



Scientific Management of Equipment in Medical Innovation Laboratory

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Abstract

Aim; To solve the problem of innovation laboratory instrument management and improve laboratory management level. **Method;** It is necessary to do an excellent job in managing innovative laboratory equipment by improving the equipment management system, functional division management, appointment registration, and strengthening the construction of management teams to guarantee the cultivation of innovation and entrepreneurship capabilities of undergraduates. **Results;** The number of innovative experimental projects approved and the number of project groups that the laboratory can accept at the same time was increased significantly. The utilization rate of laboratory equipment has increased, and the vacancy rate has decreased. **Conclusion;** Excellent instrument management can significantly improve the efficiency of scientific research in the innovation laboratory.

Keywords: Laboratory; Equipment; Management.

1. Introduction

Laboratory equipment management is an integral part of the daily work of the laboratory. It is inseparable from universities' scientific research and teaching work and is essential for scientific research and smooth progress [1]. Professional and efficient equipment management affects the school's scientific research level and results and reflects the teaching effect and student talent training [2]. In 2012, the Ministry of Education of China launched an innovation and entrepreneurship training program for college students nationwide to strengthen college students' innovative thinking and scientific research capabilities. With this plan's implementation, most domestic colleges and universities have successively established innovation laboratories aimed at undergraduates' innovation and entrepreneurship training [3]. Compared with other professional laboratories, to meet the needs of innovation or entrepreneurial projects of different majors, various universities' innovation laboratories are mostly set up as comprehensive laboratories, which have their characteristics in the types, quantities, and use modes of equipment. Compared with other professional laboratories, the management of innovative laboratory instruments and equipment has many difficulties and problems, and it also puts forward higher requirements for equipment management works.

2. Literature Review

2.1. Compared with Professional Laboratories, Innovative Laboratories have Different Functions

Most college laboratories can be divided into scientific research laboratories and teaching laboratories in function and positioning [4]. For example, Chongqing Medical University is divided into two campuses: the main campus and the Jinyun campus. The main campus is mainly responsible for the clinical internship and postgraduate training of senior undergraduates. The laboratories established are all scientific research laboratories and are affiliated to other scientific research. The platform generally does not undertake experimental teaching tasks and is only open to graduate students and teachers of scientific research teams. In addition to conventional laboratory equipment, scientific research laboratories' instruments and equipment are mostly professional equipment on various platforms, with fewer users. Most of the laboratory instruments are professional, high-end, and advanced instruments and are maintained and managed by dedicated personnel. The Jinyun campus is the primary place for undergraduate teaching. The laboratories are all teaching laboratories. They mainly undertake the teaching tasks of undergraduate experimental courses. Most of the instruments are necessary experimental instruments and ordinary instruments of various specialties, multi-instrument number, to facilitate students to operate, multi-use, and high frequency.

The innovation laboratory is the prominent place established in response to the "Double Innovation Plan" of the Ministry of Education for our school's undergraduates to carry out innovative experimental project research work. The functional positioning of the innovation laboratory lies between the scientific research laboratory and the

teaching laboratory. It is an initiation station for medical undergraduates of our school to contact scientific research. At the same time, it also undertakes part of the teaching tasks of practical courses. The configuration of equipment takes into account scientific research experiments. The characteristics of laboratories and teaching laboratories are that there are many necessary instruments and high-end instruments of various professional disciplines, bringing new topics to laboratory instrument management.

2.2. Numerous and Multiple Devices in the Innovation lab

As our university's undergraduate innovation experiment project's leading operating site, our university's innovation laboratory currently has three laboratories and one animal room, divided into two experimental platforms, with a total area of about 600 square meters. The Innovation Laboratory provides experimental sites and equipment for nearly 180 practical innovation projects each year. These projects involve basic medicine, clinical medicine, traditional Chinese medicine, prevention, stomatology, bioinformatics, and other majors. The experimental operations include the purification and analysis of traditional Chinese medicine, reagent preparation, animal anatomy, pathological section production, other basic medical practical experiments, cell culture, animal disease model establishment, PCR, and Western Blot, and other molecular biology experiments. Therefore, compared with other specialized laboratories, the innovative laboratory has more pieces of equipment and devices. The type of machines in innovative laboratory ranging from necessary equipment such as centrifuges and analytical balances to real-time fluorescence determination PCR, blood gas analyzers, atomic absorption spectrophotometers, and other specialties. Experimental equipment, equipment types, and quantities are more than general professional or subject laboratories. How to better maintain and manage these instruments and equipment is a significant difficulty in our laboratory management.

2.3. Instrument usage Frequency Uneven and Difficult to Maintain

In applying for innovative experiments, medical undergraduates have no fixed research direction. The scientific research level is still in the enlightenment stage, so it is easy to chase current medical hotspots, research directions, and experimental methods in the application of the project application. It leads to the uneven use of equipment in the use of innovative laboratory equipment. For example, cell culture, pathological section production, protein electrophoresis, and other technologies were commonly used in scientific research. Most projects require the use of PCR machines, cell incubators, refrigerated centrifuges, electrophoresis tanks, gel imagers, and other instruments. These instruments, although a larger number of lab configurations, but several groups have queued daily use items. Other highly specialized devices such as the atomic absorption spectrophotometer, sampling the atmosphere, the animal's snout systemic exposure equipment, involving a small number of these equipment items, so the frequency of useless equipment, low utilization rate, resulting in a certain level of equipment idle.

2.4. The Number and Level of Management Personnel need to be Improved

Due to many innovative laboratory instruments, equipment management personnel are often understaffed, and the equipment management team lacks training and learning opportunities. With the implementation of the national innovation strategy and the year-by-year advancement of college students' innovation and entrepreneurship projects, our school has invested much money to purchase several high-end, sophisticated, and cutting-edge imported equipment for the innovation laboratory. A lack of relevant maintenance training after purchasing the equipment to carry out an innovative and experimental pilot project of teaching activities had a negative impact.

3. Methodology

3.1. Equipment Management System Improvement

Rules and regulations are an essential part of laboratory management, an essential basis for standardized laboratory management, and a necessary guarantee for improving the quality of scientific research projects and the level of experimental teaching [5]. To improve the management level of innovative laboratory instruments and equipment, the experimental teaching management center formulated and issued a series of rules and regulations, including the "Innovative Laboratory Equipment Management System," "Innovative Laboratory Safety Management System," "Innovative Laboratory Animal Room Use and Management System." To ensure that these rules and regulations are strictly implemented, the innovation laboratory further formulated the supporting reward and punishment system "Innovative Experimental Project Credit Management System" to stimulate the experimenters' enthusiasm and enhance the awareness of complying with the rules and regulations. These rules and regulations were trained for each project participant at the launch ceremony of each year after establishing the innovative experimental project each year.

3.2. Student Assistant Collaborative Management System

To alleviate the contradiction between the shortage of innovation laboratory management personnel and the increasing number of projects entering the field each year, the innovation laboratory management team has established student assistant positions in 2014 and adopted the student assistant collaborative management model. Every year 8-10 students are selected to form a student assistant team to assist innovating laboratory management personnel and jointly participate in laboratory equipment, venues, reagents, consumables, and other management work. The student assistants responsible for managing equipment are assumed by students who have participated in the project for a long time or have extensive research experience. They are mainly responsible for the appointment

arrangement of necessary equipment, the training of the use of conventional equipment, and the inspection, maintenance, and calibration of equipment with teachers. Work, and report the damage of gear and equipment to the laboratory management staff in time.

Students' participation in the management of innovative laboratory equipment can improve students' autonomy and sense of belonging [6] and their hands-on ability and innovation ability [7], laying a foundation for students to be exposed to more professional and high-end instruments in the future. Good foundation. Since our school launched the student collaborative management model, many student assistants have obtained the postgraduate study qualifications or passed the postgraduate entrance examination for further study. Education and teaching effects have been outstanding.

3.3. Function Sub-Regional Management to Improve Equipment Utilization

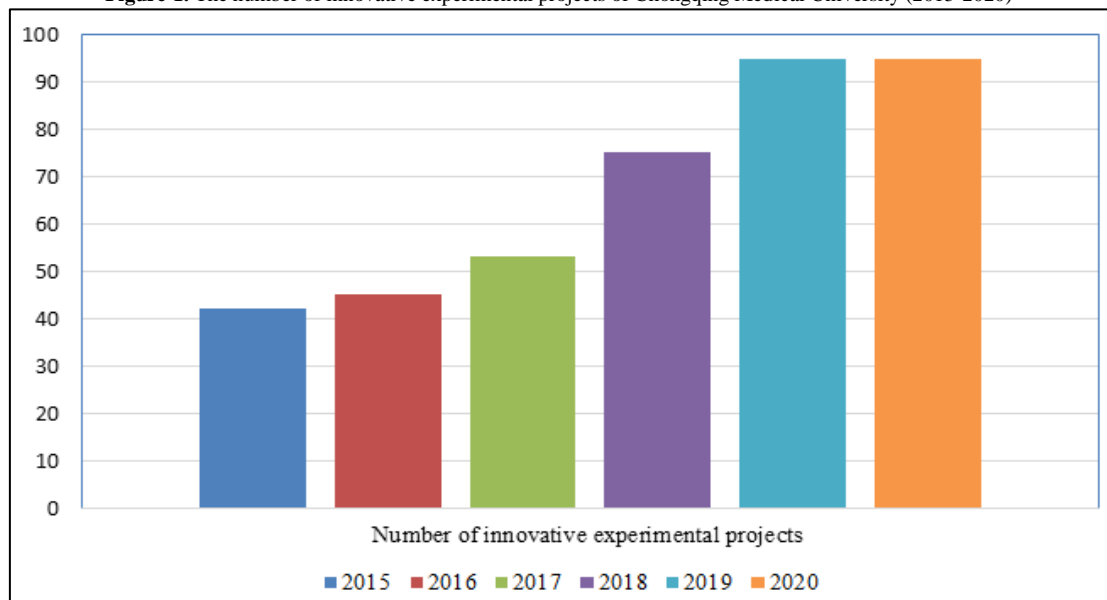
To solve the current situation of uneven use of equipment and equipment, the innovation laboratory analyzed the research content and direction of innovative experimental projects in the past five years. It carried out the original laboratory function layout and instrument configuration based on the analysis results. Now the innovation laboratory is divided into different functional areas. It contains a basic medical laboratory, molecular biology laboratory, material chemistry laboratory, animal laboratory, supplemented by the purchase of ultra-low temperature refrigerators, refrigerated centrifuges, PCR machines, and other commonly used instruments with high utilization rate to meet project requirements.

The instruments and equipment that are highly specialized, low in usage, or highly dangerous in operation were transferred to relevant professional teaching laboratories, which can be used for experimental teaching. Innovative experimental projects can also be applied for use when they need to be used. Students can operate under the guidance of experimental teachers of related majors, which significantly increases the instrument's use rate and helps improve students' instrument operation level.

4. Results

After two years of exploration and hard work, innovation laboratory management has improved significantly. The number of innovative experimental projects approved in the past two years has increased significantly compared with previous years (Fig 1). The number of project groups that the laboratory can accept at the same time has also increased from 15 groups to about 40 groups. The utilization rate of laboratory equipment has increased significantly, and the vacancy rate has decreased. Good instrument status also guarantees the accuracy of experimental data and improves the output of scientific research results. The number of papers published and the impact factor of papers in innovative experimental projects have increased year by year. At the same time, the innovative experimental project also represented our school to participate in various national science competitions and obtained excellent results.

Figure-1. The number of innovative experimental projects of Chongqing Medical University (2015-2020)



5. Conclusion

The innovation laboratory is an essential platform for undergraduates to cultivate their innovative and entrepreneurial capabilities and the starting point for medical undergraduates to enter scientific research. Improvement of the equipment management system, strengthen the construction of equipment management team, strive to improve the management level of innovation laboratory equipment, provide sufficient and powerful guarantee for the smooth implementation of innovative experimental projects of undergraduates, and contribute to the cultivation of undergraduates' innovation and entrepreneurship capabilities.

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