

## Theoretical and Practical Research on Boosting the High Quality Development of Higher Education by Technical Service Support System

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### Abstract

Based on the development trend of higher education and society's urgent demand for cross-compound talent training, the paper proposes to change the status quo of teachers and students' weak innovation consciousness of practical teaching, lack of modern testing skills and weak ability of designing comprehensive innovative experiments by constructing the technical service support system and empirical analysis. On the basis of the optimization of experimental teaching conditions, constructing technical service support system and its connotation, the subjective initiative of teachers and students should be brought into full play, and the practical ability and operation ability of teachers and students should be further enhanced to enlighten their scientific and technological thinking. Then promote the construction of a hierarchical progressive system of experimental teaching in our university from basic experiments to comprehensive experiments and innovative experiments, and realize the high-quality development of higher education.

**Key words:** Technical service support system; Experiment teaching optimization; Innovation ability; High-quality development

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“To do a good job, you must sharpen your tools.” Scientific and technological resources, especially experimental technical team and high-end instruments and equipment, are important high-quality teaching and scientific research resources of colleges and universities, and are an important part of the construction of technical service support system (Han, 2020, pp.87-89).Colleges and universities in developing science at this stage, however, carries out collaborative innovation, bravely at the peak of science and technology, and focus on the introduction of scientific and technological personnel and research results of quantitative output, ignoring the university soft power, which is the basis for scientific research and technical service support system construction. The level of the technical service support system and ability has far lagging behind the overall development of higher education, which leads to the phenomenon of “Top-heavy, unstable foundation and limited development” in scientific innovation research.

### 1. THE SIGNIFICANCE OF THE CONSTRUCTION OF TECHNICAL SERVICE SUPPORT SYSTEM

The technical service support system is the basic condition guarantee system that strengthens the ability and level of the experimental technical team as the construction core and standardized management as the carrier, and provides high-quality testing and analysis services for university teaching, scientific research, talent training and social services. Its specific form is the high-level experimental technology operation team built by relying on the “school-college” two-level instrument and equipment intensive management platform. Construction of the system is a comprehensive and efficient way to improve experiment teaching quality, improve education quality and represent the connotative development, extend the social influence and serve the local economy development. Colleges

and universities are basic research, applied research and innovations of productivity development. Construction of technical service support system is the key solution to “their” original important basis and prerequisite for scientific problems.

## **2. THE MAIN PROBLEMS EXISTING IN THE CURRENT TECHNICAL SERVICE SUPPORT SYSTEM**

Technical service support system plays an extremely important role in experimental teaching, scientific research, high-end technical personnel training, social services and other aspects of university. How to effectively play its basic support and output effects in discipline construction? It has always been a hot and challenging issue in the work research of the administrative departments of colleges and universities in China to exert its important role in practical education, cultivation of top-notch innovative talents, distribution of national scientific and technological resources and production of original scientific and technological achievements from 0 to 1 (Zhou, et al, 2019; Gao & Sun, 2019). After sorting it out, the main problems in the construction of the technical service support system are as follows.

### **2.1 The Professional Service Ability of the Experimental Technical Team Is Not Strong**

At present, many colleges and universities pay little attention to the introduction of high-end talents, salary embodiment, professional title evaluation and other aspects of the experimental technology team, and have not carried out the construction of the system to keep pace with The Times, resulting in the experimental technology team level is not high, the stability of the team is poor (Feng, 2014, pp.133-136). In addition, due to the lack of a clear division, half of the series of experiment technology personnel is responsible for both the experimental teaching and laboratory safety, equipment management, and report relevant data such as work, which causes the class level and skills of staff care themselves, so that the personnel can operate high-end equipment and high level operation personnel are relatively scarce. In addition, some colleges and universities ignore the construction of experimental technical team, and assess it together with the administrative personnel for evaluation and assessment. As a result, on the one hand, the grass-roots experimental technical personnel lack a sense of identity, sense of gain, and the enthusiasm, creativity and independent initiative of work is not high, which leads to the introduction of high-level experimental technical personnel ;On the other hand, due to the lack of identity, it is difficult to promote and transfer laboratory technicians, which makes it difficult to achieve the high-level construction of the laboratory technical team.

Owing to the lacking of high levels of the experimental technical team and the fact that a large number of high-end equipment bought no one operation or maintenance management, which leads to currently unable to use modern advanced analysis and test method in the teaching practice. So it is difficult to carry out the relevant high-order skills training operation for undergraduate students, graduate students and young teachers, which seriously hinders the teachers and the students practical ability, the cultivation of innovative consciousness and innovative ability and innovative ascend.

### **2.2 Weak Ability of Laboratory Cross Fusion and Practical Education**

Instruments and equipment are the core educational resources of laboratories in colleges and universities, the important basic conditions of training experimental teaching and practical talents, and the main media for cultivating technical and innovative talents in colleges and universities. At present, college undergraduate teaching laboratories mainly carry out basic experiments. Limited by funds, they are often unable to purchase large-scale instruments and equipment, and can only undertake some basic general knowledge and verification training. However, research laboratories, mainly relying on the subject construction, talent introduction, expenditure, more ample funds, often can purchase some large-scale precision instruments and equipment for scientific research. Due to the specialized operation of instruments and equipment, group scientific research task, the lack of personnel management operation and so on reasons, it is impossible to effectively share technical services. As a result, the functions of laboratory integration and practical education are artificially blocked, which hinders the cultivation of students’ interest in scientific research and the planning of academic career, and hampers the cultivation of first-class undergraduates and top-notch talents.

### **2.3 Serious Scattered and Fragmented Management of High-End Instruments and Equipment Resources**

Of instruments and equipment purchase of such expenses for colleges and universities is allocated according to the hat, head, and ever situation of “cake” model is given priority to, the school will funds allocated to the secondary unit, secondary units in order to avoid the contradiction, that is allocated on a per head or team again, this is valuable equipment at present most professor in a few individual laboratory (Sun, Gao, & Ren, 2014). As the sharing of high-end instruments and equipment is a comprehensive and refined project across units and industries, it also involves a series of issues such as relatively in-depth resource allocation mechanism, condition guarantee construction and professional team construction, etc.so the driving force of sharing work is complicated. The high-end instruments and equipment

scattered in professors' laboratories obviously cannot meet the conditions and requirements for long-term external shared use, which leads to the phenomenon of low overall equipment utilization rate, low resource sharing degree and poor output efficiency in universities and colleges (Li, et al, 2019; Wu, & Li, 2020). According to statistics, the sharing rate of high-end instruments and equipment deployed in colleges and universities is only 10%, and the phenomenon of "no need, no use, no use" of large-scale instruments and equipment is still very common in colleges and universities (Hao & Yan, 2015).

In addition, due to the lack of overall planning of funds, colleges and universities are unable to form a joint effort to purchase super-large equipment that leads the development of disciplines or plays a decisive role in teaching and scientific research.

#### **2.4 The Technical Service Support System Is Subject to Many Restrictions in Personnel Education**

Technical service support system includes tangible equipment resources and intangible experimental technical personnel operating skills or testing capabilities and other intellectual resources. Due to the lack of high-end equipment operators, the lack of rewards and punishment mechanism or blocked promotion channels for professional titles, the technical service support system can not effectively develop domestic advanced experimental teaching demonstration operation or foreign technical service, training, communication, etc, resulting in a large number of teachers and students for this current science, or related interdisciplinary high-end apparatus are rarely seen. Not to mention having direct access to or operating these high-end devices (Zhang & Zheng, 2019; Li, 2012). In addition, it also makes some teachers, especially young teachers, miss the golden age of scientific research and quantitative output due to the lack of equipment and resources in the early stage of work (Wu, Li, & Liu, 2020).

In today's "one-skill" and "all-rounded" talent cultivation atmosphere, society and enterprises have higher and higher requirements for students' operational level, the lack of technical service support system will inevitably seriously weaken the competitiveness of college graduates in the society; At the same time, it will also affect the cultivation of students' interest in scientific research and innovation and academic career development planning, and hinder the cultivation of students' innovation consciousness and science and technology enlightenment education.

### **3. INNOVATIVE MEASURES FOR THE CONSTRUCTION OF TECHNICAL SERVICE SUPPORT SYSTEM**

On the one hand, a large number of large-scale instruments and equipment are idle and the utilization rate is not

high, and the contradiction between supply and demand is prominent due to the scattered investment of funds, purchase of more low-end equipment, lack of instrument and equipment operators or lack of effective instrument and equipment management performance reward and punishment mechanism. On the other hand, due to the lack of access to the most advanced testing technology and methods, teachers and students have no strong sense of innovation and cannot support or resonate with advanced science and technology, resulting in poor innovative thinking and international competitiveness in the field of science and technology. The specific form of the technical service support system is the high-level experimental technical operation team relying on the construction of the "university-college" two-level instrument and equipment intensive management platform. Its ability and level represents the innovation ability and scientific research level, which can be improved from the following aspects.

#### **3.1 The Organizational Connotation of the Construction of Technical Service Support Management System**

The construction of technical service support system is not just a simple matter of moving high-end instruments and equipment together and placing them centrally and arranging personnel to manage them. The problems involved in its construction are relatively complex. Existing high-end equipment such as how to keep, how to plan new equipment as a whole, how to build to meet the requirements of different disciplines and high-end equipment placed ground, "schools -" how two level instruments and equipment intensive management platform, platform construction and management how to configure personnel how to promote stability, how to ensure high-speed operation platform, the most important thing is how to make the school decided to put last A series of new problems such as construction need to be put forward, discussed and solved. Therefore, it is necessary to sort out the connotation and essence of the construction of the technical service support system, so as to form a linkage and explore the construction scheme of the technical service support system of colleges and universities in the form of standardized management and operation through comprehensive reform.

#### **3.2 Construct the Construction Mode of High-Level Experimental Technology Support Team**

To give full play to the benefits of instruments, people are the key, and performance management is the core of personnel management. Therefore, it is necessary to build a high-level, professional testing and analysis team and strengthen the top-level design in the laboratory resource layout and personnel allocation, to reform the personnel management system and personnel training and promotion mechanism of laboratory technology, and highlight the embodiment of the extra test workload of laboratory

technicians, and actively explore new methods and approaches to improve the operational skills of laboratory technical professionals and evaluate and employ professional titles. On the basis of strengthening the communication and exchange between the two sides of the test demand, the operation level and capability of the technical service support system should be continuously improved, and the transformation level of scientific and technological achievements should be raised. In addition, we should strengthen the construction of the cultural connotation system with the construction of craftsman spirit as the core, constantly improve and enhance the technical service support system, and form a positive, willing to contribute and brave to bear the burden of the work culture.

### **3.3 The Construction of the “School-School” Two-Level Instrument and Equipment Intensive Management System**

For internal common and prominent problems in colleges and universities such as experiment site scattered, strained resources by relocating houses repeatedly, and equipment safety, colleges and universities should reform the existing management mode and inherent ideological barriers, integration of laboratory equipment, sites, personnel and other resources, and strive to break the education between college and research resource fragmentation, regime change management status, and construct several interdisciplinary interdisciplinary “university-college” two-level intensive management platforms for instruments and equipment. Through the unified integration and standardized operation of platform resources, the overall planning of newly purchased equipment, the revitalization of existing equipment, the rational allocation and effective utilization of scientific and technological resources, and the reduction of repeated construction and inefficient allocation of experimental buildings of similar disciplines, high-end instruments and equipment, and operation and management personnel. It provides strong conditions for teachers and students to carry out interdisciplinary research, practical teaching operation skills training and innovative experimental design.

### **3.4 Strengthen the Cross Fusion of Basic Conditions of Laboratory Education**

Through the internal mechanism and system reform, we strive to break the barrier between undergraduate teaching laboratory resources and scientific research laboratory resources, and realize intensive management and effective integration of laboratory resources. At the same time, undergraduate students, graduate students and young teachers are actively encouraged to join the effective way of applying and popularizing modern analytical testing methods, and explore the effect of this work on the innovative ability, innovative consciousness and practical ability of teachers and students. In the promotion of teachers and students innovation ability, innovation

consciousness and practical ability at the same time, for the society to train more high-level, high operational ability of backup technical force, for the future of the construction of expert technical team to lay a solid foundation.

In addition, through channels such as sharing and use of high-end instruments and equipment, experimental technical personnel should be designated to conduct relevant technical lectures and operation training, so as to further improve the testing and analysis ability of the technical service support system, and to stabilize the testing team by exploring the construction of internal ranks of experimental technical personnel on the platform. Continue to contribute to the output of high-level teaching and research achievements and enhance the social influence of colleges and universities.

### **3.5 Creating a New Model for Cultivating Top-Notch Innovative Talents**

While constructing the quality level of the technical service support system, we should explore the benefits and achievements of the technical service support system. By combing skills training and research interest cultivation, students are encouraged, under the guidance of the research team and the teachers of the research group, to actively connect with various national science and technology plans and college students’ innovation and entrepreneurship projects. And we should strive to realize the early entry of students into the subject, laboratory and team, and research on “three in and three out” innovative top-notch talent training mode of early achievement, early achievement and early talent. Then closely docking with the trend of social development, while meeting the personalized development needs of students, explore new ways of cross-compound talent training, improve the cultivation system of top-notch talents in colleges and universities, and realize the high-quality development of education.

## **4. THE EFFECT OF OUR SCHOOL’S TECHNICAL SERVICE SUPPORT SYSTEM CONSTRUCTION**

Through the construction of technical service support system, our school has stabilized the experimental technical team, improved the overall level and service ability of the experimental technical team, improved the scientific and technological innovation ability of teachers and students, improved the input-output efficiency of scientific and technological resources of our school, and promoted the high-quality development of our school’s education.

### **4.1 It Has Greatly Improved the Scientific Research and Innovation Ability of Teachers and Students in Our School**

Through the construction of technical service and support system, the scientific and technological innovation ability

of teachers and students in our school has been greatly promoted. According to statistics, the technical service and support system of our school has served more than 117,700 teachers and students in the past four years. Relying on the technical service support system, teachers and students have published 5,062 papers, won 194 national provincial and ministerial awards, and it trained more than 13,000 teachers and students in total. The above indicators have increased by 1.70 times, 1.33 times and 7 times respectively in four years, as shown in Table 1.

**Table 1**  
**Comparison table of performance indicators of technical service support system in recent four years**

	Instrument Testing Service (Number of times)	Support high-level paper publication (paper)	At the provincial and ministerial level Awards (one)	Operator training number of teachers and students (person)
The year in 2018	15290	695	14	1548
The year in 2019	26610	1303	28	4296
The year in 2020	34560	1444	39	3518
The year in 2021	41244	1620	113	3632

#### 4.2 Greatly Improved the Level and Ability of the Experimental Technology Team in Our School

Our university creatively divides the experimental technical team into experimental teaching, laboratory management and public platform service. According to the characteristics of different positions, the experimental technical team is classified and evaluated, and the corresponding professional title promotion assessment system of "make full use of talents" is set up. Like to be responsible for the public service platform to provide technical service or operation management of large-scale instruments and equipment experimental technology post, and review focuses on the assessment of the operation of the equipment level, function, development and service for teachers and the students scientific research achievements, etc., while they do not examine oneself research results, to guide the class personnel to improve operating level, to provide quality services.

In addition, our school has also opened up the professional title evaluation channel for professor-level experimental technical personnel, which has made a beneficial attempt for the construction of high-level experimental technical team and the stabilization of experimental technical team. In 2016, our university achieved a breakthrough in the evaluation and employment of professor-level laboratory engineers. So far, 5 professor-level laboratory engineers have been promoted in total. All of them are responsible for and participate in the sharing of large instruments and equipment in our university, which are the leading force and excellent construction achievements of our university's technical service support system.

#### 4.3 The Use Efficiency of High-End Instruments and Equipment in Our School Has Been Greatly Improved

The construction of technical service support system has realized the special management of high-end instruments and equipment in our university, greatly improving the utilization rate and sharing rate of high-end instruments and equipment. According to statistics, from 2018 to 2021, the annual operating time of large-scale instruments and equipment in our university has increased from 982.19 hours to 2676.36 hours, and the proportion of large-scale instruments and equipment with 800 hours or more per year has increased from 26.42% to 82.45%.

### 5. THE CONCLUSION

In order to build the technical service support system with the construction of Craftsman spirit as the core, our school constantly improves and improves the technical service support system of our school through the sharing of large-scale instruments and equipment, the construction of experimental operation technical team and the construction of team culture on the basis of integrating the educational resources of laboratory sites, equipment and personnel. The problem of effective integration and mutual promotion of scientific problems, technical personnel and large-scale equipment has been solved. At the same time with "schools -" two level instruments and equipment intensive management platform as the main carrier, it activate the laboratory and its internal resources in the positive energy, on the basis of improving the teachers and students and off-campus technical service support system level and ability of the user, to cultivate the teachers and students scientific research interest and enhance the school innovation and service ability of local economic development, which has realized the goal of cultivating top-notch teachers and students and high-quality development of cross-disciplines.

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