Research on the Information Reform of Experimental Teaching by the Construction of Resource Library

Pengcheng Zhang[1,2,3], Jiangyan Ru[4,*], Wencheng Wang, Xiang Gong[1,2,3], Wanming Zhang[1,2,3]

[1]Industrial Manipulator Control and Reliability Technology Innovation Center of Hebei, Cangzhou, Hebei, 061001, China
[2]Industrial Manipulator Control and Reliability Technology Innovation Center of Cangzhou, Cangzhou, Hebei, 061001, China
[3]Department of Mechanical Engineering, Hebei University of Water Resources and Electric Engineering, Cangzhou, Hebei, 061001, China
[4]Huabei Industrial School, Cangzhou, Hebei, 061000, China
[*]Corresponding author

Abstract: Aiming at the problems of resource shortage, insufficient investment and insufficient equipment in experimental teaching in colleges and universities in China, it is proposed to use information technology to establish an experimental resource library on the basis of existing experimental conditions, so as to reform the existing experimental teaching mode and improve the level of practical teaching. This paper analyzes and gives the content, structure, management mode and use method of the experimental resource library, which provides ideas and references for different schools to implement practical teaching reform. Through the establishment of experimental resource library, the sharing of experimental resources can save the cost of laboratory construction in colleges and universities[1], and improve the efficiency and management level of experimental equipment.

Keywords: Resource library, information, practical teaching reform, innovative talents, training objectives

1. Introduction

As an important teaching content of higher education, experimental teaching plays an important role in guiding students to master scientific knowledge, forming a rigorous and realistic scientific attitude, and cultivating innovative practical ability. Through experimental operation, result analysis and report writing, students can deepen their understanding and cognition of theoretical knowledge in the classroom. At the same time, they can use the knowledge they have learned to solve practical problems in reality and promote the transformation from knowledge to ability. During the experiment, the interaction and cooperation between students also cultivated their communication ability, organizational ability and collaborative spirit.

In recent years, as the demand for innovative talents training has been concerned and recognized by the whole society, practical teaching has been paid more and more attention by various colleges and universities. Some new laboratories, engineering training centers and engineering demonstration centers have been established one after another, and various new instruments and equipment and related experimental resources have been gradually enriched. However, in the process of implementation, many colleges and universities are still unable to get rid of the traditional teaching mode based on confirmatory experiments because of the relatively old experimental equipment, lack of experimental resources and insufficient investment in experimental funds. In the face of the increasing demand for innovative and applied talents, this mode has been unable to meet the training objectives of professional talents, and these existing problems can not be solved overnight. The investment of large-scale experimental resources and the low rate of return are still unavoidable problems in the development of some colleges and universities. Therefore, it is imperative to reform the experimental teaching led by information technology.

2. Analysis of the Present Situation of Experimental Teaching in Colleges and Universities

At present, among the special application-oriented undergraduate colleges and universities in China, there are widespread problems such as backward experimental projects, insufficient experimental resources, and a single experimental model. With the transformation of higher education from " elite education " to " mass education, " the scale of colleges and universities continues to expand, the number of enrollment is increasing, and the number of students is increasing. This problem is increasingly prominent.

(1) The original experimental teaching mode of the school is single, and it is almost a replica of the theoretical teaching in the classroom. Therefore, it is impossible to start from the actual learning situation of the students and teach them separately according to their personal interests, knowledge base and learning ability.

(2) The types of experimental projects are less and relatively old, and some have even been repeated for more than ten years. The new knowledge has been adjusted in the teaching of theoretical courses, but the new experimental projects have not been supplemented and updated due to the limitations of instruments, equipment and venues. Therefore, there is a contradiction between the two, which makes it difficult to promote the reform of experimental teaching.

(3) There are relatively few experimental teaching resources in the school, including pictures, materials and teaching videos without experimental instruments and equipment operation methods, no comprehensive, research-oriented and innovative experimental projects, and no corresponding relationship between experimental projects and theoretical courses. The expansion of teaching resources and students ' knowledge requires schools to provide more teaching resources from different perspectives when conducting experimental teaching.

(4) The teaching resources are relatively insufficient, the original number of students is relatively small, and it can barely meet the teaching needs. The expansion of the school has greatly increased the number of students, making these teaching equipment insufficient to support more students to learn.

Under the new situation of strengthening the connotative development of higher education, the management of colleges and universities should attach great importance to experimental teaching, fully realize that theoretical knowledge is the basis of cultivating students ' ability, and experimental teaching is an important way to cultivate students ' innovative and practical ability. To attach importance to experimental teaching, it is necessary to continuously improve the enthusiasm of teachers to carry out high-level experimental teaching, and build an experimental teaching system that coordinates with theoretical teaching and matches the professional training objectives.

3. Experimental teaching informationization reform based on experimental resource library

3.1 Experimental teaching resource library

The experimental teaching resource library is an important branch of distance education and education informatization. Modern education adheres to the educational concept of " student-oriented. " By making full use of educational and teaching resources, it can give full play to the role of students as the main body, change the traditional learning mode, and guide students to learn to organize and collect the knowledge they need independently on the network. It not only enriches the students ' knowledge, but also transforms the students ' traditional passive learning mode into an active inquiry mode, which effectively improves the students ' autonomous learning ability[2]. The experimental resource library can also optimize the teaching methods. Through the continuous introduction of computer and network technology, the classroom teaching breaks through the limitation of time and space, transforms the teaching content from static to dynamic, and simplifies the complexity, which effectively improves the efficiency of classroom teaching. In addition, the resource library also gathers a large number of excellent teaching resources together, which provides high-quality and rich materials for teaching preparation and courseware development. It not only effectively avoids unnecessary duplication of labor, but also provides effective support for the comprehensive promotion of information education and quality education. From this point of view, the continuous development and improvement of the experimental teaching resource library to enrich the teaching resources has become the primary task of comprehensively promoting educational informatization, and it is also an important way to integrate professional courses and computer information technology.

3.2 The composition and related content of the experimental resource library

The construction of experimental resource library can be positioned according to the level and goal of talent training in colleges and universities. It is based on the experimental resources of our school, focusing on the platform of key laboratories or technological innovation centers, and supplemented by the online experimental platform and physical experimental resources of brother universities and enterprises. The experimental resource library should be open, and the backward resources can be eliminated at any time, and the advanced resources can be added to make the experimental resources of colleges and universities keep advanced for a long time[3].

(1) General teaching resources

At present, the general practice teaching resources are divided into the following categories : media materials (including graphics / images, text, audio, video and animation), tools and templates (including learning aids, teaching aids), gauge sets (including test papers, test questions), courseware (including subject websites, multimedia courseware), literature, case, course resource directory index (network resource links and non-network resource index)[4]. These semi-rich and diverse teaching resources are the premise basis for constructing the experimental teaching resource library, and also the premise guarantee for the effective operation of the experimental resource library. These teaching materials can come from all aspects, such as useful pictures, texts, animations downloaded from the Internet, self-recorded experimental processes, and so on[5].At present, the methods used to collect teaching resource information are as follows.1) With the help of scanners, newspapers, magazines, books and other information will be scanned, edited and other digital processing, while in a suitable format for preservation, such as JPG, GIF, etc., in order to facilitate the use of resources later. 2) The websites related to professional courses provide a lot of experimental data resources. With the help of various search engines, it can be easily accessed. At the same time, the available resources can be sorted, downloaded and comprehensively utilized. Through the network download available teaching resources related to text resources, image resources, animation resources, video resources, courseware resources, test paper resources, lesson plans resources and paper resources. 3) You can also use AuthorWare, PowerPoint and other software to make the theme of the courseware resources.

(2) Informationization of experimental resources

With the liberalization of the enrollment expansion policy of colleges and universities, the number of college students is increasing. For the experimental teaching of colleges and universities, it will undoubtedly also face greater pressure. Under the premise that some traditional experimental instruments remain unchanged, the purchase of information-based instruments will be carried out to expand the degree of informationization of experimental projects. In the experimental teaching of colleges and universities, experiments can be carried out by adding some digital instruments or equipment to make the experimental results more accurate and the obtained data more accurate. This can also save the time of an experiment to a great extent and improve the efficiency of students ' learning. The information work of the experimental project enables the laboratory equipment to be fully utilized, and the experimental results are more scientific and correct. It can make students learn more rigorous learning attitude, but also provide greater convenience for the experimental teaching work in colleges and universities, and improve the experimental teaching effect and experimental efficiency.The main part of the experimental reservation system is three modules, which are student module, teacher module and management module. This system involves three types of users, students, teachers and administrators. Users with different permissions perform different operations. When the students submit the experimental appointment, the system will submit this information further and feedback it to the relevant departments for the arrangement of the experiment, so as to meet the different needs of different students. The promotion of the experimental reservation system makes the arrangement of students ' experimental courses more flexible, and the experimental equipment has been fully and efficiently utilized.

(3) Experimental reservation system

The traditional laboratory is opened only when students need to attend classes, because the number of students in the previous school was small, but with the expansion of colleges and universities, the number of students increased. If the laboratory is still open at the time of learning, it will undoubtedly not adapt to the present. In order to prevent this crowded situation from happening, many colleges and universities have carried out laboratories open all day long. As long as it is normal class time, experimental work can be carried out. In this way, the laboratory has achieved the highest efficiency, but at the same time, there is a problem to be solved, that is, the time arrangement of students. Because

students of different majors have different spare time, the courses that need to be experimented are also different. If there is no unified time, the experiment cannot be completed. At this time, the experimental reservation system has played a big role. No matter which professional students can make an online reservation, select the courses they need to carry out the experiment, select their convenient time, and the experimental instructors they need, submit them to the system, and the following work will be completed by the system.

The main part of the experimental reservation system is three modules, which are student module, teacher module and management module. This system involves three types of users, students, teachers and administrators. Users with different permissions perform different operations. When the students submit the experimental appointment, the system will submit this information further and feedback it to the relevant departments for the arrangement of the experiment, so as to meet the different needs of different students. The promotion of the experimental reservation system has made the arrangement of students ' experimental courses more flexible, and the experimental equipment has been fully and efficiently utilized.

(4) Experimental teaching auxiliary system

In colleges and universities, the number of teachers is limited. For the teaching of colleges and universities, if it is carried out by teachers, it is far from enough. Usually in the teaching process, some auxiliary forces will be used to carry out the teaching work of students. Through these auxiliary teaching equipment, reduce the workload of teachers, but also through these devices to help students in need in a timely manner. Some problems encountered in the experiment can be answered in time. At the same time, students can also conduct self-study and some experiment-related work through the auxiliary teaching system. The capacity of learning enriches and broadens the teaching content, enhances the sense of the times of practical teaching, and provides a relatively complete teaching solution to meet the teaching requirements to the greatest extent.

(5) Open experimental preview system

For colleges and universities, the types of experiments are diverse, and there are many experimental projects. Before the experiment, students need to understand the experimental project, but also need to master the instruments involved in the experiment and the usage of the instruments. The open experimental preview system can solve this problem well. The open experimental preview system includes the explanation of all the experimental contents, the introduction of the experimental equipment, the operation method and process of the experiment and the matters needing attention. Students from other schools can also learn experimental projects through this system, which makes teaching resources more shared, thus truly realizing the real opening of teaching resources and providing more learning convenience for other learners.

(6) Demonstration experiment system

Through the demonstration experiment system, we can make a vivid introduction and explanation of an experiment. Through the way of image, students can perceive the experimental equipment and experimental content, and have perceptual knowledge in students ' thoughts, which can deepen students ' memory. The demonstration experiment system is also a good way to promote knowledge, but it is only learned as a way to watch, and there is no interaction. The demonstration experiment system is widely used in colleges and universities.

(7) Virtual experiment project

The virtual experiment is actually evolved from the demonstration experiment system. It integrates a number of technologies, integrates various advantages, and plays a key role and significance in teaching. Modeling is often used in virtual experiments, especially for the use of PRO / E, UG, Solidworks and other software. These software can be used to simulate various experimental equipment. All the operations in the experimental process can be simulated by them.

3.3 Utilization of the construction of experimental resource library

(1) Create a spontaneous learning environment for students

In the traditional experimental teaching process, teachers will explain in the process of experimental teaching. Students will carry out corresponding experimental operations according to the teacher 's explanation, and do not need to think too much. In this way, many students rely on teachers and will not think on their own. The construction of the experimental teaching resource library system enables

students to learn independently in a relaxed learning environment and improves students ' enthusiasm for learning.

(2) Achieved a strong sharing of teaching resources

Today, with the development of information, information sharing is a major feature. Due to the limitation of various conditions, the traditional experimental teaching makes the source of learning knowledge narrow. All knowledge comes from books and teaching materials, only passively accepts learning, and has no established goals. The establishment of the experimental resource library enables the school 's teaching resources to share information through the resource library. Students can carry out experiments on demand, and use multimedia for teaching. The learning methods are diversified, including not only text and images, but also video and audio. Teaching through various means enables students to have doubts when learning, and then carry out real life with doubts.

(3) Beyond the time and space limitations of experimental learning

The traditional experimental teaching is carried out in the laboratory, and it is arranged at a unified time, which causes some problems. For example, due to the limitation of class time, the goal of students is to complete it as long as it is completed in the prescribed time, which is purely to cope with, and the time for communication between students and teachers is also limited. There are many students in a class, and some students ' questions cannot be asked in time and cannot get the correct answers in time. The establishment of the experimental resource library enables learning to span the time and space of learning. In the process of teachers ' teaching, the advantages of laboratory teaching and network teaching can be integrated, which is more conducive to teaching.

(4) Avoiding a lot of repetitive work

In traditional teaching, different students consult the same question, and teachers must answer them one by one, and different teachers may have different standards of answer. The establishment of the experimental resource library enables the teaching resources to be shared in the first time. Students and teachers can learn knowledge through this platform. The answers to all the questions encountered in the experiment can be queried in the resource library. This is the best teacher. In this way, for some problems existing in the resource base, teachers do not need to think and answer one by one again, and can put a lot of thought and energy into the experimental teaching research, and strive to improve the quality of experimental teaching in colleges and universities.

(5) Resource library emphasizes the use of advanced educational ideas, teaching theory to guide the reform of teaching mode.

From teaching to learning, it overcomes the single form of teaching materials, improves its practicability, and meets the requirements of modern learners ' personality, autonomy and practicality. The establishment of the resource library makes the leading role of teachers in teaching play a greater role. At the same time, it can also change the learning from the original passive to active, and create a teaching mode that is conducive to the cultivation of college students ' quality education and innovation ability.

(6) The teaching resource database not only provides a standardized and flexible reference for teachers to prepare lessons, but also provides a perfect and easy-to-operate technical support for teachers to implement teaching.

The teaching materials of the resource library are rich and novel, which not only increases the capacity of teaching, enriches and broadens the teaching content, enhances the sense of the times of experimental teaching, but also provides a relatively complete teaching solution to meet the teaching requirements to the greatest extent. At the same time, the teaching methods and teaching means are improved, so that the abstract and difficult to understand content in the experimental teaching becomes vivid and intuitive, to achieve the incomparable effect of blackboard teaching, so as to break through the traditional teaching mode. It constructs a teaching mode which is beneficial to the quality education and innovation ability training of college students.

(7) Teaching resource library provides a good learning platform for students. The online courseware in the resource library provides students with a scientific, advanced and easy-to-operate virtual learning atmosphere. On this platform, students can obtain more knowledge, broaden their knowledge, and at the same time, they can also provide corresponding guidance for learning. Students can also use their spare time to absorb knowledge, which makes the traditional teaching content get a greater degree of extension, from one-way (teacher-to-student) transmission to two-way (between teachers and students)

and even a wider range (between students and students, between teachers, between teachers and society). The transformation of exchange and transmission has realized interactive teaching and man-machine combination, teacher-student combination, in-class and out-of-class combination, which greatly improves teaching efficiency and effect. It provides a variety of educational environment and powerful learning tools for students ' learning and development, which helps to enlighten students ' image thinking and improve learning efficiency.

4. Conclusion

The construction of an open experimental resource library in colleges and universities is an important way to introduce advanced experimental resources. It can enhance the radiation effect and leading demonstration effect of high-quality experimental resources. It is conducive to promoting the formation of a new system of higher education information experimental teaching projects with excellent teaching effect, open sharing and effective. It is of great significance to improve the quality of personnel training in colleges and universities. Due to many constraints in the sharing practice of experimental resources, the sharing of experimental resources in local colleges and universities in China is still in its infancy. In the future, it is necessary to explore flexible and diverse sharing modes and guarantee mechanisms.

Acknowledgments

References

[1] Gui Yang, Jirong Wang (2017). Research and exploration of open experimental teaching mode. Journal of Educational Technology, Vol. 16, No. 02, p. 69-71.

[2] Yi Xiao (2023). Research on the long-term mechanism of the construction of the teaching resource database of the integration of industry and education. Educational Informatization Forum, No. 05, p. 36-38.

[3] Shuangqing Zhou, Hao Yan, Yongrui Lin, et al(2022). Resource library construction and experimental exploration based on the cultivation of innovative talents. The Guide of Science & Education, Vol. 24, p. 12-15.

[4] Yan Li, Weijian Jin, Xia Zhou(2022). Research and Implementation of University Experimental Resource Bank Based on Hybrid Cloud. Research and Exploration in laboratory, Vol. 41, No. 07, p. 272-276.

[5] Yan Li, Xia Zhou, Caihong Jia(2022). Research on the sharing mode and resource library construction of experimental resources in local colleges and universities[J]. China Management Informationization, Vol. 25, No. 17, p. 228-231.