The Reconstruction of Practice Instruction System Based on TRIZ

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Abstract: Practice instruction is the important part of university study. It is disadvantage to training talent with the traditional practice instruction method, the paper brings TRIZ in the practice instruction, reconstitutes the practice instruction system with a view to improve the creation ability of the students.

Introduction

With the approach of an innovative economy and society, the status and importance continues to improve in construction of innovative practice instruction system. So TRIZ theory is introduced into the practice instruction system, to carry out teaching reform and for the purpose of training mechanical creative design talents.

Innovative Principle of TRIZ

The founder of TRIZ was a great scientist and inventor of the former Soviet Union, G. S. Altshuller. It is found that the development and innovation of technological systems are regular, and a whole set of systematic and practical methods to solve the problem of invention creation have been set up on this basis since 1946.

The core of TRIZ theory is the theory of technological system evolution. TRIZ points out that technological systems have been evolving, and resolving conflicts is the driving force of evolution. The rate of evolution decreases with the general conflict of technological systems, The only way to mutate is to resolve deeper conflicts that hinder the evolution of technology systems. TRIZ theory has become a relatively perfect innovation design theory because the core of product innovation is to produce new working principles and process, and then put forward the corresponding rules and algorithms for people to use. It has become a relatively perfect theory of creative design.

The tools of solving problem is divided into two groups in TRIZ: (1) Analytical tools: definition and description of problems, analysis of auxiliary problems; (2) Knowledge base tools: from the accumulation and collation of human innovation experience knowledge, can provide the highest level of problem solving methods. It includes the technological evolution model, the 40 inventive principles, the 11 separation principles, the 76 standard solutions, the typical innovation examples, etc. Figure 1 is the architecture of the TRIZ. One of the tools of TRIZ or more may be use in solving an engineering problem, The construction process of innovative curriculum system is shown in Figure 2 based TRIZ. According to the model, firstly, the problem is analyzed, including function analysis, ideal solution analysis, available resource analysis and determination of conflict area; If there is a technical conflict or a physical conflict, select the inventive principle or the separation principle; If alternative technologies are needed, select the technology evolution model and the evolutionary path; if the problem has been identified, but how to solve it, choose the effect tool.
The Main Problems of the Traditional Curriculum Design System

The curriculum design is an important part of practice instruction in university, it is a comprehensive training and review of students' practical ability and creative ability, it plays a very important role in the cultivation of students' ability to apply theoretical knowledge and solve practical problems in engineering. The course design includes mechanical principle design, machining process and fixture design, etc.

The traditional curriculum design has the following problems: (1) The curriculum design is single, and the repetition rate is high, the quality of curriculum design is difficult to guarantee, it can not arouse the enthusiasm and initiative of the students in curriculum design. (2) Students are weak in comprehensive use of knowledge. Students can complete the required curriculum design tasks according to the existing design patterns and procedures in the traditional curriculum design. The traditional curriculum design is based on the validation of theoretical knowledge; (3) There is not enough strength to cultivate innovation ability. The content of the course design is relatively fixed, and the students' efforts are mainly concentrated in the numerical calculation and structural design of the specific design and detailed design stage. It involves narrow domain knowledge and involves little in the realization of technological innovation, which is not conducive to the
cultivation of students' creative ability and innovative thinking; (4) it is insufficient in the monitoring standards for the quality of curriculum design. It is difficult to evaluate the effect of curriculum design because of the lack of the mechanism of monitoring the quality of engineering course design.

Construction of Innovative Practice Instruction System

Constructing Creative Teaching Activities

Constructing scientific creative thinking and innovative ability, cultivating students' creative motivation is based on the dialectical materialist view of the world. The introduction of TRIZ theory into the construction of curriculum design innovation system will help students establish a scientific sense of innovation and cultivate students' ability to discover problems actively.

Constructing Innovative Practice Instruction System for Mechanical Products

The conceptual design of innovative curriculum design system in the design process as the main object based on the TRIZ theory, the main contents includes three levels: basic curriculum design, advanced curriculum design and innovative curriculum design.

(1) The basic curriculum design: This level mainly aims at the lower grade knowledge background, pays attention to let the student establish the engineering system concept, provides the work background for the following curriculum study, stimulates the student to seek knowledge and to the specialized interest.

(2) The advanced curriculum design: This level of curriculum design can make use of TRIZ theory to guide the design scientifically, and train the students' good creative thinking and innovative ability. The contents include the course design of mechanical manufacturing technology, the curriculum design of mechatronics system, the course design of hydraulic and pneumatic, the course design of advanced manufacturing technology and so on.

(3) The innovative curriculum design: This level is mainly through the establishment of extracurricular science and technology innovation fund set up students, college students' science and Technology Association, to organize participate in various extracurricular activities and competitions, encourage students' creativity, cultivate students' innovation ability. It includes digital manufacturing, curriculum design, mechanical CAD/CAM curriculum design, mechanical design contest, robot design and other links. Fig. 3 is the topologic structure of innovation teaching system.

Constructing an Innovative Teaching Management System

Innovative curriculum design system needs innovative teaching management system, setting up a set of management system adapting to the innovative curriculum design system is an important guarantee to train students' innovative thinking and creative ability. The construction of teaching management system mainly includes optimizing talents training plan and specialized teaching plan; reasonable arrangement of curriculum system and reform of teaching content, improve the status of curriculum design, increase the proportion of credit in curriculum design.
Constructing Teachers Team for Innovative Practice Instruction System

The construction of innovative teaching staff is the basic condition to train students' innovative thinking and creative ability. Teachers must have innovative spirit and ability, and must take an active part in teaching reform and scientific research work, and constantly improve their academic level and ability.

Quality Assurance of Innovative Practice Instruction System

Innovative curriculum design system needs a complete quality assurance system: (1) Strictly regulate curriculum design, teaching activities, adhere to the construction of the system as a guarantee to improve the quality of curriculum design and innovation level; (2) Enhancing the advancement, innovation and feasibility of the curriculum design plan; (3) Establish a complete quality evaluation index system, to study and formulate reasonable scoring project and evaluation standard, on the one hand to increase the grades and the proportion of the implementation of process control, on the other hand, the strict implementation of the curriculum design reply system, improve the weights of defense links in the entire curriculum design, guide students to design focus on the cultivation of innovative thinking and innovative ability, to cultivate students' ability to solve practical the problem.

Teaching Methods and Methods of Innovative Practice Instruction System

Comprehensive use of a variety of modern teaching methods and means, optimization teaching process of curriculum design. Through the use of comprehensive, modern teaching methods and means, analysis and search for the curriculum design of the teaching content of the best teaching methods, deepen students understanding of knowledge and grasp. Broaden the students' thinking, enhance the interest in learning, increase the students' engineering practice knowledge, improve students' ability to analyze and solve problems, and cultivate students' innovative thinking and innovative ability.

Conclusion

To guide the curriculum design of mechanical specialty by using TRIZ theory, it is beneficial to break the thinking inertia of the students, active creative thinking, accelerate the creation process, and the innovative spirit, grasp the innovative means and methods, make contributions to the training of the innovative talents of engineering.

Figure 3. The topologic structure of innovation teaching system.
References


