

# Innovative Practices in University Education Management from the Perspective of Big Data

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**Abstract:** *As the digital economy continues to expand and educational digital transformation deepens, big data technology—characterized by massive data volumes, high-speed processing capabilities, diverse data types, and high practical value—has created new opportunities for upgrading university education management models while posing tangible challenges to traditional management frameworks. This study examines current operational realities in university education management, elucidates the underlying logic and practical necessity for innovation, identifies key obstacles in implementing big data applications, and proposes actionable implementation pathways. These findings provide robust managerial support for establishing high-quality development models in higher education and ensure effective execution of educational management initiatives.*

**Keywords:** *big data; university education management; innovative practices; data-driven; educational informatization*

## 1. Introduction

With the deepening advancement of educational informatization, big data has become the core driver for innovation in university education management, and relevant policies explicitly emphasize data-driven modernization of educational governance. Currently, China's higher education is transitioning from scale expansion to connotative development. Traditional experience-based management models suffer from subjective decision-making, low efficiency, and insufficient service precision, making them inadequate for meeting the demands of the new era and students' personalized needs. Big data enables the integration of comprehensive university data across all domains, breaks down management barriers, and accurately identifies patterns, thereby providing technical support for educational management innovation. Based on this, this paper examines the necessity of innovation, practical challenges, and implementation pathways, offering insights for the digital transformation of university education management.

## 2. The Necessity of Innovation in University Educational Management under the Big Data Perspective

### *2.1 An Inevitable Requirement for Adapting to Quality-oriented development in Higher Education*

In the new era, the core mission of China's higher education lies in advancing connotation-oriented development, focusing on enhancing talent cultivation quality, optimizing disciplinary construction, achieving breakthroughs in scientific research innovation, and strengthening societal service capabilities. Traditional university educational management predominantly relies on experience-based decision-making, lacking systematic analysis of educational data, which makes it difficult to accurately grasp pedagogical principles, student development patterns, and disciplinary trends. This results in poorly targeted management measures and inefficient resource allocation. Big data technology enables the integration of comprehensive data across teaching, research, and administrative domains. Through in-depth data mining, it precisely identifies weak links in educational management—such as curriculum misalignment with societal needs and irrational allocation of research resources—providing scientific foundations for decision-making. This facilitates the transition of higher education from scale expansion to quality enhancement, aligning with the core requirements of quality-oriented development and empowering universities to achieve distinctive, high-quality growth.

## ***2.2 Addressing Students' Practical Needs for Personalized Growth***

As "digital natives" raised in the internet era, contemporary college students exhibit distinct individual characteristics in cognitive approaches, learning habits, career planning, and value orientations. Traditional "one-size-fits-all" educational management models struggle to meet the diverse developmental needs of students. Big data technology enables comprehensive collection of multidimensional data—including learning behaviors, academic performance, interests, psychological states, and social interactions—to construct precise student profiles and conduct in-depth analyses of learning requirements and developmental potential. Based on these profiles, universities can develop customized learning plans, career guidance, and psychological support services, achieving "teaching tailored to individual aptitudes." This approach stimulates students' learning initiative and creativity, fosters holistic development and personalized growth, and effectively implements the student-centered educational philosophy.

## ***2.3 A Critical Support for Enhancing University Educational Management Efficiency***

University educational management encompasses multiple domains including teaching administration, student affairs, research management, and logistical operations, characterized by complex processes and massive data volumes. Traditional management models reliant on manual operations exhibit low efficiency, susceptibility to oversights, and inadequate interdepartmental coordination. Big data technology enables automated collection, intelligent analysis, and efficient utilization of educational management data, breaking down information silos between departments to facilitate data sharing and collaborative workflows. For instance, through a big data platform, the Academic Affairs Office can monitor faculty teaching performance and student learning progress in real time; the Student Services Office can promptly identify academic challenges and psychological issues among students; while the Logistics Department can precisely address service needs of both faculty and students. This approach simplifies administrative procedures, reduces labor costs, enhances operational efficiency, and drives the transition from extensive to refined educational management practices.

## **3. Challenges in University Educational Management Innovation under the Big Data Perspective**

### ***3.1 Weak Big Data Management Awareness and Outdated Concepts***

Currently, some university administrators lack sufficient understanding of big data technologies and exhibit weak big data management awareness, still relying on traditional experiential management approaches while neglecting data-driven management. On one hand, certain administrators simplistically equate big data with "statistical analysis," failing to recognize its core value in data mining, trend forecasting, and precision decision-making, thereby lacking the initiative and motivation to actively leverage big data for educational management innovation. On the other hand, some administrators fall into the misconception of "emphasizing technology over practical application," blindly investing in big data platforms while neglecting data integration, analysis, and utilization, rendering these platforms mere formalities that fail to deliver tangible results. Additionally, many administrators lack a student-centered innovative mindset, maintaining a management-focused approach that fails to fully utilize big data to meet students' personalized needs, thereby hindering the advancement of educational management innovation <sup>[1]</sup>.

### ***3.2 Insufficient Data Resource Integration and the Existence of "Data Barriers"***

The core prerequisite for big data applications lies in data integration and sharing. However, most universities currently suffer from fragmented data and inadequate integration, creating pronounced "data barriers." Various university departments (such as Academic Affairs, Student Affairs, Research, and Logistics Offices) each maintain independent information systems and data resources. Due to inconsistent technical standards and data specifications across departments, data formats are incompatible and measurement criteria vary, hindering effective data interoperability and sharing <sup>[2]</sup>. For example, student learning data are scattered across academic management systems, psychological data within student affairs systems, and consumption data in logistics systems—these isolated datasets fail to form a comprehensive student profile, limiting the full utilization of data value. Additionally, many universities lack unified data management platforms, and their processes for data collection, storage,

analysis, and application are non-standardized, resulting in inconsistent data quality that further restricts the application of big data in educational management.

### ***3.3 Insufficient Technical Support and Scarcity of Professional Talent***

The application of big data in university education management requires robust technical support and a dedicated pool of specialized professionals. However, many universities currently exhibit significant shortcomings in both areas. In terms of technical infrastructure, some institutions lack well-developed big data platforms equipped with advanced data mining, analysis, and visualization technologies, hindering the deep processing and efficient utilization of massive educational datasets. Additionally, inadequate data security measures pose risks—universities handle sensitive information such as student privacy, faculty data, and research secrets. Without comprehensive security protocols, data breaches and tampering risks escalate, compromising the safety and reliability of big data applications. Regarding talent acquisition, universities face a shortage of interdisciplinary professionals proficient in both educational management and big data technologies. Existing administrators often lack sufficient expertise to effectively leverage big data tools for administrative tasks. Moreover, most big data specialists primarily hail from computer science and IT backgrounds, lacking deep understanding of educational management principles. This disconnect prevents seamless integration of big data technologies with practical educational management scenarios, resulting in suboptimal application outcomes<sup>[3]</sup>.

### ***3.4 Inadequate Data Security and Privacy Protection Mechanisms***

In the context of big data, educational management data in universities encompasses sensitive information such as Students' personal details, academic performance, psychological states, and family backgrounds, as well as teachers' research achievements and teaching records. The security, confidentiality, and privacy protection of such data have become major obstacles to educational management development. Currently, some institutions lack robust data security and privacy protection frameworks, with insufficient oversight over data collection, storage, usage, and transmission. This results in irregular data collection practices, unclear data access permissions, and delayed data deletion procedures. Additionally, many schools exhibit weak data security awareness, lacking professional protective measures and emergency response plans, leaving them vulnerable to external attacks and data breaches that may infringe upon the legitimate rights of faculty and students while damaging institutional reputation and educational operations. Furthermore, the application of big data technologies raises ethical concerns; the misuse of technologies like facial recognition and behavioral monitoring can violate personal privacy and provoke resistance among stakeholders.

## **4. Practical Approaches to University Educational Management Innovation in the Context of Big Data**

### ***4.1 Establishing a Big Data Management Philosophy and Promoting Conceptual Innovation***

Conceptual innovation serves as the most critical prerequisite for innovating university educational management models. Higher education institutions must proactively transcend the constraints of traditional management mindsets and adopt a modern management approach driven by data. Firstly, targeted big data training programs for educational management teams should be strengthened through various formats such as thematic seminars, online workshops, and practical simulations. This enhances managers' understanding and application capabilities of big data technologies, enabling them to fully recognize their pivotal role in improving educational management efficiency and solidify the operational principle of "data-driven analysis, data-based decision-making, data-informed governance, and data-powered services." Secondly, management thinking should shift from "control-first" to "service-first," consistently prioritizing student development as the core objective. By leveraging big data's advantages to meet students' personalized learning and developmental needs, educational management can evolve toward more humanized and refined practices. Thirdly, a positive incentive mechanism for big data application should be established to encourage managers to actively utilize big data tools for innovation. Units and individuals demonstrating outstanding performance in implementing big data applications should receive appropriate recognition and rewards, thereby fully motivating all stakeholders to engage in innovative practices<sup>[4]</sup>.

#### ***4.2 Integrating Data Resources to Break Down "Data Barriers"***

Data integration serves as the critical foundation for the practical application of big data technologies. Higher education institutions must establish an integrated data governance framework to eliminate the phenomenon of "data silos" among different functional departments. First, a unified big data management platform should be created, with standardized data protocols defining data collection boundaries, format requirements, and reporting guidelines for all departments. This enables centralized data collection, storage, and standardized management across academic, student affairs, research, and logistical operations. Second, interdepartmental data interoperability must be enhanced through collaborative mechanisms that remove information barriers, ensuring seamless data integration and optimal utilization across units [5]. For instance, consolidating data from academic management systems, student affairs platforms, and logistics services into a unified repository allows for comprehensive student and faculty profiles, providing robust empirical support for educational decision-making. Finally, comprehensive quality control throughout the data lifecycle is essential—implementing verification, cleansing, and dynamic update protocols to regularly remove invalid or inaccurate data, thereby ensuring data reliability, accuracy, and structural integrity.

#### ***4.3 Strengthening Technical Support and Cultivating Professional Talent Teams***

In the context of big data, innovation in educational management is driven by two core factors: the development of technological frameworks and the cultivation of talent resources. Universities must increase investment in technological infrastructure and build a multidisciplinary team of professionals with cross-domain expertise. Regarding technological frameworks, institutions should iteratively optimize existing big data management platforms based on their institutional positioning and operational realities. Institutions should proactively adopt cutting-edge technologies such as data mining, multidimensional analysis, and visualization tools to enhance end-to-end data processing efficiency. Concurrently, robust data security measures must be implemented, including a comprehensive lifecycle security framework that employs encryption and tiered access controls to mitigate risks of data breaches and unauthorized modifications. Additionally, emergency response protocols for data security incidents should be established to ensure swift and effective handling of unexpected situations. For talent development, regular specialized big data training should be provided to current educational management staff, focusing on improving their skills in standardized data collection, analysis, and scenario-based application, enabling them to effectively utilize various big data tools for daily management tasks. Furthermore, universities should intensify efforts to recruit specialized big data professionals through interdisciplinary collaboration with computer science and IT departments, cultivating versatile talents with both educational management expertise and big data application capabilities.

#### ***4.4 Enhance Data Security and Privacy Protection Mechanisms to Standardize Big Data Applications***

Strengthening data security and personal privacy safeguards serves as a critical prerequisite for advancing innovations in educational management models. Firstly, establish comprehensive data security and privacy protection frameworks that clearly define responsibilities and operational protocols across the entire lifecycle of data collection, storage, access, transmission, and destruction, while strictly prohibiting non-compliant collection, misuse, or leakage of sensitive student and faculty information. Secondly, clarify data usage authorization boundaries through a tiered authorization system tailored to managerial roles, ensuring compliance and security from the source of access permissions. Thirdly, implement end-to-end supervision via an audit mechanism that dynamically monitors data utilization throughout its lifecycle, enabling prompt identification and correction of violations. Fourthly, conduct ongoing data security education to enhance awareness of privacy risks among staff and students, foster proper understanding of big data technologies, encourage proactive data participation in collection and management, and clarify their data rights—including legal remedies for privacy breaches. Additionally, relevant management departments shall reasonably delineate the scope of big data applications to prevent excessive use of technologies like tracking systems, balancing efficiency improvements with privacy protection needs.

### **5. Conclusion**

The emergence of big data technology has presented unprecedented opportunities for innovating university education management models, while simultaneously posing significant practical challenges

to existing frameworks. Advancing educational management innovation aligns with the intrinsic development trends of higher education and addresses the need for personalized student cultivation. Current digital transformation efforts in university education management face practical obstacles such as outdated conceptual frameworks, pronounced barriers to cross-departmental data flow, and insufficient technical implementation capabilities. These issues must be addressed through measures including establishing data-driven management philosophies, integrating multi-source data resources, enhancing technological application capabilities and professional talent support, and strengthening data security safeguards. Moving forward, universities should further integrate big data technologies with educational management scenarios, continuously explore differentiated innovation pathways, iteratively optimize operational models, and substantially improve service quality. This will provide new momentum for high-quality development in higher education while offering practical support for modernizing China's educational governance frameworks and capabilities.

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