The Journal of Education InsightsVol 1 Issue 1 2023

ORIGINAL RESEARCH

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Research on the Construction of Open Laboratory Models in Local Universities Based on Deepening the Reform of Undergraduate Teaching

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Abstract: The open laboratory is a relatively important part of deepening the reform of undergraduate education and teaching to improve the quality of talent training in local universities. Therefore, many local colleges and universities have carried out attempts to open laboratory construction. However, the expected effect of the reform needs to be further improved. It is found that there are still many problems in the process of open laboratory development. For this reason, this paper makes an in-depth study on the construction of the innovation model of open laboratories in local universities. According to the existing problems, a feasible construction scheme was proposed.

Keywords: Local universities; open laboratories; innovation model

1.Preface

Open Laboratory is a platform for students to carry out innovative project research, and it is also an important position for innovative teaching and scientific research. How to construct the open laboratory pattern in local colleges and universities has become an important direction of deepening the undergraduate education and teaching reform in local colleges and universities, this paper first expounds the objectives of the opening of open laboratories in local colleges and universities, then expounds the functions played by the construction of open laboratories, and then analyzes the influencing factors existing in the construction of open laboratories in local colleges and universities, aiming at the influencing factors at the present stage, this paper puts forward several feasible construction schemes.

2. Purpose of Laboratory Opening

The purpose of building open laboratories in local colleges and universities is to help teachers achieve their teaching goals and students complete their professional studies, to further cultivate students' ability of self-study, self-management and practical innovation, and to promote students' interest in learning through open laboratory construction and open experiment, in the course of the experiment, the students' logical thinking ability is promoted, the students' comprehensive quality is realized, and the students' employment

and career planning are promoted [1]. The construction of open laboratory is not only open to specific objects, but open to all students, even to the society, to provide services for regional economic and social development. Therefore, when facing different objects, it requires them to be able to integrate with each other and cooperate as a team, so as to achieve hierarchical teaching, interdisciplinary teaching and even cross-disciplinary integration, to ensure that the teaching object can improve professional and professional quality in the open laboratory.

3. The role of open laboratory construction

(1) quickly realize the reversal of classroom teaching

The main task of a flip-flop class is for the teacher to provide students with materials relevant to the course. The materials can be in the form of PPT, short videos, assignments, etc. , students first preview the knowledge points to learn, and then the teacher through the classroom teaching for students to explain the system, for students in the preview of the problems one by one to answer, so as to achieve the expected teaching effect [2]. Through this teaching method can promote students' self-learning ability, and in self-learning, can effectively enhance students' self-management ability. Teachers in the classroom use of multimedia, information and other teaching models can enhance the classroom teaching atmosphere [3]. In an open laboratory, students can discover and analyze problems when they are operating, communicate with approved teachers in a timely manner, and under the correct guidance of teachers, hELP students to analyze and solve problems, which can also enhance the enthusiasm of students, but also for the all-round development of students have a positive role in guiding.

(2) promoting research and development of innovation projects

The establishment of open laboratories in local colleges and universities provides a very good learning platform for students, and it is also a development platform for training students' innovative ability. At present, there is a growing demand for multi-talented people in the social development. As the main provider of multi-talented people, local colleges and universities should strengthen the reform to train students in all aspects. First of all, the reform of teaching methods as a breakthrough point to promote students' innovative spirit and innovative thinking. Through the construction of the open laboratory model, the students who are interested in experiments can make use of their leisure time to carry out experiments in the open laboratory, they can also independently assist teachers in innovative research or participate in teachers' horizontal and vertical research projects to further improve the rate of laboratory equipment, through the experiment to obtain professional ability, practical ability and scientific research ability, on this basis to enhance students' innovation, entrepreneurship, to help the work of innovation.

(3) improving the use of equipment

The function of constructing open laboratory can not only realize the reversal of classroom teaching, promote the research and development of innovative projects, but also improve the utilization rate of experimental equipment in local universities. At present, the utilization rate of experimental equipment in some local universities is not high. The construction of open laboratory mode can not only improve students' operation ability, but also effectively improve the utilization rate of equipment. For example, because the teaching time is limited and the experimental conditions are strict, the students can not test all the experimental contents one by one in the classroom, to the open laboratory to independently carry out the modeling, independently carry out structural experiments related experimental content, so that students can enhance the operation of professional equipment skills and skills, lay a solid foundation for future employment practice operation, for the future development of students have a positive role.

4. The Construction of Local University Open Laboratory Factors

(1). Lack of a sound safeguard mechanism for open laboratories

At present, the main factor that affects the opening of laboratories in local colleges and universities is the lack of perfect guarantee mechanism. For the opening of laboratory, we should not only manage the open time and space, but also establish a brand-new laboratory management mode, which needs a relatively perfect management system, it is necessary to reconfigure the resources needed by the laboratory and improve the comprehensive quality of the laboratory managers, so as to form a series of efficient and orderly laboratory opening mechanism [5]. However, some local colleges lack of sound management mechanism at this stage, which will also affect the cultivation of innovative talents. There are two main problems that lead to this problem. First, it is common to share laboratory resources between the construction of open laboratory model and normal teaching experiments in local universities, this phenomenon is easy to appear the two coordination difficulties. Secondly, the Reserve Fund for the open laboratory is insufficient, because the laboratory is open to all students, so the maintenance cost of the laboratory equipment is much higher than the original traditional teaching mode, it will affect the normal development of the open experiment, which is easy to reduce the students' interest in the experiment, and it will also kill the enthusiasm of the open experiment staff.

(2) the managers of the open laboratory are lack of working enthusiasm

With the development of open laboratory construction, the ideal effect has been achieved. However, some local colleges and universities focus on the purchase of advanced experimental equipment, ignoring the maintenance of equipment, the purchase of consumables, the management of the test bench account work [6]. In the process of constructing the open laboratory model, it is common for some university staff to have several jobs, and the workload of the staff who participate in the construction of the open laboratory model can not be actually quantified, they can not take on horizontal and vertical research projects like teachers, nor can they have a broader promotion space like administrative staff. In the process of constructing the open laboratory model, lack of participation of laboratory staff is more common, such as local universities in the organization of study visits, training, less invited laboratory staff to participate, it is easy to lead to the lack of enthusiasm of laboratory personnel and the lack of understanding of the open laboratory model, which is not conducive to the long-term development of the open laboratory model.

(3) The opening of open laboratory is insufficient

At present, many local colleges and universities open the laboratory because of the laboratory space, teaching resources and other objective problems caused by the opening of some local colleges and universities, the opening of the laboratory is insufficient, affecting the effect of model construction. During the normal operation of the laboratory, there are two main contents: normal teaching and teachers' scientific research projects, which will restrict the time and space of the laboratory opening to the outside world to a certain extent, as a result, the open time and open space of some open laboratories are not ideal, and some students do not hold a positive attitude towards the construction mode of open laboratories. At the same time, in some local universities, the open laboratories are only open to some students who want to do graduation projects and some students who are engaged in innovation and entrepreneurship, this also dampens the enthusiasm of some students to participate in the construction of open laboratory model. According to our investigation of the types of open experiments in a local university, we can find that the graduation design experiments account for 37.04% of the total number of experiments, the teacher research project experiments account for 18.52% , the normal class hours account

for 29.63%，the other experiments of cultivating students' skills, scientific research and interest were 7.41%，3.70% and 3.70% respectively（see Table 1）[7]. In the long run, the form and content of open laboratory will become more and more unitary, which will lead to low participation of students and frustrate their enthusiasm.

Table 1 types of open laboratory experiments in a local university

Open laboratory type	Number （27）
Graduation design experiment	10（37.04%）
	10（37.04%）
Teacher Research Project Experiment	5（18.52%）
	5（18.52%）
Normal class hour experiment	8（29.63%）
	8（29.63%）
Experiment on training skills	2（7.41%）
	2（7.41%）
Scientific research experiments	1（3.70%）
	1（3.70%）
Interest cultivation experiment	1（3.70%）
	1（3.70%）

（4）There are potential safety hazards in opening laboratories

Human factors are the key factors that lead to the potential safety problems in the laboratory. Most of the safety accidents are caused by the improper operation of the laboratory personnel during the course of the experiment, or not strictly following the lab's rules. After investigating 30 potential safety problems in the open laboratories of a local university, it was found that 50% of laboratory failures occurred due to improper operation of laboratory equipment, 23.33% of the samples were not returned, 16.67% of the equipment was aged, and 10% of the samples were not returned because of other reasons（Table 2）. Therefore, to reduce the hidden danger of open laboratory, we must improve the professional quality of laboratory personnel [8].

Table 2 The reason of the accident in the open laboratory of a local university

Causes of laboratory accidents	Quantity （30）
Improper operation of the experimental equipment	15（50%）
	15（50%）
No Return of lab items	7（23.33%）
	7（23.33%）
Equipment Aging	5（16.67%）
	5（16.67%）
Others	3（10%）
	3（10%）

5. The Construction of Open Laboratories in Local Colleges and Universities

（1）. Establishing a sound safeguard mechanism

In order to ensure the smooth development of open

laboratories and achieve the expected results, it is necessary to establish a sound security mechanism. A perfect guarantee mechanism can promote students' interest in independent experiments, and at the same time enable graduates to complete their graduation design experiments in open laboratories, to realize the whole process of students' professional practice and innovation ability training. At the same time, the school should also provide some financial support for the open laboratory, mainly for the maintenance of equipment, inspection, supplies of laboratory materials and the workload of related managers. At the same time, the university should also attach importance to the enthusiasm of laboratory personnel and students, and encourage students to participate in experiments by setting up an incentive system. Only if students keep high interest in experiments and teachers keep full enthusiasm in professional practice teaching, can we better realize the construction of open laboratory mode. Through the establishment of the security mechanism, so that students, teachers can enter the experiment, love professional practice, only in this way can improve the effect of undergraduate education reform.

(2) To enhance the overall quality of management personnel

Laboratory managers play a decisive role in the smooth development of open laboratories. In order to strengthen the construction of laboratory personnel team, it can be done by several ways: first, setting up the post of laboratory teacher, so as to enhance the status of laboratory management personnel, after the theoretical teachers explain the experimental knowledge to the students, they can invite the experimental teachers to guide and teach the students in the professional practical courses, laboratory managers should be asked to participate in order to enhance their sense of achievement. In addition, the school can also implement a two-level management model, which can not only solve the problem of lack of managers, but also enhance students' sense of participation.

(3) To open more laboratories

In order to increase the openness of open laboratories, first of all, we should enrich the contents of open experiments to attract more students to participate in open laboratories, and secondly, we should specify the opening hours of laboratories, the establishment of network appointment system, so that students can accurately understand the opening time of the open laboratory, according to their own time to make an appointment on the internet [9]. The Open Laboratory is an open professional practice teaching project for all the students in the school. The students who are interested in it can participate in it as much as possible, and get exercise and promotion, to achieve cross-discipline, professional integration, collaboration, sharing. (Table 3).

Table 3 Laboratory contents, appropriate population and specific forms

Laboratory content	For the crowd	Form
Fun	All students in school	Through the form of elective courses to add interesting experiments to attract students′ attention
BASIC	Students with a weak foundation	Set Up BASIC experiments to provide students with a solid foundation
Comprehensive design	Comprehensive students	A difficult experiment outside the course
Research Creativity	Students who are interested in innovative research	Complete the innovation pilot project with the correct guidance of the teacher

(4) To enhance the safety management of open laboratories

Since human factors are the main cause of laboratory safety problems, it is necessary to strengthen the training of safety awareness of laboratory personnel, and to implement the responsibility of safety management on the individual, to the safety manager. At the same time, the management of dangerous goods in experiments should be strengthened to ensure that they are put back in their designated places after the tests have been completed [10]. Set up access control system for the open laboratory, keep the trace of the people who take part in the open experimental project, and eliminate the hidden danger to the greatest extent. At the same time, emergency materials should be provided in time, such as fire-fighting devices, labor protection measures, for different laboratory, should choose different fire-fighting measures.

6. Conclusion

The open laboratory has been in the local university for many years, and the actual effect is still far from the expectation, among which there are many influencing factors, in order to fundamentally improve the effect of the open laboratory, we should establish a perfect safeguard mechanism, improve the comprehensive quality of laboratory managers, open more laboratories and improve the level of laboratory safety management, to ensure that the opening of laboratories can be carried out smoothly and widely, to deepen the reform of undergraduate education and teaching, to train students' practical and innovative ability, and to transport compound talents for the development of society.

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