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Research on Management and Construction Strategy of Engineering Laboratory in the Context of New Engineering Education

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Abstract. The laboratory is an important base for the cultivation of innovative talents, and also an important condition for the construction and development of disciplines. According to the actuality of new engineering construction, the author analyzed the important role of the construction and management of high-level engineering laboratories in higher engineering education , and expounded the contents of laboratory construction and management from the aspects of management mechanism, experimental teaching reform, experimental team construction and experimental conditions construction, etc. The content creates conditions for cultivating new engineering and technical talents and promoting the construction of new engineering.

1. Introduction

Under the background of vigorous development of new economy characterized by new technology, new formats, new industry and new model, China has implemented a series of major reforms. The transformation and upgrading of industry, the transformation of new and old kinetic energy, and the promotion of future global competitiveness all put forward new and higher requirements for the training of engineering technology in our country. It calls for the construction of industry-oriented, world-oriented and future-oriented new disciplines [1]. Engineering laboratory is an important classroom for training modern engineering technicians and an important base for teaching and scientific research in universities. Therefore, universities must strengthen the construction and management of engineering laboratories, taking high-level engineering laboratories as a platform and support, to promote the construction of new engineering.

2. The Role of Laboratory In Higher Engineering Education

The laboratory is an important institution for experimental teaching, scientific research, technology development and academic exchanges in colleges and universities. It is an important base for the cultivation of innovative talents and an important condition for the construction and development of disciplines. As an important part of higher engineering education, experimental teaching is an important supplement and support for theoretical teaching, undertaking the task of cultivating students' hands-on ability and innovative practice ability. Experimental teaching plays an irreplaceable role in promoting the all-round development of students, grasping the core qualities of new engineering talents, cultivating students' design thinking and engineering thinking, enhancing students' ability of innovation and entrepreneurship, self-learning ability, communication and consultation ability and engineering leadership. It is an important embodiment of the teaching quality of higher engineering education [2].

The construction of new engineering is fundamentally the construction of disciplines and specialties. The laboratory is closely linked with discipline construction and is an important carrier and guarantee for discipline construction and development. Disciplinary construction and specialty construction can promote the good operation of laboratory, which in turn can promote the development of the supported disciplines and specialties. Practice has proved that high-level

laboratories are fertile ground for cultivating high-level scientific research content and achievements, and the development of scientific research in universities depends on the construction of laboratories [3].

3. Contents of Laboratory Construction and Management

Laboratory construction and management is a systematic project. The construction of engineering laboratories should serve the needs of new engineering personnel training and scientific research. According to the specialty characteristics, discipline needs and social needs, the following five aspects should be planned as a whole and scientifically laid out.

We should take the innovation of laboratory management mechanism as the core, do a good job in the top-level design of laboratory, optimize the laboratory management mechanism, explore new mode of laboratory operation, and establish the planning and objectives of laboratory construction.

By means of deepening the reform of experimental teaching, we should reform the experimental teaching methods, determine the subject position of students in experimental teaching, exercise students' comprehensive practical and innovative abilities, and cultivate engineering application-oriented talents in line with the development of the times.

To strengthen the construction of laboratory team as the key, we should improve the overall quality of the experimental staff, mobilize the enthusiasm of the experimental team, and give full play to the important role of the experimental team in experimental teaching, scientific research and laboratory construction.

With the improvement of laboratory conditions and safety construction as the guarantee, we should increase investment in experimental instruments and equipment, improve laboratory configuration, experimental quality and experimental environment, strengthen laboratory safety management, and ensure the safe and orderly operation of laboratories.

We should vigorously promote the process of laboratory management informationization, utilize the advanced computer technology to manage and build laboratory platform to realize the informationization, modernization and networking of laboratory management.

4. Strategies for Laboratory Construction and Management

At present, there are still many problems in engineering laboratories in colleges and universities, which are mainly manifested in the following aspects: inadequate management, lack of perfect management system and operation mechanism; outdated experimental teaching content and backward teaching methods; lack of full-time laboratory staff, the overall theoretical and scientific research level of laboratory staff is lower than that of teaching staff; the daily management of the laboratory is not in place, the experimental instruments and equipment are insufficiently invested, hidden dangers exist in laboratory safety management, and the level of laboratory information management is not high. In combination with the current situation of our university, the following reforms and innovations are required for the construction and management of engineering laboratories[4].

4.1. Establish a Perfect Laboratory Management System

Whether the laboratory management system is perfect or not is directly related to whether the laboratory can give full play to its functions, so as to better serve teaching and research. At present, our school has basically established the secondary management system of the laboratory, and established the asset management department as the central management department of the teaching laboratory construction, which is fully responsible for the construction and management of the teaching laboratory and promotes the implementation of various tasks. The college is specified to be the main body of the laboratory construction and management, the secondary management system of the school and the college is further straightened out, and the linkage situation of the laboratory construction is basically formed.

Colleges and universities should also establish sound and reasonable rules and regulations according to their own development, strengthen system management, and make laboratory construction and management more scientific, normalized and standardized. Based on the “Lab Work Regulations of Colleges and Universities”, our school has established and improved a series of teaching laboratories rules and regulations . Every college also combines its own professional characteristics to improve the management rules and regulations, and to hang the rules and regulations on the wall to ensure that there are regulations to obey and there are rules to follow.

There are many large-scale instruments and equipment in engineering laboratories. It is necessary to consider the principle of comprehensive benefits, break barriers and partition between laboratories, optimize the allocation of resources, and promote the integration and sharing of laboratory resources. Our school has issued the “Measures for the Open Management of Large-scale Instruments and Equipments of University of Jinan”, established a large-scale instrument open sharing platform, and gradually promoted the sharing of instruments and equipment.

4.2. Establish a Perfect Laboratory Management System

The traditional experimental teaching emphasizes theory rather than experiment. Teachers are the main subjects and experiments are mostly confirmatory experiments. Such experimental teaching mode hinders students' independent thinking and creativity, and it is difficult to cultivate innovative engineering talents to meet the needs of society. Therefore, it is necessary to reform the previous experimental teaching system, with students as the main body to plan the experimental content; improve teaching methods, enhance the interaction between teachers and students; promote the deep integration of information technology and education, innovate engineering practice teaching methods; and reform the content and system of experimental assessment. A learner-centered engineering education system can be formed, to cultivate students' ability of continuous learning, independent research and development and innovation and entrepreneurship.

4.3. Strengthen the Construction of Laboratory Teams

Laboratory team consturction is the key to laboratory construction and personnel training. At present, the engineering experimental team of our university includes teachers and experimental technicians. In the past, due to some historical problems, the professional level of laboratory team is uneven.The full-time laboratory staff is scarce and the overall treatment level and status of laboratory team is lower than that of theoretical teachers, which hinders the enthusiasm and initiative of laboratory team. In view of the current situation, we can strengthen and improve the construction of the experimental team from the following aspects.

4.3.1. The Experimental Teams.

The training of modern educational concepts and practices should be strengthened, and multi-level, multi-channel training mechanism for experimental teams should be explored. It's necessary to improve their professional ability and theoretical level through training in the form of enterprise practice, degree refresher and overseas research.

4.3.2. The Structure of Experimental Personnel.

The school formulates relevant policies and improves the structure of experimental personnel. High-level talents should be introduced into the laboratory to participate in laboratory construction, and meet the needs of personnel training and teaching and research under the construction of new engineering.

4.3.3. The Reform of Experimental Personnel System.

Deepening the reform of personnel system; improving the management and assessment mechanism of experimental personnel; reforming the title evaluation and employment system of experimental technicians; mobilizing the enthusiasm, initiative and creativity of experimental technicians; and improving the treatment and status of experimental teams.

4.4. Improving Laboratory Condition

A good experimental environment is an objective requirement to ensure the quality of experimental teaching, scientific research level, laboratory safety and normal operation of management. Laboratory conditions mainly include: experimental instruments and equipment, laboratory environment and laboratory safety management.

4.4.1. Improve the Experimental Facilities and Increase Investment in Experimental Instruments and Equipment.

To strengthen the construction of engineering laboratories, we should first increase the investment in laboratories. The enrichment, renewal and maintenance of experimental instruments and equipment are the powerful guarantee for the improvement of teaching and scientific research experimental ability.

4.4.2. Laboratory Environment is an Important Index Reflecting the Level of Laboratory Construction.

Clean, tidy and excellent experimental environment reflects the normalization and standardization of laboratory daily management. It can also reduce the hidden dangers of laboratory safety and ensure the orderly development of experimental teaching and scientific research[5].

4.4.3. Laboratory Safety is the Most Important Work in the Laboratory.

There are many large-scale instruments in high-end equipment and dangerous chemicals in engineering laboratories. We should resolutely implement the principle of “safety first, prevention first, comprehensive management”, strengthen safety education and enhance awareness of prevention. At present, our school has established a standardized laboratory safety inspection system, and adhered to the three-dimensional, all-round laboratory safety inspection system of the laboratory inspectors, the college inspection, the school regular sampling, and the safety of the laboratory. The School Asset Management Office has set up a platform for laboratory safety examination system, implemented laboratory safety education, training and access system, and brought laboratory safety into the benign track of standardized and institutionalized management.

4.5. Accelerating the Informatization Process of Laboratory Management

With the wide application of Internet accelerated speed technology, information technology and virtual simulation technology, the management of laboratories should be developed in the direction of intelligence[6]. The functions of experimental teaching, laboratory opening, experimental equipment statistics, safety management and data statistics should be realized through the network platform. Our school has completed the construction of fixed assets management system, large-scale instrument and equipment sharing platform, laboratory information statistics system, laboratory safety testing system and reagent material procurement platform, which greatly improves the management efficiency of the laboratory.

5. Conclusion

Under the background of new engineering construction, university engineering laboratories must seize the opportunity, deepen reform, and innovate ideas. The work of laboratory construction should be carried out around laboratory management mechanism, experimental teaching reform, experimental team construction, experimental condition improvement and information management. The laboratory construction provides reliable guarantee and development motivation for scientific research and higher engineering education.

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