Structuring the course and experimental system of the mechanical engineering based on the main thread of robotics and relevant disciplines

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Abstract: According to the present whole needs for the technicians of China mechanical trade, the article discusses the basic idea and enforceable method of reforming the specialized undergraduate course and experiment system. It points out the reformed course and experiment system should surround the following aspects: whether make the students acquire new knowledge better and faster, learn to how to do things and start an undertaking, learn to how to be a man, learn to how to work with others, and so on. Especially, such several relations must be handled well: (1) Relations among professional knowledge, mathematics and correlated disciplines knowledge, humanity, society, economy and management disciplines knowledge; (2) Relations among different courses; (3) Relation between theory teaching and practical teaching. Based these, structuring course and experiment system has been put forward based on robotics and relevant disciplines in this article.

Course and experiment system plays an extremely important role in the whole tutoring system. It is the important embodiment of running a school's ideas, discipline colony, objective of cultivating talented man and training mode, and an important carrier of training plan and course. In a word, course and experiment system is a model which brings up talents. Different model brings up different talents. All educational programs and reforms are realized depending on course and experiment system and content of courses in all. So, the course and experiment system is the key to teaching reform, and it is one of most difficult at present. In this article, how to build and reform undergraduate course and experiment system of the mechanical engineering, is discussed.

1. The basic principle of the reform of course and experiment system

The reform of course and experiment system should conform to the principle of basing on reality demand and looking forward future development. Basing on reality demand must match with the requirements for talents in present economic society, looking forward future development must has a bright sight, comply with the tendency of economic and technical development. Basing on reality is the way to survive according to the situation, undoubtedly it

is a basic rule. But only considering reality and neglecting future, we will meet the passive situation that suit the remedy to the case, even hard to deal with. Nowadays, with the development of social economy and technology and in order to enable course and experiment system to keep up with the changes of the times, we must have super consciousness in programming and reforming. In other words, course and experiment system should reflect the variable tendency of subjects and social demand for talents in the future.

The basis of judging whether course and experiment system is rational should be: whether it helps students learn to how to be a man in society, learn to how to work with others, learn to how to do things and start an undertaking, learn to obtain new knowledge better and faster. In general, whether it helps train the students' ability to explore and create the future world better and faster.

2. Seeing the direction of the reform of mechanical engineering professional course and experiment system from social reality demand

According to the questionnaire to trade-enterprises in our country, most of mechanical engineers are engaged in mechanical design & manufacturing technology and management or applied research work in the forefront of the production. There are general requirements: possessing a noble personality and sentiment, mastering professional technique and owning stronger management abilities. In recent years, at the employment consulting meetings of mechanical graduate, those cadres and social active activists with excellent school grade and mastering many skills especially specializing in one receive the most favors of enterprises and project units. This phenomenon proves the value orientation to talents of enterprise-----Many-sided person.

According to investigation, the typical requirements to mechanical technician in society can sum up for moral character, speciality, innovation, changeable, seeking knowledge etc

? **moral character:** Devoting oneself to jobs, obeying discipline, being modest and honest, uniting the colleague, respecting others, being ready to help others, having the sense of justice and duty, and having strong enterprise.

? **speciality:** Having more systematic and abundant basic theory and professional knowledge, having an ability to use scientific and technical ideas, view and method to analyze and solve various kinds of project problems synthetically, undertaking the great subjects' research.

? **Innovation** Having strong hope of constant exploration and innovation , not being satisfied with the existing state of affairs and achievements , daring to innovate, being glad to explore and break through, being apt to suspect and criticize.

? **Changeable** Being good at observing, being diligent in considering , dealing with an emergency flexiblely, getting along with others with open-minded, not being stubborn or blindly insisting , and following one's opinion, understanding the sayings " when it is dark in the east , it is light in the west " , " All roads lead to Rome ", and perform them.

? **Seeking knowledge** Having strong desire and curiosity of seeking knowledge, being good at learning the unknown from the knowledge we have learned, studying in all life, contenting with new knowledge constantly , improving oneself with the new skills, nourishing the great interest in relevant news and current affairs, policies and regulations, academic trends, latest achievement ,creativity and invention, technological innovation and the latest craft ,etc. ,good at using advanced science and technology for production reality creatively,

and turning into productivity.

In addition, comprehensive applied talents should also have enough self-confidence and fortitudinous will, stronger ability to organize, stronger ability to express, ability to make scheme and analyze the market, etc.

Therefore, nowadays , the society needs the composite applied technician who can innovate in the field of technology, can manage as a leader, can analyze market, can face frustration. So the reform of the mechanical engineering and experiment system should be regarded as a starting point on training the comprehensive and applied technician.

3 . **Dealing with several relations in structuring and reforming the course and experiment system**

? Relations among professional knowledge , mathematics and correlated disciplines knowledge, humanity, society, economy and management disciplines knowledge.

Although it is crucial for modern engineers who know management and operation, the main task of high engineering college is the starting of training the engineer. So, when structuring the course and experiment system, we should treat professional knowledge, mathematics, physics and other technological knowledge mainly, and treat the humanity, society, economy and management subsidiary, we shouldn't treat everything equally whether it is important or not, even put upside down primary and secondary.

The idea of "teaching everything" is prevailing. Of course, everybody expect for the idea. But, today, is it possible in the society of full of knowledge explosion, information explosion? There is another idea, namely "strengthen the foundation, treat science and engineering equally". It is unrealistic too. Only taking mathematics, the most important foundation, as an example, generally speaking, mathematics foundation past means continuous mathematics generally. Now there are dispersed mathematics, fuzzy mathematics and computational mathematics etc. If we don't simplify literary writing by leaving out superfluous words basing on the practical principle largely, it will take several years to master the applied mathematics. If we truly structure course and experiment system by the principle that science and engineering are regarded equally, even only pick flowers without the leaves, it is also so a huge knowledge base. How can digest them in short term?

?Relations among different courses

Among different courses, we should pay attention to system of the whole knowledge structure, rationality of linking the content when we choose the content, we can't emphasize the system or integrality of course in order to prevent the same content repeated in different courses. No matter specialized course, technological course or mathematics basic course, we should take practicability for the purpose and use as the limit, emphasis the application and novelty of knowledge, firmly delete the contents which are unnecessary. Meanwhile we should supplement the contents which can reflect the front of science.

?Relations among theory teaching and practice teaching

Practice is the foundation of innovation, the source of ability. Creative thinking is based on practice and begins with question. Innovation ability is trained out during the process of solving practical problem constantly. So we should completely change the past behaviors of paying more attention to theory, less to practice, more to calculating and reasoning, less to experimental demonstration and theory breaking away from reality. We should bring practice

teaching from the past subordinate status to equal status, and treat them equally, make them become a organism which is harmonious each other, make project education return to project really , make student learn to how to summarize the problem , analyze the problem and solve the problem in practice .

Former president of U.S.A. national Academy of Engineering, Mr. Woolf, had said, project is not science, even not an applied science. The writers think it is the deepest description to the essence and function of project. High academy brings up engineers who are engaged in such work as engineering design, building, transforming, management in the future. It is an eternal theme of project education to train project ability all the time. If project ability breaks away from project practice, it will be water without a source, a tree without root.

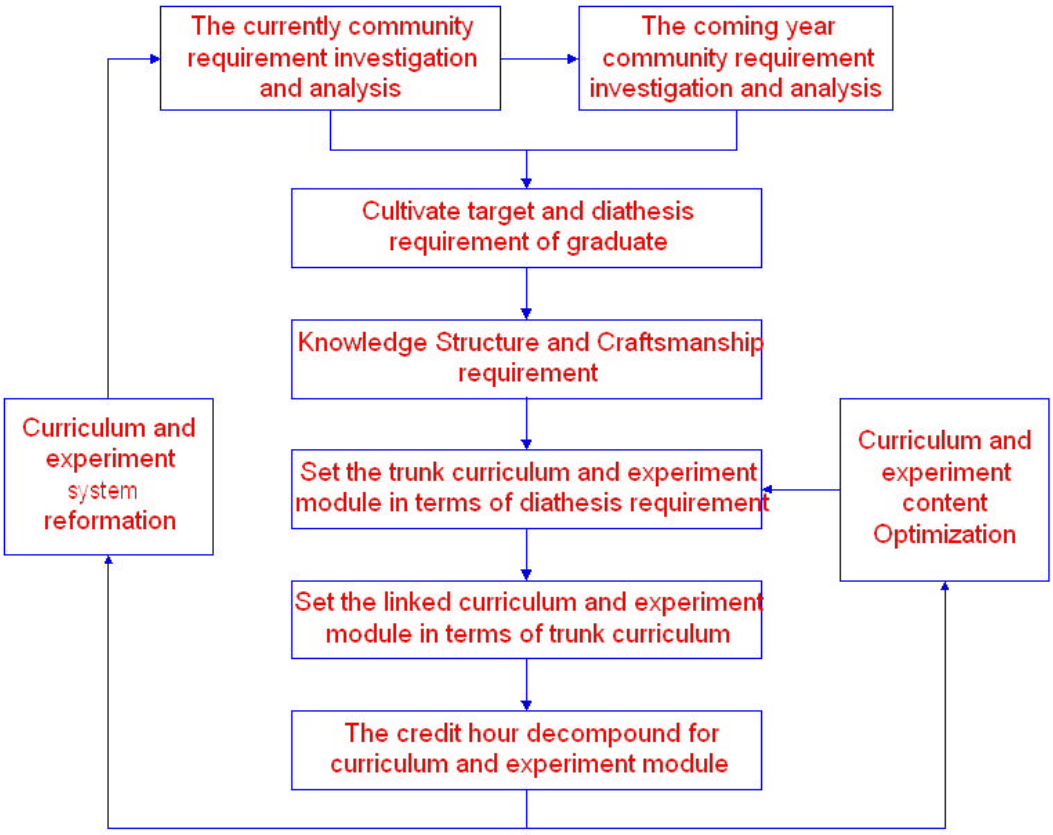
Altogether, it is the main issue for reforming and constructing course and experiment system that how to let the mathematics knowledge ,humanity and society science, economy and management subjects, engineering technology merge together effectively, and how to combine the theory with practice well.

4 The necessary and feasibility to construct the Mechanical Engineering Course and experimental system in term of the theory of robotics and the correlative subject

The theory of robot integrates many subjects and it is one of representational information machine product, including mechanical engineering, material engineering, automation, computer technology, measurement & control technology and so on. Based on the theory of robotics and correlative subject, we construct the specialty curriculum of mechanical engineering and the experimental system, reflecting the different subjects across and infiltrate, this can benefit for strengthening student's information science and cultivating the person with the width knowledge and strong ability to solve the complex engineering problem, and improving the student's synthesis diathesis of technology.

Since 1998, The Specialty of Mechanical Design & Manufacture and Automation (LANZHOU university of science and technology) has actualized the new course and experimental system basing on the theory of robot and correlative subject, from the practice and effect of project actualized last three years, the new teaching system can certainly extend the knowledge structure of student and improve the ability to solve the complicated engineering problem.

5 One of the undergraduate course of mechanical engineering and experimental system



Graph1 Curriculum and experimental system construction and Reformation flow chart

1) The modularization frame for the courses and experimental system

Basing on the above theory, we can construct a sort of the procedure flow of the courses and the experimental system's reformation, See ing graph 1. The undergraduate course of mechanical engineering and experimental system in LANZHOU University of Science and Technology is constructed in terms of the procedure flow, according to the type of subject, the whole system is divided into some modules, namely:

?Curriculum system module

The whole curriculum system includes some modules, as below:

The robot technology, the measurement & control technology, the mechanical engineering, the basic theory of computer, electrician and electron technology ,the basic theory of mechanics and mathematics, literate human ores & social science's knowledge and economy & Management's knowledge. Each curriculum module includes some courses of the same subject. The whole curriculum system has formed the knowledge's Bourne, See ing graph 2

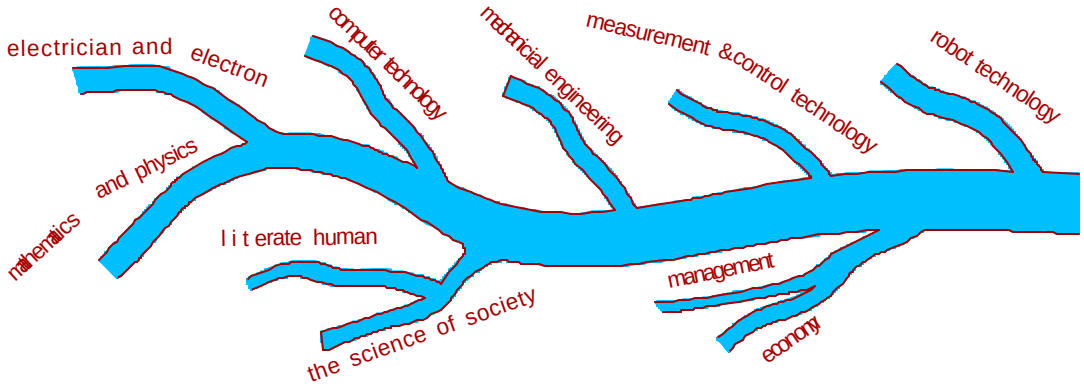


Fig. 2. Knowledge basin picture of course module

?Experimental System Module

The Whole Experimental System includes some module, as below:

The drill, Investigation & Practice of society, Simulation experiment of curriculum validation, Computer application, Metalworking exercitation, Simple machine design, integrated engineering design, Robot design innovation match, and so on. Each experiment's module trains and improves the ability and diathesis in a certain field.

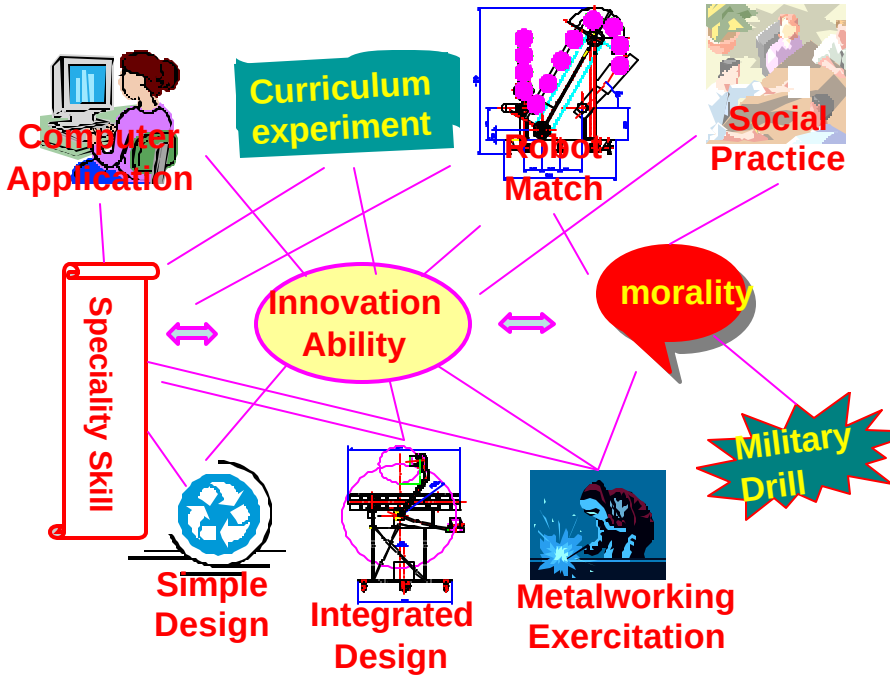


Fig. 3 Corresponding relation among every module of experiment system and talent's quality.

2) The essentiality of each module in the curriculum and experimental system

After the constitutor of module confirmed, basing on the levels of running a school for different university, the cultivation object of person with ability and different position of employment, the essentiality of each module have differently emphasized on it. LANZHOU University of Science and Technology is an application engineering Course University, The essentiality of the current curriculum and experimental module see graph 4. The essentiality ratio of the total curriculum and practic module see graph 5.

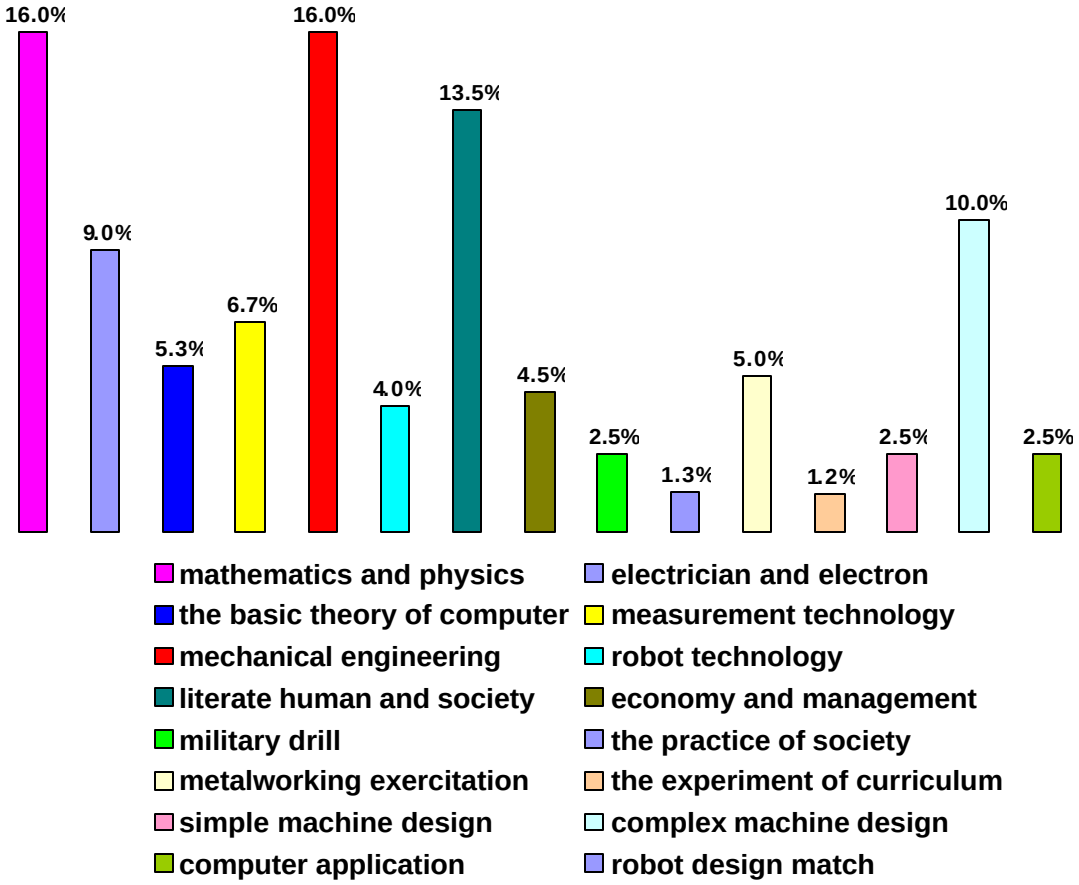


Fig. 4 professional course of the mechanical engineering and weight of every module class hours of experiment system

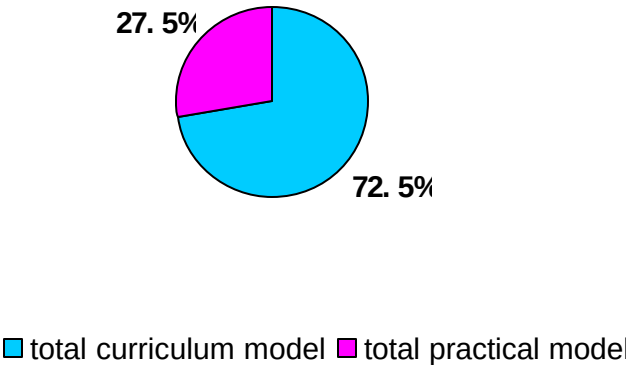


Fig. 5 Curriculum and practical module right