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Research on the Reform of Laboratory Teaching Management Models in Higher Education from the Perspective of Information Management

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Abstract: With the continuous advancement of information technology, traditional teaching management models can no longer meet the demands of modern laboratory management. Information management, characterized by efficiency, convenience, and intelligence, provides new ideas and directions for reforming laboratory teaching management models in higher education. Based on this, this paper explores reform strategies and practical approaches for laboratory teaching management models from the perspective of information management, aiming to offer references for enhancing the modernization and intelligentization of laboratory teaching management.

Keywords: Information management; University laboratories; Teaching management

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1. Introduction

The rapid development of information technology presents both challenges and opportunities for laboratory teaching management in higher education. Traditional management models face numerous shortcomings in terms of efficiency, resource utilization, and safety, necessitating innovation through information-based approaches. Information management can not only improve the efficiency of laboratory resource allocation but also enhance the standardization and scientific rigor of teaching management, providing strong momentum for the transformation and upgrading of laboratory teaching management models. Therefore, exploring laboratory teaching management reforms in higher education from the perspective of information management holds significant practical importance and value.

2. Building an information-based laboratory management platform

In the context of the information age, reforming the teaching and management model of university laboratories is imperative. Among these reforms, building an information-based laboratory management platform is of

utmost importance. Such a platform can not only enhance the efficiency of laboratory resource utilization but also standardize the experimental teaching process and ensure the quality of experimental education.

2.1. Platform function design

The design of the platform's functions must include an experimental reservation system as an indispensable component. Through this system, faculty and students can clearly view the real-time usage status of laboratories and schedule lab usage flexibly according to their teaching and research needs. This approach avoids potential resource conflicts and time wastage associated with traditional reservation methods, significantly improving laboratory utilization rates. Additionally, the reservation system can leverage historical usage records of faculty and students to intelligently recommend suitable laboratories and time slots, further enhancing the convenience and accuracy of scheduling.

With the implementation of a course management function, experimental teaching plans can be transparently and clearly presented to both teachers and students. Teachers can use the platform to publish experimental course information, including course names, teaching content, and required resources, while students can view and select courses via the platform. This process not only simplifies the cumbersome steps of traditional teaching but also ensures that experimental education is more organized and orderly [1]. Furthermore, the course management function enables real-time tracking and evaluation of experimental courses, providing strong support for improving teaching quality.

The platform also facilitates a more scientific and rational allocation of laboratory resources. Based on real-time laboratory usage, equipment maintenance status, and the needs of faculty and students, the platform can automatically or semi-automatically allocate resources. This avoids resource idling and wastage while ensuring the smooth progress of experimental teaching. Additionally, the resource allocation function provides real-time monitoring and statistical analysis of resource usage, offering data support for optimizing resource allocation and scientific management.

2.2. Data integration and sharing

The information-based laboratory management platform enables real-time updates and sharing of laboratory resource information, allowing administrators, faculty, and students to access the latest status and usage conditions of resources at any time. This mechanism not only improves the efficiency of utilizing information resources but also promotes communication and collaboration between faculty and students [2]. Furthermore, the data integration and sharing mechanism supports laboratory safety management. By analyzing and mining laboratory resource usage data, potential safety hazards and risk points can be identified in a timely manner, providing a scientific basis for enhancing laboratory safety management. During the development of the information-based laboratory management platform, emphasis must be placed on its stability and security. The platform should adopt advanced technical architectures and protective measures to ensure data integrity and security. It should also have good scalability and flexibility, incorporating cutting-edge laboratory management technologies to continuously update experimental knowledge for students. This ensures that the platform can better adapt to the evolving needs and demands of future laboratory teaching and management.

3. Optimizing experimental teaching processes

From the perspective of information management, optimizing the experimental teaching process is a key step to improving the efficiency and quality of laboratory teaching management in higher education. By integrating

online resources, applying intelligent monitoring technologies, and enhancing evaluation systems, the experimental teaching process can be comprehensively upgraded, thereby creating a more efficient, interactive, and personalized learning environment for students.

3.1. Experiment preparation and guidance

Traditional preparation methods often rely on printed textbooks, which contain large amounts of information that are difficult to navigate, making it hard to engage students' interest. However, in the context of information technology, abundant online resources provide new possibilities for experiment preparation [3]. By building a comprehensive online preparation resource library, students can access diverse preparatory materials such as experiment guides, instructional videos, and simulation experiments anytime and anywhere. These resources not only cover the basic theories and operational steps of experiments but also incorporate real-world cases and FAQs, helping students to deeply understand experimental principles and familiarize themselves with processes in advance. This establishes both theoretical and practical foundations for conducting various experimental activities in an orderly manner. Furthermore, online preparation platforms can provide intelligent guidance functions, recommending personalized learning paths and exercises based on students' progress and comprehension levels, thereby enhancing the effectiveness of preparation [4].

3.2. Experiment process monitoring

In university laboratories, monitoring the experimental process is crucial for ensuring the safety and quality of experimental teaching. Traditional monitoring primarily relies on teachers' on-site observation and recording, which can be subjective and incomplete, thus affecting the quality of monitoring. By leveraging intelligent monitoring technologies within information management platforms, real-time monitoring and data analysis of the experimental process can be achieved. For example, with sensors and cameras installed, the platform can collect key parameters such as temperature, pressure, and current during experiments, as well as students' operational behaviors [5]. After analysis, this data can generate experimental process reports, providing teachers with objective and accurate evaluation references. Additionally, intelligent monitoring technologies can detect and warn of potential safety hazards in a timely manner, ensuring the safe conduct of experimental teaching.

3.3. Experiment reporting and evaluation

Experiment reporting and evaluation are critical components of the experimental teaching process and essential for assessing student learning outcomes and the quality of experimental teaching. Traditional methods of report submission and evaluation often face challenges, such as the risk of losing paper reports and cumbersome assessment procedures. Information management platforms simplify this process significantly by offering online submission, automated grading, and feedback functionalities. Students can submit their experimental reports through the platform, which can automatically check the report's format and analyze its content, providing preliminary scores and feedback [6]. The feedback highlights students' strengths and shortcomings during the experimental process and offers targeted suggestions for improvement, helping them enhance their experimental skills and theoretical knowledge. Moreover, the platform enables online storage and sharing of experimental reports, allowing students and teachers to access and compare them conveniently, thereby supporting continuous improvement in experimental teaching quality.

4. Strengthening laboratory safety management

Laboratories, as critical venues for scientific research and teaching, require robust safety management. With the continuous advancement of technology and the expansion of laboratory facilities, traditional safety management methods are no longer sufficient to meet the needs of modern laboratories. Therefore, strengthening laboratory safety management by adopting advanced safety monitoring systems, safety training and drills, as well as risk assessment and early warning mechanisms, is essential for enhancing laboratory safety management standards.

4.1. Safety monitoring systems

By installing high-definition cameras, smoke detectors, temperature and humidity sensors, and other devices, real-time monitoring of the laboratory environment can be achieved. These devices can detect various abnormalities within the laboratory, such as smoke, fire sources, and temperature irregularities, and immediately trigger alarm systems. Safety monitoring systems can also upload monitoring data to the cloud in real-time, enabling management personnel to remotely view and analyze the data. This ensures that the laboratory's safety status is continuously monitored, allowing for rapid responses to emergencies and preventing the escalation of incidents [7]. However, having a safety monitoring system alone is insufficient. Laboratory safety management must also focus on enhancing the safety awareness and emergency response capabilities of faculty and students. To this end, universities should regularly conduct safety training and drills, utilizing virtual simulation technology for realistic training exercises. Virtual simulation technology can replicate actual laboratory environments and procedures, allowing faculty and students to practice experimental operations and safety drills in a virtual setting. Through such simulations, participants can familiarize themselves with various safety equipment and emergency protocols, improving their ability to handle unexpected incidents. This training approach not only offers a high degree of realism and interactivity but also effectively mitigates potential risks associated with real-world operations [8].

4.2. Risk assessment and early warning

In addition to safety monitoring and training, risk assessment and early warning are critical aspects of laboratory safety management. By effectively analyzing historical data, experimental operations, equipment status, and other relevant information, potential safety risks can be predicted, allowing for preventive measures to be taken in advance. Risk assessment and early warning systems enable real-time monitoring of various laboratory data. Upon detecting anomalies, they immediately issue warning signals to alert management personnel, faculty, and students to take appropriate actions [9]. This data-driven risk assessment and early warning mechanism facilitates precise identification and effective control of laboratory safety risks.

Building on this foundation, advanced data analysis technologies, such as machine learning and data mining, can be employed to deeply mine and intelligently analyze the collected data. These technologies can identify abnormal patterns and correlations within the data, thereby predicting risk factors that may lead to safety incidents. For example, analyzing the chemical properties and interaction rules of experimental materials can predict combinations that may cause explosions or release toxic gases. Simulating and optimizing experimental procedures can help identify and correct operational errors that might lead to accidents. Moreover, laboratory safety management should emphasize information sharing and collaboration. Establishing an integrated laboratory safety management information system can consolidate and share information from various safety processes, such as monitoring, training, and risk assessment. This integration ensures seamless data connectivity and efficient information flow. Such systems not only enhance the efficiency and accuracy

of safety management but also promote inter-departmental collaboration, fostering joint efforts to maintain laboratory safety and stability [10].

5. Conclusion

In summary, information management offers a new perspective and pathway for reforming laboratory teaching management models in higher education. With the support of information technology, laboratory resources are allocated more efficiently, management processes are optimized, and safety monitoring is strengthened, significantly improving the efficiency and scientific rigor of laboratory teaching management. As information technology continues to advance, it will play an increasingly vital role in laboratory teaching management in higher education, driving the modernization, intelligence, and efficiency of laboratory management. This progress provides a robust foundation for teaching and research in universities.

Disclosure statement

The author declares no conflict of interest.

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