

Discussion on the Construction of the Safety Management System of University Machinery Laboratory under the New Situation

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Abstract: Under the background of “double first class” and “new engineering” construction, the construction of mechanical laboratories in colleges and universities is facing major changes. Higher requirements and standards for laboratory safety management are put forward for the increase of teaching and scientific research tasks, the expansion of laboratory scale, the increase of laboratory equipment and the change of laboratory environmental conditions. Based on the characteristics of the construction of university mechanical laboratories under new situation, this paper analyses the problems and challenges in the safety management of university mechanical laboratories at present. The aspects of strengthening safety concept, improving management system, introducing laboratory information management system and establishing virtual simulation experiment are considered. A new idea and system for the safety management of university machinery laboratories are proposed in this paper, which can provide some reference for the construction and safety management of relevant university machinery laboratories.

1. Introduction

With the rapid development of the economy, the Ministry of Education has put forward new requirements for higher education. The construction of “double first class” and the development of “new engineering” have become the new direction and new strategy of higher education reform, the educational concept has been changed from cultivating traditional and single practical talents to cultivating new talents with innovative spirit and all-round comprehensive development in the way of exploring collaborative innovation and interdisciplinary integration.

As an important part of the construction of new engineering, the mechanical discipline is facing unprecedented challenges under the new development requirements. The new development of the mechanical discipline will inevitably lead to new changes in the mechanical specialty laboratories in colleges and universities[1]. University laboratory is not only a place to cultivate students' knowledge and ability, but also an important base to cultivate modern and innovative talents. Under the new situation, university laboratory gradually tends to be integrated, intelligent and collaborative[2]. The traditional laboratory safety management mode has been unable to keep up with the modernization construction concept of the laboratory, and the potential safety hazards of

the laboratory have increased. Under this background, the university laboratory must develop a new laboratory safety management system applicable to the new situation in order to achieve the safe, orderly and healthy development.

2. The necessity of safety management of mechanical laboratory in colleges and universities

The laboratory is an important part of the infrastructure of colleges and universities, which plays a vital role in cultivating students' practical ability, innovative awareness and comprehensive quality[3]. The mechanical laboratory in colleges and universities is an important base for building “double first class” and “new engineering”. The safety management of the laboratory is an important part of the laboratory management, which provides strong support for the development of various work in colleges and universities.

2.1. Laboratory safety management is the basic guarantee for successful experimental teaching

The mechanical specialty has strong practicality. Many mechanical experiments are arranged in its teaching process to strengthen students' grasp of relevant mechanical knowledge and improve students' practical ability[4]. Generally, simple experiments can be demonstrated in the classroom, but involving complex and highly professional experiments that need to be completed with the help of equipment and instruments, traditional teaching classes are difficult to meet the teaching of such experiments, therefore, professional laboratories are needed to carry out more complex practical teaching and scientific research. Laboratory safety management is the necessary condition and basic guarantee for the successful development of mechanical professional experiments.

2.2. Laboratory safety management is the key measure to avoid safety accidents

As the construction and investment of universities laboratories increase, the number of laboratories has increased and the internal functions are complex, and the number of experimental instruments and equipment has increased and concentrated, once a safety accident occurs, the loss is incalculable, ranging from damage to experimental instruments and equipment to casualties[5], so the establishment of a perfect laboratory safety management system is to reduce laboratory safety risks and eliminate the occurrence of safety accidents.

3. The current situation and existing problems of the management of mechanical laboratories in colleges and universities

Under the new situation, university laboratories are facing new changes, while the corresponding laboratory management model is relatively lagging behind, and laboratory safety management is facing many new problems and challenges.

3.1. Weak awareness of experimental safety

There are many factors that cause laboratory safety accidents, and the most important one is human factors. According to statistics, 98% of laboratory accidents are caused by human factors[6]. Due to the influence of the traditional education concept of “emphasizing theoretical education and neglecting practical teaching”, laboratory safety education is more easily to be ignored. The degree of safety education for experimental teachers in colleges and universities is not enough, the corresponding safety training business is relatively less, and the lack of case study and

analysis of laboratory safety accidents in other colleges and universities and enlightenment, leading to the weak safety awareness of the experimental teachers and the insufficient comprehensive safety knowledge. Most of the personnel entering the laboratory have not received systematic safety training. They only focus on how to operate the experimental equipment, but ignore what safety precautions should be paid attention to before using these equipments. In addition, most schools did not incorporate laboratory safety education into their teaching system and did not offer courses related to laboratory safety management, lack of systematization and normalization of laboratory safety education[7].

3.2. The laboratory management system is imperfect and difficult to implement

The construction of laboratory management system is the premise of ensuring the safety of laboratory work. At present, most university laboratory management systems are mainly aimed at teaching laboratories. Under the new situation of educational reform and development, the scale of scientific research laboratories is gradually expanding. The previous laboratory management system did not take into account the complexity and particularity of scientific research laboratory management, so there are some problems in the system construction. First, it is difficult to implement the laboratory management system in place. As an important work of university construction, laboratory construction has been gradually improved after years of development and reform. However, due to the shortage of full-time laboratory personnel, it is difficult to implement the established management system in place. Second, the subject of safety responsibility is not clear. For teaching laboratories, there are special personnel in charge, and the safety responsibility system is clear, and the safety management can be guaranteed. However, for research laboratories, which are the main places for graduate students to conduct daily scientific research, the supervisor responsibility system is implemented. Because the supervisor cannot supervise in real time, the laboratory is at the free disposal of graduate students. There are great security risks because some graduate laboratories are jointly responsible by several supervisors, and the subject of safety responsibility is not clear, which makes it difficult to implement various management systems.

3.3. The construction of laboratory teachers is not valued and professional

For mechanical laboratories, there are many kinds of instruments and equipment, and the safety management is more professional. Taking the mechanical laboratory of our school as an example, in addition to traditional machining equipment, there are also intelligent equipment such as CNC machine tools, 3D printers, robots, etc. Under the new situation, more and more sophisticated and advanced equipment are introduced into the laboratory, which requires the laboratory workers to have more strong professional technology and rich practical experience, and be able to formulate different management methods for different types of equipment, but most colleges and universities have not set up a team of laboratory safety management experts at present, the laboratory lacks professional safety teachers [8], and the laboratory safety management personnel have not even received professional training, resulting in poor effect of laboratory safety education.

In addition, under the new situation, universities have gradually increased their investment in laboratories. A common problem of most universities is that the area of laboratories has not changed, but the number of experimental equipment is increasing, which leads to the disordered layout of laboratories and brings many security risks. At the same time, the scientific research laboratory is relatively scattered, and the full-time management personnel of the laboratory are few and unprofessional, resulting in a series of problems such as high risk of safe operation of the laboratory and great difficulty in management.

4. Safety management measures of mechanical laboratory in universities

4.1. Strengthen laboratory safety education and training to improve safety awareness

Strengthening safety education and training is an important guarantee for laboratory safety management[9]. We should always keep laboratory safety in mind and put safety first in all management work. For students, the course of laboratory safety management is included in the annual syllabus and set as a compulsory course. Through classroom teaching, students can systematically learn about laboratory safety management, some laboratory safety education lectures and publicity activities can also be carried out, and laboratory safety education, examinations and emergency drills can be arranged for the new students enrolled each year to improve their safety awareness. As for teachers, safety training and assessment shall be carried out for the new personnel who work in the laboratory, and they can only work after passing the examination; Regularly invite domestic experts and scholars to carry out special lectures on safety education and fire drills, organize laboratory managers to visit and learn from other university laboratories and learn valuable management experience. In addition, we can also make full use of campus networks, posters, knowledge contests and other forms to strengthen laboratory safety publicity, actively create a safe and environmentally friendly campus atmosphere, and imperceptibly improve the safety awareness of teachers and students.

4.2. Improve the laboratory management system and clarify the responsibility system

A perfect laboratory safety management system is the basis for ensuring the successfully development of laboratory work. Colleges and universities should first establish the general principles of school-level safety management, the secondary unit should develop a laboratory safety management system with the characteristics of the college based on the school-level documents,, including safety inspection, risk assessment, emergency plan, laboratory access and other management systems, at the same time, a three-level safety management responsibility system of "school-school-laboratory" has been established and improved [10], a school-level laboratory safety management organization has been established, and a mechanism of "hierarchical management and step-by-step responsibility" has been firmly implemented. Adhering to the principle that whoever uses is responsible, the laboratory administrator signs a safety responsibility notice with teachers and students, strictly implements the laboratory safety management system, and implements the safety responsibility in place.

4.3. Attach importance to the construction of laboratory teachers and improve their professionalism

Laboratory teachers are the main body of laboratory management in colleges and universities, and also the key force of teaching and scientific research and training innovative talents in colleges and universities, the academic structure, professional knowledge and management ability of the laboratory teachers will affect the construction quality and management level of the laboratory, so universities should pay attention to the construction of the laboratory teachers. The practical skills and experimental quality of students fundamentally depend on the strong professional knowledge, rich practical experience of the experimental teachers to teach, this requires that the laboratory should be equipped with a team of teachers with excellent professional knowledge. Colleges and universities should provide more professional skills training opportunities for experimental teachers, so as to integrate the new knowledge, new concepts and new skills learned into practical teaching and laboratory management, through diversified learning and training, the professional level and

comprehensive quality of laboratory teachers can be really improved.

4.4. Strengthen the information of laboratory management

At present, the management of most university laboratories relies on laboratory workers, which is not only inefficient, but also prone to management errors. The laboratory information management system is developed by means of network information, which integrates safety education, teacher and student reservation management, experimental teaching and other functions, the management end is the laboratory management personnel, and the use end is open to teachers and students. Before carrying out the experiment, users need to learn the relevant laboratory safety education courses online. After passing the examination, they can apply for an appointment for the experiment, and they can enter the laboratory to carry out the experiment after being reviewed by the management end.

In addition, virtual simulation experiment resources can also be set up, which can reduce the cost of experiment and will not produce material consumption and machine loss. When the experimenters enter the virtual simulation system, they can easily observe the internal structure and working process of large mechanical equipment, thus improving the safety of the experiment.

5. Conclusion

The management of university laboratories not only includes the management of personnel, but also involves the management of instruments, equipment and experimental environment. It is a complex and arduous work. In order to comply with the new situation and new tasks of the reform and development of higher education, colleges and universities should change minds to actively explore the new era of laboratory safety management concept. A laboratory safety management system suitable for the development of colleges and universities was developed by considering the actual situation of their own schools, so as to provide the daily management of laboratory safety in colleges and universities.

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