

Stimulate the Sense of Ownership of Experimental Technicians to Help the Cultivation of Talents in University - Taking the College of Environment and Energy of Zhejiang Guangsha Vocational and Technical University as an Example

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Abstract

A high-level experimental technical team is the cornerstone of experimental teaching and scientific research. When building the experimental technology team, colleges and universities adopt diversified training mechanisms to improve their comprehensive quality, motivate them to participate in teaching practice and teaching reform, establish platforms for the use of large-scale instruments and equipment and safety guarantee system, stimulate their sense of ownership to mobilize their enthusiasm, and give full play to the role of experimental technicians in the cultivation of high-quality talents.

Keywords

Laboratory technicians; Talent development; Laboratory teaching; Laboratory science.

1. Introduction

Since the Central Leading Group for Comprehensively Deepening Reform adopted the Overall Program for Coordinating and Promoting the Construction of World-class Universities and First-class Academic Departments [1,2], the construction of “double first-class” has become an important development direction of higher education. In the construction of “double first-class”, not only the first-class teaching environment and equipment are needed, but also the construction of first-class experimental technology team is more crucial. Laboratory technicians in universities are the main body of laboratory equipment management and use, and also provide important guarantee for scientific research and talent cultivation [3].

Currently, most university laboratory technicians have master's degree or even doctoral degree, with solid professional knowledge and high professional quality. However, the policies on training, promotion and incentives to match the construction of high-level experimental technology team are not yet perfect [4]. Some colleges and universities still treat experimental technicians as teaching assistants, and the phenomenon of marginalization of experimental technicians is common, which is obviously not in line with the purpose of the construction of “double first-class” colleges and universities, and also seriously impedes the pace of the construction of first-class experimental technology team [5]. Therefore, how to stimulate the sense of ownership of experimental technicians, that is to say, to improve their professional quality, mobilize their work enthusiasm and improve their work efficiency, has become the primary problem that needs to be solved urgently for the construction of high-level experimental technicians who can adapt to the development of “double first-class” colleges and universities [6,7].

Taking the construction of the experimental technology team in the College of Science of Zhejiang Guangsha Construction Vocational and Technical University as an example, this paper describes how the College of Environment and Energy has enabled the quality of undergraduate teaching to be efficiently improved by cultivating and stimulating the sense of ownership of experimental technologists in their work, thus helping the cultivation of talents in colleges and universities [8,9].

2. Open Up Diversified Training Channels to Improve Comprehensive Quality and Feed Back Into Teaching

In recent years, the construction of disciplines has led to significant improvements in the laboratory environment and instrumentation, but the comprehensive quality of laboratory technicians is often neglected. Some colleges and universities due to the poor professional ability of experimental technicians, backward management, resulting in idle instruments and equipment, hardware investment benefits cannot be effectively played. Therefore, improving the overall quality of the experimental team is a key link in the construction of first-class laboratories. In view of this, the College of Environment and Energy to actively introduce highly educated laboratory technicians, has formed a trapezoidal academic structure of high-level experimental technology team. At the same time, according to the requirements of "National Experimental Teaching Demonstration Center Management Measures", the college has set up a special class of professors as the experimental teaching steering committee to provide support for the establishment of high-level experimental technology team. Firstly, the experimental technicians are counseled in professional and technical aspects to improve their professional knowledge; secondly, the experimental technicians are trained for the newly opened experiments or new technologies, instrument and equipment maintenance and method development, intelligent technology application and safety education; finally, the college also promotes multi-channel and multi-form professional skills by means of on- and off-campus training, short-term further education, conference exchange, etc. training activities. This series of initiatives not only broaden the horizons of experimental technicians, but also strengthen their sense of innovation, so that their comprehensive quality can be rapidly improved, and feed back into the experimental teaching.

3. Helping Undergraduate Laboratory Teaching and Reform to Comprehensively Improve Teaching Quality

3.1. Participation in undergraduate laboratory teaching to improve laboratory teaching efficiency

Undergraduate laboratory teaching is a complex and comprehensive work, which involves not only the experimental teaching sessions, but also the guidance of experimental design, the operation and demonstration of experimental instruments and equipment, and fault maintenance. This requires close cooperation among teachers, laboratory technicians and students. Laboratory technicians are involved in the whole process of experimental teaching, including pre-course preparation, teaching implementation and post-course summarization, and their professional quality directly affects the quality of experimental teaching. For the experiment, a teacher has to face 20 to 30 students for explanation, operation demonstration, as well as guidance and inspection, often overwhelmed, it is difficult to do everything, when encountered in an emergency situation is even more distracted. Laboratory technicians can find out the problems encountered by students in the experiment in time and give guidance in theory and practice. Therefore, the laboratory technicians are the competent helpers of the laboratory teachers, not only timely and effectively make up for the shortcomings of the

teachers in teaching, but also fully realize the teaching concept of “student-centered”, and provide assistance for high-quality talent cultivation.

3.2. Participate in experimental teaching reform to enrich and innovate the teaching mode

3.2.1. Reform and practice of teaching methods

At present, the experimental teaching in some colleges and universities is still dominated by teachers lecturing first and students operating mechanically, with students lacking active thinking and weak creativity. Starting from the actual curriculum, the college encourages experimental technicians to actively apply for teaching reform projects, explore new teaching modes and promote experimental teaching reform. Microcourse is a new teaching mode with short video as the carrier, which is widely used in experimental teaching by virtue of its advantages of prominent theme, vivid form, short and concise. This not only makes the teaching form more diversified and intelligent, but also breaks through the space limitation and becomes a powerful supplement to classroom teaching. In the experimental courses for non-specialties, students have different knowledge backgrounds, and it is very easy to make mistakes or irregular operations, resulting in damage to instruments and equipment or even experimental failure. Laboratory technicians take advantage of their work to record the use of instruments and equipment, experimental operations into micro-videos and share them with the learning group, so that students can study the experimental content in advance, and then the teacher can answer questions and consolidate their knowledge in the classroom. After two academic years of teaching reform practice, students' feedback on this method is good, and students' classroom response and teaching evaluation are significantly improved. Obviously, this kind of pre-study method can effectively stimulate students' active learning consciousness, thus effectively improving the effect of experimental teaching.

3.2.2. Reform and practice of experimental content

Laboratory teaching, as a practical platform combining theory and practice, reflects the level and quality of teaching [6]. In the experimental teaching for biology majors, experimental technicians carry out multi-angle reforms on the basis of previous experiments, introducing methods and techniques commonly used in professional research, so that the original teaching content and professional knowledge have achieved a good convergence. For example, in the decompression distillation experiment, magnetic heating and stirring method instead of capillary method, to avoid the students cannot quickly and accurately intercept the required length of the capillary tube as well as due to the distillation process of the capillary tube breakage caused by the predicament of the experiment cannot be carried out; in the melting point determination experiment, in addition to the use of the Tiehler tube determination, but also added a closer to scientific research microscope melting point instrument to determine the melting point of the experimental links; in the organic separation and purification experiments. In the organic separation and purification experiments, the introduction of thin-layer chromatography detection means, realizing the effective connection between teaching and scientific research; in the water vapor distillation of volatile oil experiments, anise oil and pepper oil comparison experiments, through direct condensation to obtain pepper oil, instead of flammable and explosive hazardous materials, ether extraction of volatile oil, thus eliminating the laboratory safety hazards.

3.3. Guiding college students' innovation practice to help cultivate innovative talents in colleges and universities

The cultivation of innovation and entrepreneurship ability of college students is related to the development of the times and the direction of the society. For professional students, the vast majority of innovation and entrepreneurship projects need to be completed in the laboratory,

so the laboratory technicians play an important role. Laboratory technicians realize the resource sharing between teaching and research laboratories by exerting their own professional advantages and increasing the opening of research laboratories. Through project design, interest guidance, inside and outside the classroom linkage, etc., they train students from various aspects such as professional technology, teamwork, communication ability, etc., and at the same time, they also expand their own research direction, realize the intersection of disciplines and promote the construction of disciplines, exploring an effective way for the training of innovative talents in colleges and universities. In the past two years, the experimental technicians have guided students to win a number of innovative practice projects for university students in Jinhua City.

3.4. Establishment of a platform for the use of large-scale instruments and equipment to enhance students' practical abilities and standards

In the past, the experimental teaching of large-scale instrumentation basically used on-site explanation and demonstration by teachers, with the whole class of students watching at the same time, which is difficult to ensure that each student has a comprehensive and in-depth understanding of instrumentation; coupled with the limitations of classroom time, teachers seldom discuss in depth the working principles of instrumentation and technical applications, resulting in insufficient understanding of the ability of instrumentation to solve scientific research problems. On the basis of the original undergraduate experimental teaching, the college has added large-scale instrumentation such as gas chromatography, high-performance liquid chromatography and Fourier infrared spectrometer into the experimental teaching of analysis and organic synthesis, so that the students can independently arrange their experimental schedules under the systematic training and guidance of the experimental technicians and carry out in-depth investigations and attempts. At the same time, students can learn the working principle and usage of the instruments and equipment with on-line operation, which improves their practical ability and level. In addition, the laboratory technicians reform the experimental teaching system according to the characteristics of the discipline, the differences in specialties, the actual needs of scientific research and the learning effect, and increase the open experiments with flexibility and explorability.

4. Practicing Laboratory Safety to Ensure Smooth Experimental Teaching and Learning

4.1. Conduct job security and practice laboratory safety

Laboratory in colleges and universities is the main position of experimental teaching and scientific research, and laboratory safety is the prerequisite and guarantee of talent training and scientific and technological innovation. Laboratory safety risk, very easy to fire, explosion, poisoning, burns and corrosion and other accidents, is the focus and difficulty of university safety work. Laboratory technicians, as laboratory managers, should strengthen the training of safety knowledge and ability, and effectively improve the ability and level of laboratory safety management in colleges and universities. At present, laboratory technicians have passed the special equipment training and obtained the special equipment operator certificate issued by the Beijing Municipal Market Supervision Administration. The safety work of laboratories with different functions has both commonality and specificity. While standardizing the management of laboratories, laboratory technicians should modularize and differentiate the safety work to connect with different courses, so as to make safety education an indispensable link in the process of experimental teaching, and to create a good experimental teaching environment for teachers and students.

4.2. Standardized assessment system quantitative assessment system to stimulate the growth of laboratory technicians

A high-level experimental technology team should be built on a fair and scientific assessment system, therefore, standardizing the assessment system and quantifying the assessment system is an effective measure to stimulate the enthusiasm and innovative vitality of experimental technicians. The experimental technology and management work involved in the four experimental courses offered by the College of Environment and Energy, Inorganic, Analysis and Physics are quite different, and at the same time, there are a lot of uncertainties in the open-type and inquiry-type experiments as well as the scientific research work, therefore, the work of the experimental technicians is tedious and the quantitative assessment is very difficult. In recent years, the College of Environment and Energy has adopted initiatives such as basing on the experimental content and class hours, distinguishing the fixed teaching content from exploratory experiments, etc., to make the experimental work more concrete, clarify the responsibilities and business boundaries of the personnel in different positions, and enable them to carry out more professional and scientific research explorations while efficiently completing their work. At the same time, the School of Environment and Energy also quantifies the work of experimental technicians involved in the open management of large-scale instrument and equipment platforms, laboratory safety supervision, student management, undergraduate thesis counseling, etc., so as to make it related to the performance and annual appraisal, to establish a horizontal comparison of job scales, and to improve the internal competition mechanism. In addition, the College of Environment and Energy also implements a reward and punishment system, and the assessment results are consistent with the evaluation of excellence and title promotion, practicing the principle of unity of contribution and benefit, fully mobilizing the enthusiasm and innovation power of experimental technicians, so as to effectively improve the overall quality of the team.

5. Conclusion

Laboratory teaching is an important part of higher education, and high-level and high-quality laboratory technology teams are indispensable for laboratory teaching in first-class colleges and universities. Therefore, through scientific and effective measures to cultivate the sense of ownership of experimental technicians, motivate them to actively participate in experimental teaching and experimental teaching reform while completing laboratory safety management and experimental preparation work, and constantly explore new experiments, write teaching materials and develop and use large-scale instrumentation, so as to provide strong support for improving the quality of experimental teaching and guaranteeing the safety of the teaching process. At the same time, a scientific assessment system is established to actively promote the experimental technology team to play a greater role in talent cultivation and scientific research in the university.

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