

Exploration and Practice of Education Reform for Laboratory Safety in Colleges and Universities

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Abstract: *The laboratory in colleges and universities is an important place to carry out teaching and scientific research activities. The purpose of laboratory safety education is to continuously improve the experimental safety awareness of teachers and students, effectively enhance the initiative of safety precautions, safeguard their own and collective safety, and maintain the normal order of experiments in colleges and universities. Aiming at the problems existing in laboratory safety education, such as simplification of educational methods, formalization of educational process, insufficient safety culture construction and imperfect safety education system, and following the basic principles of laboratory safety education in colleges and universities, this paper puts forward the reform path of laboratory safety education in colleges and universities. In-depth promotion of laboratory "intrinsic safety" education, extensive publicity and training of laboratory safety education, rich practical activities of laboratory safety education, construction of safety education platform based on WeChat applet, and integration of the concept of "course thinking and politics" into laboratory safety education.*

Keywords: *laboratory in colleges and universities; laboratory safety; education reform; exploration and practice; problem analysis; reform path*

1. Introduction

Laboratory is an important place for universities to organize high-level scientific research and carry out academic cooperation and exchanges, and also an important base for universities to gather elites and cultivate innovative talents, which plays an important role in enhancing innovation, promoting the transformation of achievements and promoting the development of disciplines [1]. Due to the expansion of colleges and universities and the sharing of laboratories, the number of laboratory personnel in colleges and universities is more intensive, and the number of mobile laboratory personnel is increasing, which makes the safety management more difficult, and the potential safety hazards and risks of laboratories are increasingly prominent, and laboratory safety accidents occur from time to time [2]. The purpose of laboratory safety education is to continuously improve the experimental safety awareness of teachers and students, effectively enhance the initiative of safety precautions, safeguard their own and collective safety, and maintain the normal order of experiments in colleges and universities. The Ministry of Education explicitly requires local education authorities and universities to strengthen laboratory safety education, constantly improve the safety awareness of teachers and students, enhance the safety protection ability of teachers and students, and improve the overall level of campus safety and personnel training in colleges and universities.

The carrier of safety accidents is mainly people, and the effectiveness of students' safety education directly affects the probability of accidents. Mastering laboratory safety knowledge is one of the effective means to enhance students' safety protection and accident handling ability, effectively reduce the occurrence of laboratory safety accidents or minimize injuries. The theory of behavior change put forward by Bandura, Geller and Heinrich points out that it takes time for behavior change to adapt to and adopt trained safety practices, and it is suggested that safety practices and safety knowledge should be popularized as soon as possible, and safety culture should be developed into standardization, or from unconscious unsafe behavior to unconscious safety behavior. Through a large number of literature analysis, it is shown that the lack of safety knowledge and safety awareness of laboratory personnel is the main reason for the accident. While strengthening the safety education of relevant laboratory personnel, an intelligent laboratory safety system based on the Internet of Things is established. By carrying out the reform of laboratory safety education, implementing the principle of "prevention first,

safety first", implementing various rules and regulations of safety management, and comprehensively improving the safety knowledge and awareness of teachers and students, teachers and students can be safely guaranteed in laboratory operation.

2. Analysis on the Problems of Laboratory Safety Education in Colleges and Universities

2.1 Simplification of Educational Methods

The form of safety education has an important influence on the educational effect, and it is difficult for learners to actively accept safety knowledge learning through single safety education. At present, most of the laboratory safety education in colleges and universities in China adopts theoretical education, mainly irregular safety lectures and safety training, and the education method is relatively simple, so it is difficult to stimulate learners' initiative [3]. Secondly, the types of practical education are relatively lacking, limited to fire safety and emergency escape. Some drills are a mere formality, and students lack actual perception of danger. Their ability to deal with emergencies is not exercised, resulting in the separation of theory from practice.

2.2 Formalization of Educational Process

Safety education has a formalized tendency of coping with inspection, ignoring process and not paying attention to actual effect. On the one hand, the Ministry of Education has defined the contents of safety education inspection item by item in the list of laboratory safety inspection items, and some colleges and universities take this as a benchmark to carry out safety education for inspection and trace. On the other hand, the access of laboratory safety education in some colleges and universities needs to be further improved, and no systematic and comprehensive learning materials are provided, only question banks are issued for brush-question learning. The examination questions are single, mostly single-choice subjective questions, and less objective questions are designed. It often happens that others take the test instead or pass the test, which leads to the ineffective safety education.

2.3 Insufficient Safety Culture Construction

Safety culture not only involves safety values, safety concepts and safety ethics, but also includes safety regulations, safety management system, standardization and standardization of safety production, and is the soul of safety management. As an integral part of campus culture, the laboratory safety culture in colleges and universities is still lacking [4]. Many laboratory leaders and safety officers have not received the necessary laboratory safety education in their own learning stage, and their safety awareness is weak. Although there are many hidden dangers in the laboratory, it is considered that the laboratory is in good safety condition because there is no safety accident. Students generally lack safety training, the experimental operation is not standardized, personal protection is insufficient, and safety accidents may occur at any time.

2.4 Imperfect Safety Education System

Laboratory safety education is an important part of higher education system. Some colleges and universities did not incorporate laboratory safety education into the school teaching system, did not carry out laboratory safety education courses or formed a systematic curriculum system, and the teaching knowledge structure, framework and content design were not clear enough [5]; Laboratory safety education in some colleges and universities still focuses on common sense education such as fire safety knowledge, and lacks targeted laboratory technical safety education content, teaching new knowledge and skills, and typical case analysis, so laboratory safety education is not targeted and practical enough.

3. The Basic Principles of Laboratory Safety Education in Colleges and Universities

3.1 Combining People-oriented and Prevention-oriented

For university laboratories, it is necessary to firmly establish the concept to ensuring the life and health of teachers and students as the foundation and developing into teachers and students, and regard teachers and students as the powerful driving force and fundamental dependence of safety education. It

is feasible to promote the mandatory "I am wanted to be safe" of safety education from the perspective of management, and transform and upgrade to the "I want to be safe" from the perspective of governance, and enhance the conscious safety awareness and ability of teachers and students [6]. Universities should adhere to the principle of giving priority to prevention, and we must not ignore any potential safety hazards, and we must not be lucky enough to nip them in the bud.

3.2 Combination of Key Groups and Outstanding Personality

The key groups include teaching staff in experimental posts, students and other personnel who enter the laboratory for study and research, and have the necessary professional safety knowledge and skills for corresponding experimental posts and experimental projects. To highlight individual requirements, on the one hand, the educational content needs to comprehensively consider the professional characteristics of the educational audience, contact with the characteristics of laboratories, experimental processes and research projects, highlight the particularity of disciplines and experiments, and make the content more targeted and practical [7]. On the other hand, universities need to strengthen laboratory safety self-education, give full play to students' initiative and design more effective educational means and contents from the bottom up.

3.3 Combination of Regular Education and Centralized Education

Regular education is an effective way to ensure the safety of laboratories in colleges and universities, which requires colleges and universities to implement safety education in every link of laboratory safety management. Laboratory personnel should always pay attention to safety issues, uphold the concept of safety, and regularly carry out safety education. In addition, according to the actual situation of colleges and universities, we should strengthen the integration and induction of educational resources, and focus on safety education in stages to ensure good educational results.

3.4 Combination of All-staff Education and Key Education

Taking "full coverage of safety education" as an important task of laboratory safety education, it varies from person to person and classifies education. All personnel involved, including laboratory managers, laboratory users and participants, should receive necessary laboratory safety education. On this basis, according to the different characteristics of certain types of safety education, such as chemical laboratories or biological laboratories, targeted safety education for key personnel should be carried out to further enhance the pertinence of laboratory safety education [8].

3.5 Combining Theoretical Education with On-site Education

Theoretical education focuses on the systematization of educational content, while on-site education focuses on the practicality of education. Laboratory safety education in colleges and universities should not only stay in theoretical education such as books and classrooms, but also adhere to integrating theory with practice and focus on solving practical problems. For example, the use of fire-fighting equipment must be combined with on-site teaching, and laboratory staff can be regularly organized to carry out fire drills or field visits to further enhance intuitive understanding and enhance educational effects.

4. On the Reform Path of Laboratory Safety Education in Colleges and Universities

4.1 In-depth Promotion of Laboratory "Intrinsic Safety" Education

Intrinsic safety refers to the safety performance of the machine or equipment itself. When the system fails, the machine or equipment can automatically prevent operational errors or accidents. Even due to human error, the equipment system can be automatically eliminated, switched or safely stopped, thus ensuring the safety of people, equipment and property. Intrinsic safety has a prerequisite, guiding and basic position. People have a need for safety in essence, and system and personal safety can be realized through educational guidance and institutional constraints. It is necessary to strengthen the education and publicity of safety knowledge, enrich students' safety knowledge reserves and create an "intrinsically safe" laboratory safety atmosphere. Universities should realize the modularization and standardization of laboratory layout. According to laboratory needs, universities should improve safety

emergency facilities and replace them in time to realize laboratory environmental safety. It is necessary to promote laboratory safety through multiple channels, make simple mind maps and post them in experimental buildings or sidewalks, and cultivate students' safety awareness through subtle safety education.

4.2 Extensive Publicity and Training of Laboratory Safety Education

According to the requirements of "full-time, comprehensive and whole-process", we should innovate publicity and education forms, preach and popularize safety common sense, strengthen teachers' and students' safety awareness, improve teachers' and students' safety skills, and achieve the goal of "educating a student, driving a family and influencing the whole society". Safety publicity and education should be regarded as the necessary content of daily safety inspection, and the responsibility of safety education and training should be investigated for safety accidents. Leaders in charge of the school, relevant functional departments, secondary departments and laboratory personnel responsible for safety management need to have the corresponding professional knowledge and ability of laboratory safety management. Universities should establish a safety training mechanism for laboratory personnel. Teachers and students who enter the laboratory must first be trained in safety skills and operating norms, and master the maintenance and use of laboratory safety equipment and facilities and protective equipment. Those who fail the examination are not allowed to enter the laboratory for experimental operation. For majors involving toxic and harmful chemicals, animals and pathogenic microorganisms, radioactive sources and radiation devices, dangerous mechanical processing devices, high-pressure vessels and other dangerous sources, the relevant courses of safety education will be gradually incorporated into the talent training program.

4.3 Rich Practical Activities of Laboratory Safety Education

On the basis of daily laboratory safety education, special laboratory safety practice activities are carried out, and laboratory safety knowledge publicity activities or laboratory accident drills are organized on a monthly or quarterly basis to provide teachers and students with a simulated emergency environment, so that teachers and students have the opportunity to apply the safety awareness and emergency handling methods they have mastered into practice and effectively improve their safety awareness and emergency handling ability. Universities must carry out special treatment actions for hazardous chemicals and inspection activities for special equipment, while reducing the hidden dangers of laboratory safety, improve the attention of teachers and students in the whole school to key areas [9]. At the same time, universities should combine online training with offline training, organize our laboratory staff to visit other university laboratories, and learn other university laboratory safety management methods and safety education means. In the self-media era, colleges and universities can make full use of platforms such as WeChat WeChat official account, Tik Tok and Xiaohongshu to regularly promote laboratory safety knowledge and typical safety accidents, so that teachers and students can learn laboratory safety knowledge at any time, build a safe defense line, and implement laboratory safety awareness into every detail of daily life.

4.4 Construction of Safety Education Platform Based on WeChat Applet

WeChat applet is a lightweight application program based on WeChat platform, which is a new technology to develop application system on WeChat platform. It does not need to purchase any hardware equipment, build a background server or register a domain name [10]. It can be used without downloading and installing, and users can directly open it for use. Compared with traditional applications, it is lighter, more convenient and faster. You don't need to uninstall like traditional applications. When users no longer need a small program, they can just close it directly. Taking WeChat as the ecological environment, we can make full use of various resources of WeChat platform and provide more comprehensive services. The construction of laboratory safety informatization needs to integrate safety education, safety management and public services, and build an educational platform that is suitable for different work contents, convenient to use and stable in operation. The safety education platform based on WeChat applet can be used flexibly across platforms without downloading and installing, which can reduce the complexity of laboratory safety management and ensure the safe, orderly and stable operation of laboratory work [11]. The safety education module provides safety education, learning resources and knowledge evaluation. The safety management module provides functions such as safety inspection, safety statistics and safety early warning. The public service module provides functions such as experiment reservation, interactive communication and operation

guide. The platform integrates the training, study and test of laboratory safety education, improves the means of laboratory safety education and improves the informatization level of laboratory safety management.

4.5 Integration of the Concept of "Course Thinking and Politics" into Laboratory Safety Education

In order to solve the "two skins" problem of professional education and ideological and political education, curriculum ideological and political education came into being in response to the times, and ideological and political elements such as patriotism education, collectivism education, life education, environmental awareness, safety education and social responsibility were integrated into professional education, which exerted a subtle influence on students' ideology and behavior and helped students to shape a correct world outlook, outlook on life and values [12]. University laboratory is an important platform to cultivate students' practical ability and innovative ability, and it also bears the responsibility and mission of ideological and political education. The idea of course ideological and political education is integrated into laboratory safety education, aiming at strengthening standardized operation, raising safety awareness, enhancing responsibility, improving moral quality, improving comprehensive quality and promoting all-round development. Universities are the main units to carry out curriculum ideology and politics. First, it should improve the method of integrating ideological and political education into laboratory safety education, identify the combination point of ideological and political education and laboratory safety education, deeply explore the ideological and political elements in the discipline, use various methods such as classroom teaching, case analysis, video watching, expert lectures and group discussions to inspire students' thinking, pay attention to teacher-student interaction in the teaching process, prevent one-way indoctrination and transmission of information, and fully mobilize students' enthusiasm [13]. Second, it is feasible to build a value-oriented laboratory safety culture, create a cultural atmosphere of "safety first, prevention first", spread socialist core values, carry forward scientific spirit and rigorous and realistic style in the process of imparting knowledge, and fully reflect the educational value of the course.

5. Conclusions

The laboratory in colleges and universities is an important place to carry out teaching and scientific research activities. Laboratory safety is the basis of education, teaching and scientific research in colleges and universities, and safety education is the most effective method to prevent accidents. In recent years, the education system has established the concept of safe development and carried forward the idea of "life first, safety first", and the laboratory safety work in colleges and universities has achieved positive results, and the overall safety situation has remained stable. However, laboratory safety accidents still occur from time to time in colleges and universities, revealing that there are still weak links in laboratory safety management, which are highlighted in the aspects of inadequate implementation of laboratory safety responsibilities, lax implementation of management systems, insufficient publicity and education, and imperfect work guarantee system. Through the research of this topic, we will provide a complete solution for the reform of laboratory safety education in colleges and universities, explore effective strategies to carry out laboratory safety education, improve the level of laboratory safety education, and ensure the normal operation of teaching and scientific research.

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