

Application of Blended Teaching in Biomedical Laboratory Safety Education

Xiaojing Su¹, Jun Mao², Zhiying Zhao^{1*}

¹Department of Medical Technology, Baotou Medical College, Baotou 014040, Inner Mongolia, China

²Practical Teaching Skills Center, Baotou Medical College, Baotou 014040, Inner Mongolia, China

**Author to whom correspondence should be addressed.*

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Abstract: With the continuous advancement of higher education reform, educational informatization and digitalization have become important reform directions for biomedical laboratory education in colleges and universities. Against this background, the blended teaching model has been widely applied and has demonstrated great vitality and effectiveness in enhancing the interest and effectiveness of education and teaching. This also provides new opportunities for biomedical laboratory safety education. That is, it is necessary to actively construct a blended teaching model to comprehensively improve the quality of safety education and promote better learning, growth, and development of students. This article analyzes the connotation of blended teaching and explores its application value and countermeasures in biomedical laboratory safety education, for the reference of relevant personnel.

Keywords: Biological laboratory; Safety education; Blended teaching; Application value; Application countermeasures

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1. Introduction

As the saying goes, safety is of utmost importance. Safety education, as a crucial part of college biological laboratory education, is directly related to students' personal safety and professional growth. In the past, most of the biomedical laboratory safety education work had problems such as being monotonous and traditional, which directly affected students' learning interest and the actual educational effect. In the new era, with the continuous development of information technology, the blended teaching model has been widely used. The safety education work in biomedical laboratories should also be innovated and reformed in line with the ideas of "changing with the times" and "innovating with the times" to create a new model of biomedical laboratory safety education based on blended teaching. This can stimulate students' interest and potential, reduce their learning difficulties, strengthen their mastery of safety knowledge, and provide strong support for their safe practice in biomedical laboratories.

2. Overview of the connotation of blended teaching

Blended teaching is mainly a teaching model supported by information technology, which integrates the advantages of offline and online teaching^[1]. Compared with the traditional offline teaching model, the blended teaching model not only draws on the advantage of strong offline guidance but also incorporates the online informatization and networking teaching technologies that students are familiar with and love. Thus, it forms a new teaching model that can be carried out in a blended manner before, during, and after class. At the same time, this model is an educational model that covers multiple links before, during, and after class, focusing on the in-depth integration of “offline teaching” and “online teaching”. It aims to ensure the efficiency of “offline teaching” while giving full play to the flexibility and interest of “online teaching” to better guarantee the educational and teaching effects and promote the growth and development of students^[2].

3. Application value of blended teaching in biomedical laboratory safety education

3.1. Enriching teaching resources and expanding course capacity

Good resource construction is an important foundation for ensuring the quality of education and teaching and a key to enhancing students' safety awareness. In the past, during the process of biomedical laboratory safety education, the teaching content mostly centered around textbooks. This education model with single-sourced resources covered one-sided safety knowledge and had a rigid teaching pattern, which not only affected students' learning interest but also hindered the cultivation of students' safety literacy^[3]. Blended teaching can rely on the advantages of the Internet in resource richness and introduce various types of safety education resources. For example, the study can introduce vivid safety education micro-courses to strengthen students' safety awareness in a modern way that students like; introduce digital safety education cases to deepen students' attention to experimental safety issues, thus better expanding the course capacity, enabling students to deeply master relevant safety knowledge and skills, and enhancing their safety awareness and literacy^[4].

3.2. Promoting multidimensional interaction and improving comprehensive abilities

High-quality interaction is the key to improving the quality of biomedical laboratory safety education. Therefore, specific educational practices should also promote multi-dimensional interactions among students and between teachers and students through the innovation of teaching models and methods, stimulate their thinking vitality, and improve their enthusiasm and participation to comprehensively improve the educational quality^[5]. However, most of the traditional biomedical laboratory safety education work mainly relied on simple question-and-answer interactions. The interaction methods were single, and students were often in a passive state, with low learning enthusiasm and participation, which also led to poor teaching quality. Driven by blended teaching, there are more diverse interaction possibilities among teachers and students. For example, digital platforms can be used to guide students to carry out cross-time-and-space interactions and exchanges, further enhancing their learning interest. Another example is that students' experiences can be strengthened through digital simulation drills and other methods, stimulate their participation and enthusiasm, and further cultivate their teamwork, thinking, and problem-solving abilities, leading to the comprehensive improvement of their safety literacy and comprehensive qualities^[6].

3.3. Expanding teaching paths and cultivating good habits

Currently, most of the biomedical laboratory safety education work is carried out in laboratory classroom

teaching. Teachers often lack attention and supervision of extracurricular preview and review links, which directly affects students' learning and hinders the cultivation of their good experimental habits ^[7]. The promotion of blended teaching can break the time-and-space limitations of traditional classrooms and extend safety education from "laboratories" to "networked" and "digital" directions. This can not only relieve teachers' pressure of taking care of both experimental teaching and safety education in class but also comprehensively promote the innovation and reform of students' preview, learning, and review links, comprehensively improving students' learning quality. For example, the blended teaching concept can share digital resources before class to promote students' interesting preview; guide students to conduct blended exploration in class to cultivate their professional abilities and safety literacy; design corresponding review and practice links after class, assign digital homework, etc., to consolidate students' professional understanding and safety awareness. In addition, teachers can rely on digital and intelligent means to monitor and evaluate students' learning and review situations, provide effective guidance and suggestions in a timely manner, and promote the cultivation of students' good learning habits and safety awareness, laying a solid foundation for their long-term development in the biomedical field.

4. Application countermeasures of blended teaching in biomedical laboratory safety education

4.1. Pre-class blending to guide efficient preview

As the saying goes, "A journey of a thousand miles begins with a single step." For biomedical laboratory safety education, it is necessary to do a good job in the preview link. It can not only help students understand the content to be learned in advance, grasp the key and difficult points of learning, and improve their subsequent listening efficiency but also help them gradually find a path for independent learning, thinking, analysis, and problem-solving, thus facilitating their better growth and development ^[8]. It can be seen that the previous safety education work mostly guided students to simply read textbook knowledge, lacking the assistance and guidance of digital resources, which affected students' preview and subsequent learning effects. To change this situation, a "blended preview" link can be introduced based on the blended teaching concept and ensuring students' preview efficiency and subsequent learning effects through "online + offline" preview guidance.

First, in the "offline preview" link, teachers can guide students to establish basic knowledge points of biomedical laboratory safety based on the teaching content, such as the storage requirements of relevant drugs and reagents, the operation specifications of some experimental instruments, etc. By reading this content, students can initially learn some useful safety knowledge, consolidate their safety awareness, and lay a foundation for subsequent learning of safety knowledge and skills. Taking the teaching of "biological sample processing" as an example, before the teaching, teachers can let students preview the characteristics of different biological samples and the corresponding protective measures according to the textbook, such as how to handle infectious samples, etc., to lay a foundation for the high-quality promotion of safety education in subsequent classes. Second, in the "online preview" link, teachers can build a digital platform based on commonly used software by students, such as WeChat and QQ, and then distribute some digital resources related to safety education according to the teaching content, such as safety knowledge micro-courses and safety education courseware, so that students can deeply understand the importance of experimental safety and master relevant safety operation steps ^[9]. At the same time, teachers can design some preview questions

in the digital resources, such as “How to prevent the infection risk caused by aerosol transmission?” etc., to point out the direction for students’ preview and improve their preview effect. In addition, teachers can also distribute some digital “preview sheets” through the digital platform, so that students can write down their questions or share their experiences after previewing. On this basis, by collecting and analyzing these “preview sheets,” teachers can comprehensively understand students’ preview effects, questions, and doubts, providing a guarantee for the high-quality development of subsequent classroom teaching.

4.2. In-class blending to guide flipped practice

The classroom is the main front for biomedical laboratory safety education. In the actual teaching process, teachers should change the classroom teaching model based on the blended teaching concept, create a “blended classroom”, and promote students’ flipped learning and practice, so that students can gain more knowledge, joy, and growth in the classroom.

First, relying on the “offline teaching” concept, teachers should fully integrate and explain digital resources. In the specific process of biomedical laboratory safety education, teachers should grasp the charm of the traditional classroom, guide students to learn safety knowledge through oral explanations, and improve their safety skills. On this basis, teachers can guide students to carry out relevant experimental operations, correct their deficiencies, and deepen students’ understanding through practical explanations^[10]. In addition, teachers should also improve the curriculum construction based on digital resources. For example, teachers can rely on digital micro-courses to display laboratory safety knowledge and skills. During this process, teachers can use functions such as pause and replay to explain the laboratory safety operation steps in detail and strengthen students’ safety operation awareness.

Second, teachers should combine the advantages of “online teaching” to promote students’ blended learning and flipped practice. Specifically, teachers can start from the following steps: First, display micro-courses to kick off the flipped learning. Teachers can prepare some digital micro-courses based on the teaching content for students’ flipped learning. The micro-courses should not only include the explanation of basic safety knowledge, such as the correct wearing of personal protective equipment but also incorporate some flipped practice tasks, such as “analyzing the causes and countermeasures of a chemical reagent leakage accident in a laboratory.” Through these case tasks, students are guided to apply the learned knowledge to practical situations and cultivate their problem-solving abilities.

Second, form flipped groups to promote cooperative exploration^[11]. Based on the learning characteristics of universities, when promoting blended flipped teaching, teachers should form several learning groups of 4–6 people to promote competition and comparison among groups and communication and learning among group members, creating a good learning atmosphere.

Third, guide flipped practice to promote collaborative interaction. After dividing the experimental groups, teachers can give the “initiative” to students, let them watch the “safety education” micro-courses, and conduct discussion, communication, and practical exploration around the flipped tasks interspersed in them. It should be noted that during this process, teachers should actively participate in group cooperation, on the one hand, maintaining classroom order, and on the other hand, providing some guidance and advice to students in a timely manner. For example, when the group discusses how to prevent cross-contamination of laboratory biological samples, teachers can guide students to start from the links of sample collection, storage, and processing, analyze the factors that may lead to cross-contamination and the corresponding preventive measures.

Fourth, display and evaluate the results to complete the flipped teaching. After each group completes the flipped practice task, teachers can guide them to display their results and share their gains in turn^[12]. During this process, teachers can summarize and comment based on the performance of each group to strengthen students' understanding of knowledge points. On this basis, teachers can also guide students to conduct group peer evaluation to promote their exchange of views and experiences, creating a positive classroom atmosphere and laying a solid foundation for the comprehensive cultivation of students' thinking, innovation, cooperation abilities, and safety literacy.

4.3. Post-class blending to consolidate educational effects

Practice has proved that the quality of teaching depends not only on the pre-class preview and in-class teaching links but also has a great relationship with the post-class review and practice links. For biomedical laboratory safety education, the post-class review and practice are key links to consolidate the educational effects. In this link, teachers should promote students' knowledge learning, review, and practice based on the blended teaching concept, comprehensively improve their safety awareness and literacy, and consolidate the educational and teaching effects^[13].

First, teachers can design some post-class assignment tasks to promote students' offline review and practice. For example, teachers can assign post-class tasks closely related to the actual operations in biomedical laboratories, such as analyzing the safety risks in a certain experimental project and formulating corresponding preventive measures, or asking students to write a summary report on the emergency drill of laboratory safety accidents, so as to strengthen students' in-class learning results, consolidate their professional and safety understanding, and improve their comprehensive abilities^[14].

Second, teachers can guide students to carry out "blended" post-class review and practice to comprehensively improve their safety awareness and literacy. For example, teachers can design some "digital exercises" related to biomedical laboratory safety education, send them to the educational platform, and then guide students to practice and review flexibly. At the same time, teachers can analyze students' exercise-doing situations based on big data technology, understand their learning difficulties, and provide precise guidance to help them overcome their learning difficulties and improve their abilities. In addition, teachers can also use digital and intelligent technologies to intelligently analyze students' learning situations and recommend some personalized learning resources to improve their learning effects and comprehensive abilities. Finally, teachers can upload digital resources to platforms such as Douyin and Cloud Classroom to innovatively guide students to carry out review and practice. For example, teachers can open a self-media account for biomedical laboratory safety education on the Douyin platform, regularly upload some digital resources to promote students' learning, communication, and interaction. Another example is that teachers can use the Cloud Classroom platform to carry out "online safety education," breaking the teaching constraints of traditional laboratories, allowing students to learn and review regardless of time and place^[15].

Also, teachers can assign some experimental safety operation tasks through the digital education platform and guide students to carry out practical operations after class. During this process, teachers can connect with them through voice and video to guide their post-class practices, help them solve problems, and promote them to better master relevant knowledge. Teachers can also guide them to upload the process and results to media platforms for evaluation and communication, thus better stimulating their safety awareness and learning interest and effectively improving their practical operation abilities and safety awareness.

5. Conclusion

In conclusion, in the new era, biomedical laboratory safety education has also entered the fast lane of informatization and digitalization reform. In this regard, teachers should deeply understand the application value of this model, and continuously use new ideas and methods to create a new model and pattern of biomedical laboratory safety education based on blended teaching, leading the comprehensive cultivation of students' professional abilities and safety literacy, and helping them learn more, go further, and soar higher in the future!

Disclosure statement

The authors declare no conflict of interest.

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