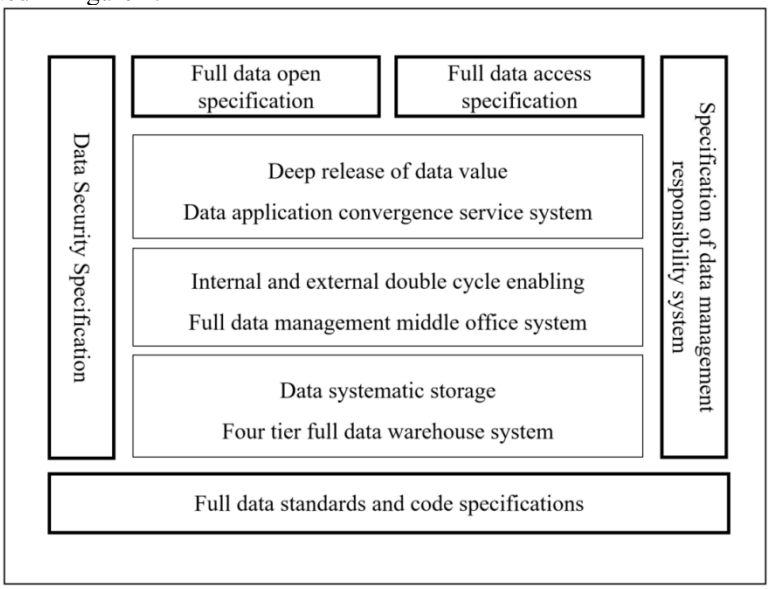

Fig. 2. In depth governance system

5.3.1 Data specification systems.

The five major data standardization systems of data governance can provide a comprehensive framework for information construction and data governance from a global perspective, offering both theoretical and practical foundations across various aspects such as technology, process, system, and scope. One fundamental aspect is the establishment of data standards and code specifications that serve as the theoretical basis for information construction and data governance. Another crucial element involves the standardization of data security protection, which aims to unify regulations for secure

management during data circulation and external exchange. Furthermore, there is a need for standardized approaches to enable open sharing of data. This entails defining downstream interface formats within data centers to break down "information silos" while fostering resource sharing patterns. Additionally, it is essential to establish standardized coding practices for accessing upstream data in the center along with harmonizedreporting/collection processes for business-related information. Lastly, effective implementation of responsible data management necessitates establishing operational rules governing each step involved in collecting, sharing authorizing, and utilizing valuable resources[8].

5.3.2 Support systems.

Develop a data management middle office system to facilitate the internal and external circulation of data governance, establish a comprehensive four-tier data warehouse system to support systematic data storage, construct a data application service system, and effectively unleash the value of data.

(1)Integrated middle platform system.

The aim is to enhance the data and service support capabilities, reconstruct and integrate the previously loosely constructed business system and data, unify public business and core data related to individuals, finance, and materials in college chemical management, establish seamless integration of diverse data sources and business processes, achieve effective data asset management, as well as enhance overall collaborative office abilities, work efficiency, and information services for teachers and students[9]. The architecture of the data center system is illustrated in Figure 3.

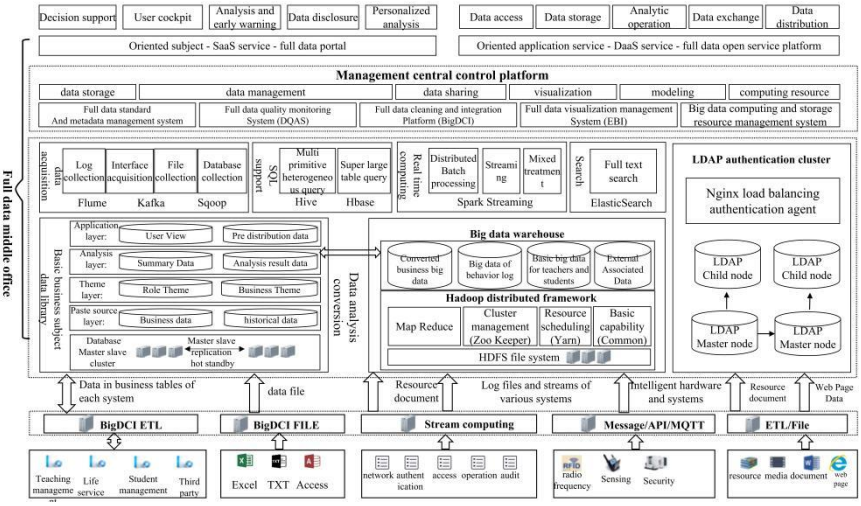

Fig. 3. integrated middle platform system

(2) Four tier data warehouse system.

The management and protection of "full volume" data primarily encompasses business, type, and time dimensions. By establishing a four-tier architecture warehouse, a standardized and rational hierarchical data processing framework is implemented to enhance the efficiency of data processing. The four tier data center is illustrated in Figure 4.

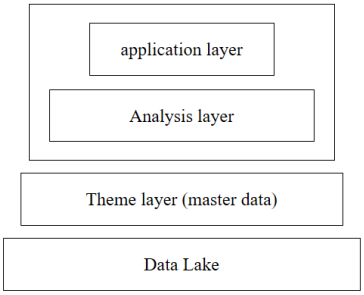

Fig. 4. Four tier data center

(3) Data application integration service system.

Realize the release of data value and implement comprehensive and accurate policies to establish a robust data governance system. By effectively managing data assets, construct an internal circulation system for data governance based on the central data storage center. Develop data services such as a data portal and open access to facilitate decision-making through precise analysis, enabling continuous reform driven by insightful exploration and utilization of database information across all school operations.

6 Integrated service governance

6.1 Ideas on integrated service governance

In the service domain, the focus lies on minimizing system transformation and achieving encapsulation through interface standardization. Within the service center, deployable tools are utilized to facilitate flexible configuration for business managers, ensuring unified account management, authority trusteeship, basic data, and services to maintain consistency across all applications within the entire system. At the service front desk, integrated functions for theme customization, layout management, and interface control are provided along with a solution enabling seamless transition between mobile devices and PCs for rapid deployment of new applications.

6.2 construction scheme of service center

Build a "1+5+m" service platform solution, that is, one service base, five basic services, and M application scenarios to support the implementation of the service platform.

Develop a comprehensive "1+5+m" service platform solution, comprising of one

service base, five fundamental services, and M application scenarios to facilitate the implementation of the service platform. The service base ensures unified management of basic capability clusters, centralized dispatching services, standardized core business operations, integrated operational monitoring, and streamlined application assembly.

The five fundamental services comprehensively address information utilization requirements by encompassing process services for online approval workflows, content services for message dissemination and monitoring purposes, data services for online data querying and configuration of various collection processes including review, error correction and data return write-up; additionally providing authentication access to diverse applications.

M individual Application scenarios involve establishing a loosely coupled distributed application service system tailored specifically towards micro-level clothing needs. By adopting a user-centric approach that transcends traditional boundaries between business departments and application systems; this entails reorganizing and aligning service content according to different roles' requirements while also integrating processes pertinent to teaching activities, scientific research endeavors as well as daily administrative tasks; simultaneously considering ancillary support required in areas such as teachers' accommodation arrangements.

7 Conclusions

The utilization of data assets in vocational schools constitutes the primary approach for educational informatization to support and facilitate education and teaching reform, thereby promoting the high-quality development of schools. Building upon existing digital campus infrastructure, vocational schools should integrate cutting-edge information technologies such as cloud computing, the Internet of Things, big data, and mobile internet into their operations[10]. By prioritizing data application and adhering to a "data-oriented" and "service-oriented" mindset, they can effectively implement a comprehensive strategy that encompasses top-level design, a unified middle platform, data-driven decision-making processes, and targeted breakthroughs. Through scenario-based service construction efforts that identify operational pain points while leveraging strengths and addressing weaknesses accordingly, vocational schools can provide robust support for educational reform initiatives aimed at achieving high-quality development.

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