

# Exploration of Laboratory Safety Education based on Modularity and Artistry

Hanhan Fan\*, Jiujuan Zhu

School of Science, China University of Geosciences, Beijing, 100083, China

\*fanhanhan1988@sina.com

---

## Abstract

Constructing the targeted and practical modularity of safety knowledge can satisfy the diverse needs of teachers and students. While enriching the forms of safety education by artistry, students can pay more attention to safety and enhance their innovation ability and comprehensive quality. Through the organic integration of safety education based on modularity and artistry, a new system of safety culture education in chemical laboratory is explored.

## Keywords

Chemistry Laboratory; Safety Culture Education; Modularity of Safety Knowledge; Artistry of Safety Education.

---

## 1. Introduction

University laboratory is not only an important place to cultivate the scientific research innovation ability of teachers and students, but also the key point of university safety work, and the best classroom to carry out safety education. Combining professional characteristics, building an effective chemical laboratory safety education system is an effective means to maintain laboratory safety and an important link in laboratory safety construction and management[1-5]. During the process of developing laboratory safety culture education, the specialty and acceptability of safety education contents is the foundation of laboratory safety culture construction. For the diversity needs of laboratory safety education from teachers and students at different levels, it is imperative to construct targeted and practical modularity of safety culture education. Combining with the professionalism and uniqueness of each laboratory, vivid safety education should be carried out in the form of artistic safety education to improve the recognition and acceptance of safety education by teachers and students. Through modularization of safety knowledge and artistic form of safety education, a new system of safety culture education is constructed to improve students' safety knowledge, safety awareness and safety ability.

## 2. Problems Existing in Safety Education of Domestic Chemical Laboratory

Domestic colleges and universities safety management system pays attention to equipment and rules, but neglects the development of safety atmosphere and culture. While focus on the construction of laboratory safety and the informatization and technicalization of management, the laboratory safety management organization constructs the soft environment of campus safety culture by making a series of rules and regulations and organizing relevant safety training and examination[6-8]. But there are still a number of widespread problems as follows:

(1) The contents of safety education lack pertinence and professionalism. Highly targeted and accepted safety education content can accomplish more with less, which can not only effectively improve the safety awareness and safety ability of teachers and students, but also increase the

enthusiasm and initiative of participating in safety education activities. Commonly, the teachers and students in colleges and universities share the same content of safety education, which is comprised of the basic safety knowledge. However, in the face of different demands for laboratory safety education from undergraduates, graduates, foreign students, scientific researchers and lab managers, the safety education is poor in results due to lack of hierarchical, targeted and professional content.

(2) The effective way to improve laboratory safety education is cultivating a teacher team with basic theory and practical experience, cause that safety education teachers call for more profession. Most of the college laboratory safety is managed by security department, laboratory and equipment management department and other related functional departments, but relevant personnel are short in teaching ability, limited at safety knowledge, meanwhile unfamiliar with the specific circumstances of the laboratory, resulting in limited organization in laboratory safety education, rare interaction with students and blocked feedback from students.

(3) The form of safety education is onefold, and the lectures on safety knowledge in large laboratories cannot meet the cultivation of students' safety practice ability while improving the popularity. The correct use of many security facilities and fire fighting equipment and successful self-rescue in emergency is the ultimate goal of safety education. Most safety education is focused on lectures and videos, lacking practical operation and opportunities to be acquainted with real laboratories, however, all safety emergencies are traumatic. The safety knowledge lacks practicability and is not consistent with the actual laboratory environment.

(4) The main body of safety education is scattered, the safety responsibility is not clear, the contents are low in cohesion and coherence, the actual demand of safety education is not consistent with the teaching content, resulting in the lack of integrity and linkage of safety management and construction of chemical laboratories. It is an effective way to establish a safety education system that is targeted and professional with cultural connotation to solve the multi-level and multi-demand of laboratory safety education for undergraduates, graduates, overseas students, laboratory management personnel and scientific research personnel.

The introduction of modular safety knowledge and art form education to safety culture education for chemistry laboratory not only strengthens the education of safety culture, also completes student's ideological and political education[9-10]. Students are more acceptable and positive in safety culture education, students' ability of safety is cultivated and students' safety awareness and comprehensive quality is improved[11].

### **3. Modular Safety Education Content Meets the Diversified Needs of Safety Education**

Based on geology, resources, environment majors in our school, there are more than 20 undergraduate experimental teaching centers of chemistry and innovative practice base. Students are encouraged to participate in all kinds of course contests and innovative entrepreneurial projects to get improved in the innovation consciousness and innovation ability. Therefore, in the face of multi-level and diversified demands of chemical laboratory safety education, the diversity and effectiveness of safety education can be met by carrying out targeted, professional and whole-process modular safety culture education and dynamically adjusting safety education content according to students' feedback.

Due to the different experimental projects and teaching requirements, each laboratory has the safety knowledge with diversity and professionalism. The types of laboratories can be divided into teaching laboratories, research laboratories and teaching research laboratories. Therefore, it is imperative to construct targeted and practical "modular" safety culture education content in the face of diverse levels, nature and user capabilities (Figure 1).



**Figure 1.** The content of “modular” safety culture education

(1) As the general laboratory safety knowledge, fire safety is the safety knowledge and safety ability that all teachers and students must have, it has the characteristics of universality and extensiveness. We can strengthen the safety awareness through " Ideological and Political Theories teaching in All Courses ", and master the four abilities of fire safety, accurate use of fire extinguishers, eye washers, sprinklers and other conventional fire facilities.

(2) Professional safety education of chemical reagents, especially the whole process of hazardous chemicals procurement, using, storage, waste treatment and other safety knowledge must be mastered by teachers and students involved in chemicals, which is under dual supervision by the school and local police station in accordance with the relevant management regulations.

(3) Professional safety education of radiation safety knowledge with the development of large-scale instrument and equipment becomes common professional safety knowledge, especially the geological engineering research often involves the ore samples, instrument with radioactive source, radioactive substances used as a marker. Radiation safety knowledge is the key safety knowledge for radioactive source users and maintainers[12], whose safety awareness and safety responsibility are more clear.

(4) Professional safety education of special equipment safety education involves the laboratory equipments relevant with high temperature, high speed, high pressure, low temperature, cylinders and other special equipments. Special equipment requires a more strict surrounding environment and routine maintenance, and must be carried out in accordance with operation specification, it also calls regular inspection and documentation.

Therefore, according to different levels of teachers and students and diversified demands of laboratory safety education, different modules can be targeted to carry out specialized and targeted laboratory safety culture education, so as to improve the effectiveness and applicability of safety education.

#### **4. The Artistic form of Safety Culture Education Improves the Effect of Safety Education**

In order to highly improve the effect of laboratory safety culture education, artistry is taken into the laboratory safety education, while improve the safety awareness of students, students' safety and innovation ability is cultivated as well. On the basis of the universal safety knowledge lecture, the

professional, targeted, and whole process of safety education is carried out with the help of a variety of media, multi-classroom linkage.

With the rapid development of the Internet, all kinds of rules and regulations and standards can be easily obtained, but how to find targeted practical information in a lot of information is the key point and difficulty of safety education. Therefore, with the tool of the comprehensiveness of the safety knowledge manual, the pertinence of the safety culture publicity and the professionalism of the safety education, different media are adopted jointly to propaganda and educate, and the laboratory safety knowledge that all teachers and students should master is compiled into a book for reference at any time.

According to different experimental projects or experimental equipment from different laboratories, targeted safety culture publicity color pages are designed, short, vivid and situational content is easy to master in order to improve the effectiveness of safety education.

For the professionalism of the experimental project, safety education can be carried out in the form of art [13-14] according to the matters needing attention in the experimental process and the key points of operation, so as to increase the artistry of safety education and improve the recognition and acceptance of teachers and students for safety education.



**Precautions for using ion meters**  
The electromotive force of the fluorine standard solutions should be measured from low to high fluoride ion concentrations, and the measurement conditions (such as stirring time, stirring speed, etc.) must be consistent.

**Blank solution**  
The blank solution is a solution that is measured under exactly the same conditions as the sample in order to eliminate the interference produced by various co-existing colored substances in the reagent.

**Figure 2.** Artistic form of safety culture education

The "Blue Cat Chemistry" series of safety education art works with vividness and professionalism (part is listed in Figure 2) is a new form of laboratory safety education of "experimental chemistry" created by all teachers and students in the chemistry Experimental Teaching Center. The theme of the group of pictures is derived from the key and difficult points of the 12 experimental projects of "Experimental Chemistry". While mobilizing experimental teachers to participate in the publicity and education of laboratory safety, students are invited to participate in the English translation to improve students' participation and enthusiasm in laboratory safety education.

And vivid image and concise English notes can more effectively carry out laboratory safety education for foreign students, so that the safety education needs of students at all levels are met, which do more with less and serve multiple purposes.

## 5. Organic Integration of Modularization and Artistry to Promote Laboratory Safety Education

To construct a perfect chemical laboratory safety culture education system, it is necessary not only to have laboratory safety culture education content and multiple education forms that meet the needs of teachers and students at all levels, but also to have standardized laboratory safety culture education institution and evaluation mechanism, so as to better promote the implementation and implementation of safety culture education[15-16].

Laboratory safety education institution is an effective means to ensure orderly development of laboratory safety education, timely update of safety education content, dynamic adjustment of safety education form, and fair development of safety education evaluation, but also a fundamental method to reduce the probability of safety accidents from the source.

In the original comprehensive laboratory safety education system and evaluation mechanism, combining with the characteristics of chemistry laboratory in our school is more, with the aid of "course education" leading role, targeted the improvement of the safety education content and rich form of education, education to build a sound chemistry laboratory safety culture system, form a benign loop (figure 3).



Figure 3. Safety culture education system

## 6. Conclusion

Laboratory safety work is not only the education of ideological consciousness, but also the cultivation of practical ability. Only the organic integration of modern technical defense and subjective initiative defense can achieve the safe operation of the laboratory. Based on the modular and artistic design and implementation, aiming at the demands of multi-level and diversified chemical laboratory safety culture education, mobilizing the enthusiasm and initiative of all teachers and students, and the professional, organizing diversified and practical safety education activities by combining various forms of media technology are the effective way to improve the effectiveness of chemical laboratory safety education in the university.

## References

- [1] Y.J. Li, W.W. Zhang, et al. Construction of safety education and training system for chemistry laboratories in colleges and universities, *Experimental Technology and Management*, vol. 36 (2019) No.07, p.232-234, 247.

- [2] L. Ma, W. Zhang, H.J. Chen, et al. Construction of people-oriented safety education model of chemical laboratory, *Research and Exploration in Laboratory*, vol. 38 (2019) No.07, p.285-289.
- [3] Y. Zhou. Research on University Laboratory safety Management Based on EHS Management System, *Chinese University Science & Technology*, (2012) No.04, p.18-21.
- [4] B.Y. Li, K.S. Huang, D. S. Ai. Exploration on elements and system construction of laboratory safety education in colleges and universities. *Experimental Technology and Management*, vol. 36 (2019) No.11, p.245-253.
- [5] H. Lin. University information Construction based on campus security, *Chinese University Science & Technology*, (2019) No.06, p.94-96.
- [6] B. Sun, J.Y. Zhang. Research on countermeasures of key Laboratory construction in Universities -- Taking Nankai University key Laboratory as an example. *Chinese University Science & Technology*, (2018) No.03, p.15-17.
- [7] H. Xia, G. Huang, H.X. Ma, et al. Training system of high-level biosafety laboratory personnel in the United States and its enlightenment, *Research and Exploration in Laboratory*, vol. 38 (2019) No.12, p.252-255.
- [8] W.B. Dai, S.J. Xu, W.J. Wang, et al. Research on laboratory safety performance under the background of construction of "Double First-class" colleges and universities, *Research and Exploration in Laboratory*, (2020) No.01, p.303-306.
- [9] M.H. Xu. Research on the path of graduate students' laboratory security education under the guidance of "Ideological and Political Education Teaching in All Courses". *Journal of Heilongjiang College of Education*. Vol. 37 (2018) No.09, p.45-47.
- [10] M.Y. Yao. Research on the path of laboratory safety education under the guidance of "Ideological and Political Theories Teaching in All Courses", *Education Teaching Forum*, (2019) No.48, p.47-48.
- [11] C.M. Wang. Multi-governance model of laboratory from the perspective of actor network, *Chinese University Science & Technology*, (2020) No.04, p.15-17.
- [12] X.M. Jin, Y. Gong, Y.Q. Chen, et al. Research and practice on safety management of radiation and protection in laboratory, *Experimental Technology and Management*, vol. 36 (2019) No.04, p.172-174, 178.
- [13] Z.G. Wu, L.G. Zuo, Y.J. Guo. Reflections and study on laboratory safety management of universities, *Research and Exploration in Laboratory*, Vol. 38 (2019) No.09, p.303-305.
- [14] C. Chen, J. Gu. Significance, Content and path of rule-of-law education of ideological and political courses in colleges and universities, *Journal of Sichuan Normal University (Social Sciences Edition)*, Vol. 46 (2019) No.04, p.5-12.
- [15] N. Yuan, Y. Li, D.H. Zhang. Operation and management strategy of open project in key laboratory -- a case study of Ocean University of China, *Chinese University Science & Technology*, (2018) No.08, p.12-13.
- [16] J. Wang, S.G. Wang, J. Ren, et al. Exploration and practice on construction of university laboratory safety management under new situation. *Experimental Technology and Management*, vol. 36 (2019) No.07, p.235-238, 252.