Laboratory Construction Mode and Resource Utilizing of Local Universities

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***Abstract*—There are many troubles existing in the lab construction and lab resource utilizing in the local colleges and universities, especially the newly established local ones. Some of the distinct problems are repeated construction, such as blindfold pursuit for the advanced equipment and instruments, single function labs and low equipment utilization ratio. This paper proposed a new kind of laboratory construction mode: resource integration, school-enterprise coalition, research-education combination. Through the construction practices of the Practical Education Center of Mechanical Design-Manufacturing and Control of Hunan Industry of Science & Technology(HNIST), it shows that the construction mode presented above reveals excellent operability and effectiveness. This study was designed to guide the local newly-established universities attaching much importance to the efficient use of the laboratory resources. This research is also helpful to train the high quality talent.**

Keywords- local newly-established universities/colleges; lab constructiont; practical education; lab resource

I. INTRODUCTION

The experiment is a way to find rules of the natural and environment under the human intervention. Theory is produced from the experiment which is also the source of the modern science and technology. Therefore, some scholars have pointed out: The experiment is the mother of science and technology[1]. With the continuous development of higher education, improving the quality and accomplishment of the people is an important part of the universities. The universities are actively exploring a new kind of personnel training mode by which the students can develop integrally including the quality in humanity, in science, and in the practice ability. Improving the students' practical abilities can't be separated from the construction of the university laboratory. Recently, the country has proposed the excellent engineer training program. One of the key contents of improving the quality of personnel training in the local universities is embodying in the laboratory construction, laboratory management and efficient use of laboratory resources. The local or universities, especially the new local universities exist many problems in the lab construction, such as biased perceptions, inadequate funding, poor benefits etc.. This paper presented a new kind of laboratory construction mode which includes resource integration, school-enterprise coalition and research-education combination. Through the practical construction of the Practical Education Center of Mechanical Design-Manufacturing and Control, it shows that the proposed construction mode has good operability and effectiveness.

II. CONSTRUCTION STATUS IN LOCAL TEACHING-ORIENTED UNIVERSITIES

From the early age, most of Chinese people agree with the standpoint: Mental labors govern while manual labors are governed. Under the impact of this viewpoint, there exists the proneness of paying attention to books and knowledge, despising the training of the practical ability and the practical link during the teaching process. Experimental contents in science and engineering subjects are over-reliant on the ones of the theory teaching. The weakened experimental aspects are the reflection of this tendency in the teaching form. Modern society requires the students not only grasping the solid professional knowledge, but also having pioneering and innovative spirits. They can continue to engage in technological innovation. Therefore, universities must acclimate to social demands for qualified personnel under the new situation and update the concepts of education. Strengthening the practical link and deepening the reform in practical teaching methods are needed to promote the work level of the university practice in educating people.

On the other hand, the government is still the main body of the universities' investment. Public finance is still the main source of the higher education funding. Higher education funding adopts the two-level administration system: the central government and the provincial government, in which the provincial governments are of the main. But the basic operation in the universities doesn't act in accordance with the laws of economics. The funding(including laboratory construction funding) is invested and managed by many departments. The laboratory construction projects are either applied to the ministry of education, or to the ministry of science and technology or the ministry of reform commission with an alternative name. Sometimes, even are produced the phenomenon in which several departments approve the same laboratory construction project of the same universities. Mutual contact and coordination among the various departments are less. The bureaucratic procedures are very strong in the laboratory construction projects from planning, budget implementation to completion. The one who accepts the funds can return nothing to the social. The investment managers of the laboratory equipment don't bear any investment pressure. Thus, for the laboratory construction projects, we focus only on the pre-approval and make less research and attention to

the running status and effectiveness which are the main aspects of the follow-up management after the laboratory construction. The conventional laboratory construction mode led to a fragmented state of the university laboratory which results in a serious waste of the construction funds, such as the repeat purchase of equipment[2]. The detailed aspects are in the following aspects:

A. Universality in lab repeated construction

Currently the management system is the most fundamental problem constraining the laboratory development. With enrollment expanding, the number of majors and laboratories continues to increase. Because the laboratory management system is not perfect, the laboratory development has come to being a complexion of which the laboratory scatters layout and can't rely on each other. The fragmented and separate lab development situation causes a serious waste of capital for equipment purchase and makes the limited laboratory construction funds even more severe. This situation affects the expansion of the laboratory-scale and sustainable development.

When the local universities lay a course about the laboratory construction plan, the contents of the practical teaching designated in the training program are mainly referenced. The laboratory construction plan is established in actualizing smoothly the practical teaching for all the majors. Thus the egalitarian ideology has dominated. The colleges and departments would like possessing all of the experimental equipment which they wanted. To balance the relationship of the colleges and departments, the universities sprinkle black pepper among the colleges and departments in the laboratory construction funds invested. This results in the dispersion of construction funds. And the universities can't focus the funds to purchase the advanced equipment required. The laboratories belonged to the colleges and departments are of relative independence, separate development, non-collaboration. These result in one hand, the repeated purchase of equipment with similar or even the same functions, the other the low capacity utilization rate or even long idleness.

B. Unilateral pursuit for the advanced equipmens

One of the keystones of the university laboratory construction is equipment which is an important component of the university fixed assets. At the same time, the experimental apparatus are the material basis of the school survival and development, the essential conditions of the teaching and research, the obligatory tools and instruments for knowledge and technological innovations[2][3]. A necessary part of laboratory equipment procurement process is the demonstration before the equipment purchase decision which is the key to ensure the effectiveness of laboratory construction.

The relevant staffs, who choose the teaching equipment, often ignore the reality of teaching and care only about the parameters and the indicators of the apparatus. They think that the function of the chosen device is the more complete the better and the accuracy the higher the better. At times some teachers even choose only imported equipment and don't consider the domestic equipment by a long sight. They deem that the advanced equipment, even the imported advanced equipment, can reflect the laboratory constructed by the province leading, even domestic leading. Actually only parts of the function are used for the advanced equipment in the real teaching process. It's alike the large bull draw a small jalopy. The imported teaching apparatus, which are worth several hundred thousands of dollars, service only a few experimental classes. These devices are sometimes in long-term downtime to be repaired due to a few hundred dollars of parts bad. And even the long-time idleness causes the device to failure, which results in enormous waste of resources.

C. Without embodying the university's social service function

Social service is one of the three major functions of the universities. Laboratory plays a key role for the exaltation of the university social service capacity. Compared with the foreign country laboratory investment efficiency, the overall level of ours is very low. One important reason is the university laboratory construction is not a good combination of the industrial development and the economic development of the surrounding area. To complete the practice teaching contents of courses is the main aim for the purchase of the equipment.

In assigning a projection for the equipment purchase, many teachers often act blindly or make hasty investigation with some other universities but don't close contact with companies or research institutions. This leads to the singleness of the laboratory equipment, which can only meet the needs of the experimental teaching. Although some laboratory teachers purchased the equipment needed for their own research projects or for a short-term external paid services. It seems that the equipment is embodied in the social service role of the laboratory. In fact, once the teachers' research projects are finished, the purchased equipment would be idle. And it goes against the sustainable development of the university laboratory.

III. LOCAL TEACHING-ORIENTED UNIVERSITY LAB CONSTRUCTION COUNTERMEASURES

The 21st century is the era of knowledge-based economy which provides opportunities and challenges for the construction and development of the university laboratory. Nowdays university laboratories should dare to innovate and break the routine to become the base for exploring and practicing material and spiritual civilization though extending actively to the community and going straight to the big market of the national economy. Universities should temporize and deepen the reform of the laboratory system, management mechanism and practical teaching methods. At the same time, universities, especial the local universities should concentrate their limited funds to build the science and technology service centers which have the high degree of openness, the high efficiency of resource use, the good services of technology and the excellent mechanisms of management. These will guarantee the healthy development of the laboratory[4][5].

A. *Promoting the integration of resources*

Universities must develop a scientific and rational management system to improve the executive ability and performance of the macro-management of the laboratory administrative systems. Universities should strengthen the control to the overall layout of the laboratories in order to coordinate and manage these aspects of the laboratory equipment, such as purchase, distribution, use and maintenance. Thus it will solve the problems of which the university laboratories fragmentise, develop independently, lack coordination each other so as to function inefficiently.

In 2009, the Hunan Institute of Science & Technology adjusted the departments and set up the college of mechanical engineering. The college regarded it as the chance to transfer the automatic control lab, signal & system lab, which originally belong to the mechanical and electrical engineering department, to other college. At the same time, the newly established college strengthened the mechanical laboratories, such as the mechanical and electronic control lab, the material property test lab, to setup the mechanical design-manufacturing and control practical education center. Through the resource integration, the lab functions are more clearly and the relationship between the labs are more coordinated. The supporting role among the labs is also more obvious to provide a guarantee for the construction and development of the labs of the practical education center.

B. *Combining education and research*

The university is the important potence and the main base for the science research and high-level personnel training. Higher education reform in our country, particularly the practice of educating people is gradually in-depth. Establishing scientific and standardized laboratory construction mechanism is one of the key elements related to the success of the reform of university laboratories and to the best use of the laboratory resources. The collegiate department should organize the academic and teaching backbones to fully discuss to determine the content of laboratory construction and propose the construction project application which can ensure in a sense the combination of teaching and research. The collegiate department academic committee demonstrates the economic and technical feasibility of the proposed laboratory construction projections and studies out the doable ones to report to the service departments of the university. The college-related functional departments should organize the internal or even external experts to demonstrate the necessity and rationality of the applications and put forward the proposed projects to the college leadership for approval.

The college of mechanical engineering pays attention to the research and discussion for the laboratory construction during the usual teaching and research activities and academic discussions. The college also encourages teachers to transform their own research projects into the student's comprehensive or innovative experimental projects. In a way, doing in this method can ensure the development of both teaching and scientific research during the purchase of equipment. In 2011, the mechanical design-manufacturing and control practical education center set up a new material preparation and test laboratory. The equipment in this laboratory can meet the research needs of the teachers for the preparation of new materials. At the same time, the lab can also provide the practical conditions for the course of "material forming principle", which is an important major course, and for the other courses related to the material produce and test. The lab is open throughout the day. The graduation project experiments related to the material preparation and test are carried out in this laboratory and the laboratory equipment utilization is very high.

C. *Joint of school and enterprise*

The general CEEUSRO is the "soft technology restructuring activities"[6][7] integrating the talents, technology, financial resources and equipment among the industries, universities and research institutes where the R&D projects and tasks as a link. The local universities, which are going to do vitality and train the talent with high level of applicability and application, must comply with the principle of joining with the market and servicing to the community. Currently the university-industry cooperation should perform the changeover from the scattered, small, short-term and project-oriented cooperative to the scale, medium- or long-term and institutional cooperation. Colleges should put down the "haughty manner" and organize relevant personnel from time to time to the enterprise to carry out investigation. Then they will satisfy the needs of the enterprises and help them solve the problems in technology, testing, production and management to strive for diversified, multi-disciplinary and multilateral cooperation. Colleges can even construct the joint laboratories with the well-known enterprises combining with the personnel training requirements. This mode will expand the university's influence in the community and improve the efficiency in the use of experimental resources and the degree of sharing.

The college of mechanical engineering has been focusing on coalescence with the enterprises. During the last three years, the college has accumulated to hire 15 people from the enterprises as part-time teachers. In addition, the college set up electromagnetic equipment manufacturing strategic alliances coalescing with the electromagnetic industries in the Yueyang region. The college, coalescing with the Yueyang Municipal Commission of Economy and Information Technology, established the cooperation platform for mechanical and electrical products manufacturing and test. The college also coalescing with Yueyang Hongsheng electromagnet Co., Ltd. established the design institute of the pressure vessel. These strongly expanded the path of laboratory resources for social services. Though the cooperation with the industries, the development of bilateral is ensured and the hematopoietic function of the laboratory is improved.

The service scope and ability promote increasingly with the above mentioned methods and strategies. The equipment is close to the teachers researching field and teaching contents. The faculty contributes more and more time and energy to the lab construction and lab service. The participation ratio of the students in the academic

competition and technological manufacture was close 92%. Table Ⅰ showed the lab use ratio in the near three years

TABLE I. LAB SERVICE

Year	*Teacher Research Projects Number*	*Student Research Projects Number*	*Student Competition Projects Number*
2010	8	4	15
2011	12	8	28
2012	21	18	45

IV. CONCLUSION

The 21st century is the century of innovation, but also a century of competition. The most distinctive place within the universities where the spirit, culture and academic level are agglomerated is the laboratory. Universities must improve the status and role of the laboratory construction to the importance of cultivating high-quality talents. The university should take the laboratory construction as an important work of the higher education system and plan with high starting point, construct with high-level. The local universities construction funding is very limited. So these colleges and universities must abandon the idea of the traditional laboratory construction and follow the historical trend to broaden the sources of funds. The efficacious methods are integrating resources, joining the industries etc.. Thus these colleges and universities can enhance their own level to manage and use their laboratories well.

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