

Original Paper

Research on Laboratory Management from the Perspective of Modern Education Theory

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Received: May 2, 2023

Accepted: May 24, 2023

Online Published: June 12, 2023

doi:10.22158/elsr.v4n2p133

URL: <http://dx.doi.org/10.22158/elsr.v4n2p133>

Abstract

This paper examines how modern educational theory informs laboratory management practices and the importance of doing so. Theoretical analysis reinforced that laboratory management significantly impacts students' learning and development. Furthermore, strategies that apply modern educational theories to laboratory management were proposed. We aim to provide practical guidance based on modern educational theory to improve laboratory management practices, ultimately creating conducive conditions for student learning and development.

Keywords

modern educational theory, student-centered, laboratory management, safety management

1. Introduction

Laboratories play a crucial role in modern education by providing students with opportunities for practice and experimentation, which fosters their learning and development. To ensure student safety, high-quality teaching environments and educational resources as well as promoting cooperation and innovation, effective laboratory management is essential (Chen, 2011). This paper aims to explore how to optimize laboratory management from the perspective of modern educational theory (Tang, 2017) to meet contemporary education's requirements.

Student-centered educational concepts have gained considerable attention in the development of modern educational theory. According to Vygotsky's social and cultural theory (Azabdaftari, 2012), students fare better when participating in genuine and meaningful learning activities. Moreover, the interest theory of Hidi (Hidi, 2006) and Renninger (Renninger, 2000) highlights the impact of students' individual interests and active participation on learning. These theories emphasize students' initiative, personalized learning, and exploratory learning, which offer a new perspective for laboratory management. Student participation in decision-making (Mager & Nowak, 2012) is an effective laboratory management strategy.

Mulryan Kyne (Mulryan-Kyne, 2010) found that when students participate in laboratory rule formulation and experimental design decision-making processes, their sense of responsibility and autonomy increases and the participation and learning outcomes improve.

Experiments aim to provide opportunities for practical operation and exploration to promote student learning and development, making them an indispensable part of education. However, there has few researches on laboratory management from the perspective of modern educational theory, despite the widespread application of laboratories in teaching. Therefore, conducting effective research on how to manage laboratories effectively from this perspective and improve the level and efficacy of laboratory management is significant for modern education's development.

2. Theories of Modern Education and Laboratory Management

2.1 Overview of Modern Education Theory

Modern educational theory is a series of educational theories that have developed based on critiques and reflections of traditional educational concepts and practices. It emphasizes that the goal of education is to cultivate students' comprehensive abilities, stimulate their creativity and thinking abilities as well as adapt to the increasingly complex and diverse social requirements. The core principles of modern educational theory are student-centered, situational teaching, collaborative learning, technology integration and lifelong learning, etc. These principles and concepts have great significance in guiding laboratory management.

The laboratory management process should place students at the center and prioritize their learning needs and development. Drawing on the principles of situational teaching and collaborative learning, laboratory activities and tasks should be designed collaboratively. The concept of technology integration also applies to laboratory management, such as utilizing modern technology to support innovation in laboratory teaching and management. The concept of lifelong learning is another essential consideration, reminding us that laboratory management should pursue sustainable development and the continuous improvement of students' abilities.

In summary, modern educational theory provides a theoretical foundation and guiding principles for laboratory management. It inspires us to create more effective, meaningful, and innovative practices in laboratory environments, ultimately leading to the cultivation of well-rounded students.

2.2 Role and Significance of Laboratory Management

Laboratory management plays a crucial role in modern education by providing strong support for students' learning and development through ensuring laboratory safety and providing high-quality teaching resources and facilities.

Laboratory safety and risk management are pivotal in ensuring student safety and health. Effective laboratory management involves developing clear laboratory safety rules, conducting risk assessments and providing appropriate safety training and supervision. By following these protocols, the risk of

accidents and injuries can be minimized, providing students and teachers with a safe and secure experimental environment.

Moreover, laboratory management includes the efficient management and maintenance of laboratory resources and facilities. The implementation of good laboratory management practices ensures that students have access to sufficient and high-quality teaching resources including experimental equipment, materials and technical equipment. The full utilization and maintenance of these resources can help improve students' learning experiences and their experimental results.

In conclusion, laboratory management is a crucial component of modern education that ensures laboratory safety and provides high-quality teaching resources and facilities for students. Effective laboratory management practices can maximize students' learning potential and development.

3. Relationship between Modern Education Theory and Laboratory Management

Modern educational theory and laboratory management share a close connection. By prioritizing student care and safety and adopting situational teaching (Zhu, 2009) and practice-oriented (Peng, Wang, & Zheng, 2013) methods, laboratory management promotes student responsibility and critical thinking while also supporting the development of continuous learning and self-protection abilities. In this way, modern educational theory and laboratory management reinforce and enhance each other, collaborating to provide students with a safe, healthy, and meaningful laboratory learning environment.

3.1 Student Caring and Safety-first

Modern educational theory places student safety and health at the forefront of education, emphasizing students' overall development. Laboratory safety management (Wen, Zhou, & Cheng, 2009) aligns with this theory and is dedicated to ensuring the safety and health of students in laboratory environments. By developing safety regulations, providing safety training, conducting risk assessments and implementing supervision measures, potential hazards in experimental activities are minimized and a safe learning environment is established for students.

3.2 Situational Teaching and Practice-oriented Methods

Modern educational theory emphasizes placing learning in real and meaningful contexts, emphasizing that students construct knowledge and skills through practical application and practice. Laboratory management is closely related to this theory, as students conduct practical activities in the laboratory and apply theoretical knowledge through experiments and operations. The goal of safety management is to ensure that students can safely participate in practical activities in the laboratory environment, supporting their learning and knowledge building in this context.

3.3 Cultivations of Responsibility and Critical Thinking

The modern educational theory emphasizes the cultivations of responsibility and critical thinking so that they can make informed decisions in various situations. Safety management in laboratory settings emphasizes the cultivations of safety awareness and a sense of responsibility, requiring students to comply with safety rules, being aware of risks and taking appropriate safety measures. By participating

in laboratory safety management, students can develop critical thinking skills, assess potential safety hazards and risks, making informed decisions and cultivating their sense of responsibility.

3.4 Continuous Learning and Self-protection Abilities

Modern educational theory emphasizes the continuity and autonomy of learning, encouraging students to continuously develop and enhance their self-protection abilities during the learning process. Laboratory management supports students in mastering laboratory knowledge and skills by providing safety training and guidance. This process of continuous learning promotes students' ability to independently assess risks, protect their own safety in the laboratory environment and cultivates their ability to manage safety independently, ultimately promoting their self-development.

4. Innovative Methods of Laboratory Management from the Perspective of Modern Education Theory

4.1 Laboratory Management Model of Student Participation in Decision Making

The laboratory management model of student participation in decision-making emphasizes active participation and cooperation, placing students at the center of laboratory management and involving them in decision-making. Based on modern educational theory, it highlights the importance of subjectivity, participation, and responsibility among students. It aims to enhance students' safety awareness, cultivate safety skills and establish a positive safety culture in the laboratory.

Implementing the laboratory management model of student participation in decision-making involves providing necessary training and education for students. This includes safety operation skills training and education on basic laboratory safety principles and norms. Once trained, students can participate in developing safety regulations and procedures, evaluating laboratory safety risks, making improvement suggestions and taking joint responsibility for laboratory management to maintain a safe and orderly environment. The model also stresses cooperation and consultation among students, who can participate in decision-making through group discussions, meetings, and other methods. This promotes interaction and cooperation among students, enhancing management effectiveness.

4.2 Applications of Situational Teaching in Laboratory Management

Situational teaching is a teaching method that employs real-world situations and practical activities to enable students to apply theoretical knowledge to practical situations when solving problems by situational teaching in specific situations. In laboratory management, this teaching method can enhance students' laboratory management expertise and practical skills.

To apply situational teaching in laboratory management, it is essential to start by designing scenarios. Teachers or laboratory administrators can create real-world laboratory situations that simulate actual safety issues and challenges. By immersing students in these situations, their learning interest and motivation can be stimulated. Students must analyze safety hazards and suggest relevant solutions by using their existing knowledge and skills. They can collaborate in groups, discuss the situation and

engage in practical operations, participating actively in problem-solving processes to improve decision-making and laboratory management expertise.

Introducing situational teaching in laboratory management can enhance students' practical abilities, promote safety awareness and foster teamwork. A student-centered laboratory management model can be built, which enhances the effectiveness of laboratory management and learning experience. Firstly, students can apply theoretical knowledge to practical laboratory management situations, develop practical abilities and skills, solve practical problems, understand the complexity of laboratory management and improve operational and decision-making skills. Furthermore, situational teaching exposes students to laboratory safety situations, challenges them with safety issues and enables them to appreciate the importance of safety management while learning how to identify and respond adequately to potential hazards. Finally, situational teaching fosters teamwork and collaboration among students through problem-solving, mutual communication and negotiation. This improves the effectiveness of laboratory management and cultivates students' cooperative and communication abilities.

4.3 Practices of Technology Integration and Digital Laboratory Management

Technology integration and digital laboratory management unify laboratory equipment and systems on a single platform. Remote monitoring and control, real-time data acquisition and analysis, and equipment maintenance and fault diagnosis can be achieved using digital tools. This integration enhances the utilization and efficiency of laboratory equipment while reducing maintenance costs.

Technology integration and digital laboratory management enables centralized collection, storage and sharing of laboratory data through digital tools, facilitating real-time updates and data sharing. Laboratory managers can use this data to analyze effectively and make decisions, optimize laboratory resource utilization and improve research and development efficiency. Additionally, technology integration and digital laboratory management enable safety monitoring and risk management in the laboratory. Security monitoring systems and sensors can be applied to monitor the laboratory environment and equipment status in real-time, reducing security risks. Digital tools and data analysis can help establish safety standards, operating procedures, and provide laboratory safety training and educational resources.

The integration of technology and digital laboratory management improves the efficiency and accuracy of laboratory operations and data processing. Automated processes and experimental equipment save time and human resources while minimizing the occurrence of human error. Digital tools and software can quicken data analysis, decision-making and enhance the efficiency of laboratory management. In addition, digital tools and data analysis can also enhance safety and risk management in the laboratory. In real-time, monitoring and security warning systems detect potential security risks and take corrective action as necessary. Digital tools and data analysis can identify, evaluate and mitigate risks in the laboratory, ultimately enabling the development of applicable risk management strategies.

5. Conclusion

This paper emphasizes the significance and role of laboratory management in modern education through the lens of modern education theory. The relationship between modern education theory and laboratory management is examined through clarifying the theoretical underpinnings of each field. Innovative methods and practices in laboratory management are proposed based on the guidance of modern education theory, providing laboratory managers and researchers with the necessary tools and resources to address the increasingly complex challenges of laboratory management. Future research should explore the relationship between modern education theory and laboratory management further and develop more innovative laboratory management strategies and practices.

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