Construction of Machinery Specialized Laboratories under the Concept CDIO

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Abstract. Machinery involves a lot of knowledge, including many practical activities. Mechanical professional talents are not only to learn solid theoretical knowledge and practical experience to be able to accumulate. CDIO engineering education concept to construction machinery specialized laboratories indicate the direction of development and improvement. This paper is based on the concept of CDIO engineering education, for the current status of mechanical engineering laboratory building, further concrete measures for laboratories' construction is made. These implements can improve the quality of teaching practice to a certain extent, so that students could master the integration of theory to practice, laboratories rationalize the allocation of resources.

Keywords: CDIO, machinery, laboratories' construction.

1. INTRODUCTION

CDIO engineering education philosophy is co-founded by Massachusetts Institute of Technology and the Royal Institute of Technology in Sweden and the other two schools composed a multinational study team, in 2000, that In the nearly $ 20 million financial aid provided by Knut and Alice Wallenberg Foundation. In the same year, the international organizations called CDIO established. So far, Education International CDIO project has grown to more than 26 countries on five continents [1]. 2005, CDIO engineering education model was introduced into China. China also began and more than twenty other countries of the world together to improve CDIO engineering education philosophy[2].After nearly a decade of improvement and absorption, many colleges and universities in the country based on the idea of CDIO curriculum and their laboratory building construction have considerable achievements. And it has been used in mechanical engineering and aerospace very professionally.

CDIO composed of Conceive, Design, Implement and Operate. CDIO model is designed to train students in the appropriate expertise to enhance students 'individual abilities, to develop the right attitude of students, enhance students' teamwork skills. Overall, the product is to train students for the system conception, design, implementation, operation and other comprehensive ability and quality [3]. Obviously, in this capacity building process, ability or practical ability is the foundation. It requires schools to provide students a laboratory system to meet their ideas. Meanwhile, construction of the laboratory in the CDIO concept system is also able to maximize the utilization of the laboratory.

2. CHALLENGES FACING THE LABORATORY CURRENTLY

In China, most colleges are teaching-oriented universities for the purpose built [4]. In the process of development, Schools are mainly teaching, supplemented by the experiment. Experiment as a way of exploring the truth, and has no extremes in teaching. It is clear that building of laboratories is an on-demand supply road. With the progress of science and technology, the development of teaching methods, our demand for amount and type of instruments and equipment is growing. In the process of development, many colleges and universities has exposed their flaws of their laboratories. Such defects should be improved form the concept of building and construction planning.

On one hand, most of the laboratory's construction is based on the professional requirements to purchase laboratory equipment. This way there will be similar to that of laboratory waste problems caused by repetitive construction [4-5]. On the other hand, certain laboratory equipment sharing is relatively difficult, resulting in inefficient use of the lab. Some laboratories there are different degrees

of mismanagement and other issues. Meanwhile, some laboratory instructor is really not to enlighten the students thinking, and they are not the role of guiding students to experiment.

As mechanical engineering laboratory, also needs to be based on a solid engineering to construction. CDIO product concept as an excellent study of engineering education, could bring in mechanical engineering a complete idea of the laboratory construction and a series of guiding principles.

3. CDIO PROJECT EDUCATION IDEA ON THE CONSTRUCTION OF LABORATORY OF GUIDANCE

In order to meet teaching requirements and make full use of laboratories, Under the CDIO engineering education idea of building a joint laboratory system of educational philosophy. There are 12 standard of CDIO. Among them, the standard 4-Introduction to engineering courses provide products, processes, and systems required for the construction engineering framework, and provides the necessary personal and interpersonal skills[6]. This standard gives us a clear sense of direction, the laboratory's construction should be based on giving students a complete platform. The standard 6-Engineering practice place and laboratory supports and encourages students to learn through hands-on products, processes and systems of building capabilities, and learning academic knowledge and social learning. The standard 9-Improve teachers ' ability of engineering practice. Take action to improve the teacher's personal and interpersonal skills and the ability of products, processes, and systems built. Standard 9 is mainly aimed at teachers ' demands. It gives our laboratory staffed with a standard, laboratory assistant or laboratory instructor should have a strong practical ability, guidance for the students but also the experience, overall.

4. THE CONSTRUCTION OF MACHINERY SPECIALTY LABORATORY UNDER THE CONCEPT OF CDIO

The construction of machinery specialty laboratory is about four parts below. Figure 1 shows us a general way to construct laboratory.

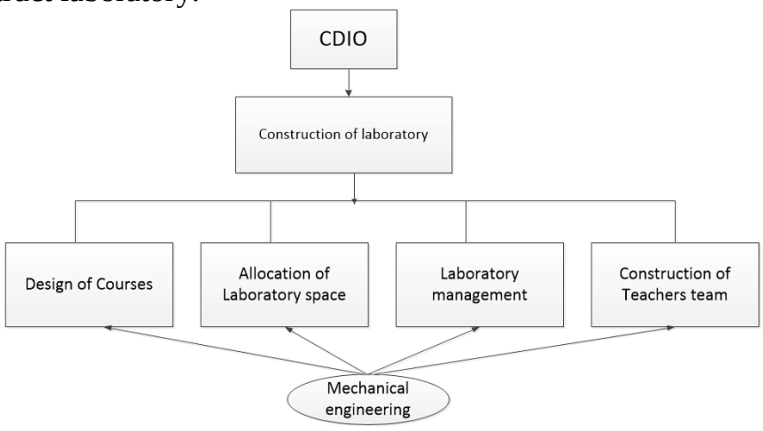

Figure 1: The way to construct Mechanical engineering laboratory

5. PROGRAM OPTIMIZATION

Mechanical engineering, design and technology the two aspects are needed to reconcile. Perfectly reasonable design does not necessarily fully feasible in technology. This means that, technology to some extent not able to satisfy the design. To solve this problem, let the students fully understand the relationship between design and technology is necessary. In terms of course design, it is good to combine the design of machinery and metalworking, to give students an overall awareness from design to manufacturing [7].

6. OPTIMIZATION OF THE MECHANICAL ENGINEERING EXPERIMENT

Laboratories should have a rational distribution of resources and the allocation of space. First, there is certain space allows students freedom to play [8-9]. Second, there are reasonable arrangement of CNC machine tools, joiner's benches for reasonable layout, and so on the rational distribution of the necessary equipment. Meanwhile, the laboratory equipped with a working area of engineering drawing is necessary.

7. THE IMPROVEMENT OF LABORATORY MANAGEMENT

The improvement of laboratory management for the whole teaching is important. First of all, the opening hours of lab time with the students as far as possible coordinated with curriculum planning and co-ordination. At the request of certain management, offer students opening hours of relative freedom [10]. Second, strengthening laboratory safety management is important. Strengthen the management of objects, installations, apparatus and equipment, so that on-demand supply, audit assignments. Third, develop appropriate performance appraisal plan for the laboratory assistant and the teachers.

8. BUILDING STRONG AND STABLE TEAM OF TEACHERS

Teachers team building is a very important part, Teachers are the way navigator to the students, beacons to the students. During the construction of the laboratory, it is a great idea to employ some projects experienced engineers as a part-time teacher [11]. Meanwhile, improving laboratory assistant recruitment criteria of teachers, and accordingly improving laboratory assistant teacher treatment. Building an organization with clear responsibilities assigned teaching force is necessary, because relatively stable teachers are more conducive to the long-term development of the laboratory.

9. CONCLUSIONS

Establishment of a clear, complete, System Engineering outline of educational goals is the CDIO project education concept, in the outline of laboratory construction for teaching and learning is a revolutionary meaning. Under this mode of Labs' building and student course-building is a long and meaningful process, which needs to be summarized and improved implementation. Machinery professionals have a responsibility to actively optimize the knowledge structure, enhance laboratory capacity, and construct application capabilities. Also, have an obligation to respond positively to the national education reform and development plan. Practical courses as an important way to leading students ' ability of innovation and application development, in practice, it should fully play its role. Laboratory as the main platform for practical courses should be to really start building from the details. Implement the scientific concept of development, training compound talents comply with the new social development, it's necessary to actively follow the trend of social development to build the lab. CDIO model is under the premise of social development, Implement the scientific concept of development can be a sustainable development of the advanced mode of education. CDIO mode is particularly suitable for the development of mechanical engineering major.

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