

Exploration of Information Management Strategies for College Education and Teaching Based on Big Data

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Abstract:

This paper explores the application and practice of big data in the information management of university education and teaching, aiming to propose a series of management strategies based on data analysis. The study first analyses the data-driven teaching decision support system, emphasizing the improvement of education quality and students' learning effectiveness through teaching quality monitoring and academic performance prediction. Then, it discusses the implementation path of personalised learning and precision teaching, proposing to design personalised learning programmes for students through data analytics, which in turn improves learning efficiency. The article also discusses strategies for intelligent course management and resource allocation, emphasising the important role of data in course scheduling and resource optimisation. The study provides university education administrators with new ideas for data-driven decision-making and promotes the development of education informatisation.

Keywords:

Big Data, Higher Education, Teaching Informatisation

1. Introduction

With the development of information, big data has become an important force to promote the reform of college education. The information management of education and teaching can not only effectively improve the quality of teaching, but also promote the optimal allocation of educational resources. The application of big data technology provides unprecedented opportunities in the field of education, making teaching management more accurate and scientific. Especially in colleges and universities, through data analysis and decision support systems, education administrators are able to more comprehensively understand the academic dynamics of students, adjust teaching strategies in a timely manner, and optimise the allocation of resources. At the same time, the demand for personalised learning is increasing, and the traditional 'one-size-fits-all' teaching model can no longer meet the diverse learning needs of students. Therefore, how to use big data technology to achieve the

precision of teaching decision-making, implementation of personalised teaching, and intelligent management of resources has become a core issue to be solved in the field of higher education. In this paper, we will discuss the application of big data in teaching and learning in higher education and put forward corresponding management strategies.

2. Data-driven Decision Support System for Teaching and Learning

2.1. Teaching Quality Monitoring and Improvement Strategies

With the continuous development of big data technology, education management in colleges and universities has gradually shifted to a data-driven model, and the monitoring and improvement of teaching quality no longer relies on traditional experience and subjective assessment. By collecting and analysing a large amount of teaching-related data, including students' learning behaviours, classroom interactions, homework grades, and test performance, education administrators are able to assess teaching quality more objectively and comprehensively. This data-based monitoring of teaching quality is not only limited to the effectiveness of the teacher's teaching, but also covers the appropriateness of the course content, the innovativeness of the teaching methods and the full use of teaching resources. The accumulation of data and real-time feedback enable effective monitoring of teaching quality throughout the process, and any deficiencies in any part of the process can be quickly exposed and promptly improved. For example, by analysing the long-term trend of students' performance in a certain subject, teachers are able to find out which knowledge points have general comprehension barriers, so as to make targeted adjustments to teaching strategies or redesign teaching activities. In addition, the data-based means of teaching quality monitoring can provide a scientific basis for colleges and universities to formulate a reasonable performance evaluation system, closely correlate the teaching effectiveness of teachers with the learning outcomes of students, and promote teachers' self-improvement and professional growth. On this basis, the improvement of teaching quality is no longer accidental, but a continuous process achieved through constant data analysis and feedback optimisation, forming a teaching improvement mechanism of dynamic regulation and scientific management [1].

2.2. Predicting Student Academic Achievement and Intervention Strategies

In the wave of education informatisation, the prediction and intervention strategies for students' academic performance rely on the accurate analysis of big data and the assistance of intelligent algorithms. By deeply mining students' learning data, educators can not only monitor students' learning status in real time, but also predict students' future academic performance based on the data results. This big data-based prediction mechanism can provide teachers with targeted interventions to help students overcome learning bottlenecks in a timely manner and avoid falling behind due to early under performance.

Specifically, by capturing multi-dimensional data on students' historical grades, study habits, classroom interactions, etc., the instructional system is able to model students' learning characteristics. This data provides teachers with a powerful tool for gaining insight into student potential and problems, and can predict how students will progress in a given course. When the system detects a possible downward trend in a student's performance, teachers can take effective interventions based on the predicted results, such as adjusting teaching strategies, providing personalised tutoring

or increasing extracurricular learning resources. Such prediction and intervention is not simply a reaction to grades, but rather a way to help students optimise their learning paths through real-time feedback and precise guidance, thereby reducing the risk of fluctuating academic performance. With this data-driven strategy, teachers' instructional decisions no longer rely on traditional experience or intuition, but are based on scientific analyses and data support [2].

3. Personalised Learning and Precision Teaching Strategies

3.1. Personalised learning pathway design based on data analytics

The design of personalised learning paths is an important part of education and teaching reform in the era of big data. Through a comprehensive analysis of students' learning data, it is possible to tailor a suitable learning route for each student according to his or her learning characteristics, interests and needs. This personalised learning pathway not only takes into account the students' basic knowledge level, but also fully mobilises students' motivation to learn, avoiding a one-size-fits-all teaching model and allowing each student to progress at his or her own pace. Data analysis plays a crucial role in this process. By tracking students' performance in different subject areas in real time, teachers can get a clear picture of where students are weak and provide targeted learning resources and counselling accordingly.

For example, in the study of a course, certain students may have more difficulty in understanding a particular concept, while others may have already mastered that part of the content. By analysing the data, the system is able to identify these differences and adjust the difficulty and pace of the learning task according to the student's specific situation. For students with learning difficulties, the system can recommend learning plans and learning materials in a targeted way to help them fill in the gaps in their knowledge; while for students who make faster progress, it can provide more expansive learning resources to stimulate their interest in learning and promote in-depth learning. In addition, the design of personalised learning paths is not only a matter of interaction between teachers and students, but also a systematic teaching platform project. Through data-driven personalised learning design, students can truly enjoy education that meets their own characteristics and enhance overall learning outcomes.

3.2. The construction and application of an adaptive big data learning platform

The construction and application of an adaptive big data learning platform first requires an in-depth understanding of the diverse needs and characteristics of learners, so that a personalised learning path based on big data can truly reflect its value. With the continuous development of education informatisation, colleges and universities are gradually realising that the traditional one-size-fits-all teaching model can no longer meet the differentiated learning needs of students. By building an adaptive big data learning platform, learning content and teaching strategies can be dynamically adjusted according to students' learning progress, mastery and interest preferences, ensuring that every student can learn at the right starting point, thus achieving an efficient learning process.

Relying on powerful data analytics, such platforms are able to conduct real-time analysis of multi-dimensional data such as students' learning trajectories, test scores, and engagement, to identify students' weaknesses in the learning process in a timely manner, and give personalised intervention recommendations. For example, at a

certain stage, the platform can automatically identify students with learning difficulties and proactively push targeted practice questions or supplementary teaching materials, while for students who are progressing well in their learning, it can recommend more challenging extension content to promote the deepening of their thinking and the extension of their knowledge. This real-time feedback and adjustment based on data makes the learning process more relevant to the actual situation of students, and improves the effectiveness of learning and student participation [3].

At the application level, the Adaptive Learning Platform is not only a simple learning tool, but also an important bridge between teachers and students. Teachers can use the student data reports provided by the platform to more accurately understand the learning status of the class as a whole as well as that of individuals, and make timely adjustments to their teaching plans and methods, thus forming a kind of data-driven closed loop of teaching and learning. At the same time, the platform can also provide intelligent support in the allocation of teaching resources, providing the most appropriate learning materials and course arrangements to students, further promoting the efficient use of educational resources. In this way, the adaptive big data learning platform not only enhances the personalisation and precision of learning, but also promotes the development of education informatisation and creates a more flexible and efficient teaching mode.

4. Intelligent Course Management and Resource Allocation Strategies

4.1. Optimisation of course scheduling based on big data

In college education and teaching, the optimisation of course scheduling is a key link to achieve efficient allocation of teaching resources and improve teaching quality. Curriculum optimisation based on big data not only focuses on the traditional timetable arrangement, but also analyses students' learning habits, interests and preferences, as well as the correlation between disciplines, in order to achieve personalised and fine-tuned curriculum design. By collecting and mining data on students' historical performance, engagement and academic performance, education administrators are able to accurately understand the learning needs of different groups of students, and then adjust course schedules to ensure that each course is offered and timed to match students' learning pace and needs.

For example, based on big data analysis, administrators can identify students' learning peaks and troughs at specific times, and then reasonably arrange the course time to avoid students attending classes at the time when their energy is most concentrated, so as to enhance the teaching effect. Meanwhile, the optimisation of course content can also be achieved through big data analysis. For example, by analysing the learning feedback and performance distribution of previous students in a course, we can find out which teaching links have bottlenecks and which knowledge points need to be strengthened in the teaching arrangement, which will provide data support for the subsequent course arrangement and improve the relevance and effectiveness of the course. Through big data-driven course arrangement optimisation, universities can achieve the refinement and intelligence of teaching management, and thus improve teaching quality and student satisfaction [4].

4.2. Dynamic allocation of teaching materials, teachers and teaching resources

In the allocation of teaching resources in higher education, the dynamic allocation of teaching materials, teachers and teaching resources is not only the basis for guaranteeing the quality of teaching, but also a key link to achieve precision and efficiency in information management. With the development of big data technology, education managers are able to obtain all kinds of data in real time, and through the intelligent analysis and processing of these data, they can achieve the precise scheduling of teaching resources. The selection and updating of textbooks no longer relies solely on the traditional advice of subject experts, but is adjusted by analysing student learning trends, course feedback, and even the future direction of the subject. For example, if the textbooks of a certain course have been used for a period of time, and data analysis shows that certain chapters are more difficult to understand, or students generally report that certain knowledge points are difficult to master, the content of the textbooks can be adjusted in time for the next semester or more appropriate teaching resources can be selected, so as to achieve the dynamic optimisation of the textbooks. In addition, the allocation of teacher resources is no longer based on a fixed model, but is dynamically adjusted according to teachers' professional expertise, teaching evaluation and students' needs. With the help of the big data platform, the school can monitor the teaching effect of different teachers in real time, and give more teaching opportunities to teachers with excellent performance, while providing more training and guidance to teachers with poor teaching feedback, so as to improve the overall quality of teaching. The allocation of teaching resources also needs to be flexibly adjusted according to the data feedback, including experimental equipment, classroom resources, network platforms and so on. Through real-time monitoring of teaching activities, the resource allocation system can intelligently allocate teaching equipment and venues to the most needed courses, maximising the use of school resources, avoiding waste and improving the overall efficiency of teaching [5].

5. Data Sharing and Collaborative Management Strategies

5.1. Promoting information sharing and cooperation among universities

In modern university education, the construction of mechanisms for information sharing and co-operation is crucial for promoting efficient management and innovation in education and teaching. The sharing of educational resources, teaching data and research results among different universities can not only avoid the duplication of resources, but also improve the overall quality of education and research level. Information sharing among universities can enable them to learn from each other and exchange ideas in curriculum, teaching methods and discipline development. Especially in the promotion of academic research and interdisciplinary projects, cooperation between schools helps to form a wider knowledge network, promote the collision and exchange of academic ideas, and thus promote the diversified development of scientific research and teaching.

However, it is not easy to realise information sharing among universities. Firstly, differences in data formats, platform architectures and technical standards often lead to inefficiencies in information sharing and difficulties in information integration. Therefore, it is particularly important to establish a unified technical platform and a standardised data management mechanism. Colleges and universities should break information barriers by building open educational resource sharing platforms to achieve the free flow of information on teaching resources, curriculum systems,

teaching cases and other information. Through these platforms, teachers can not only access cross-college teaching experiences and materials, but also participate in the teaching reforms and innovations of other colleges and universities, stimulating new ideas and methods of education and teaching.

5.2. Breaking down data silos and building a collaborative management platform

In the current big data-driven education management environment, information sharing among colleges and universities is often constrained by data silos, resulting in the inability to efficiently circulate and synergise the use of resources. Breaking these data silos not only enhances the integration effectiveness of educational resources, but also promotes cross-campus and cross-disciplinary collaboration, thus promoting the development of university information management to a deeper level. First, building an efficient collaborative management platform is the core of realising data sharing. The platform needs to have strong data storage and processing capabilities, and be able to realise cross-system and cross-platform data interconnection and interoperability to ensure the barrier-free flow of education and teaching information between different faculties and campuses. With the help of the platform, schools can share key data such as teaching progress, student performance, course content and staff information in real time, so as to achieve accurate matching and dynamic adjustment of resources.

At the same time, the realisation of data sharing does not only rely on the construction of technical platforms, but also requires the guarantee of policies and systems. Universities should establish unified data standards and specifications to ensure data compatibility and security. By formulating clear sharing rules and security protocols, information barriers are broken to ensure compliance and security of data sharing. This not only enhances the intelligent level of education management, but also provides strong support for teaching reform, academic cooperation and resource optimisation among universities. Through the construction of this collaborative management platform, colleges and universities are able to more accurately grasp the use of teaching resources and analyse the problems and bottlenecks in the process of education and teaching, so as to adjust teaching strategies and optimise the allocation of resources in a timely manner.

6. Conclusions

With the wide application of big data technology in university education management, the process of education informatisation is ushering in unprecedented opportunities and challenges. From teaching decision support system to personalised learning path design to intelligent course management and resource allocation, data-driven strategies provide strong support for quality improvement and management innovation in university education. Breaking down information silos and promoting data sharing and collaborative management not only contribute to the rational allocation of resources, but also promote changes in the education model. In the future, improving teachers' and students' big data literacy and informatisation capabilities will be the key to promoting the sustainable development of higher education. Colleges and universities should gradually realise the deep integration of education informatisation under the double guarantee of technology and system.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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