Building a creative classroom system for mechanical engineering students

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ABSTRACT: Problems that exist in traditional mechanical engineering teaching are analysed in this article. The necessity for a creative classroom at university for mechanical engineering teaching is discussed and argued for. The establishment of the creative classroom system for mechanical engineering students is explored by considering issues of management, practice, outcome assessment, and so on. The creative classroom in mechanical engineering has been implemented at Wuhan University of Science and Technology, Wuhan, Hubei, China. Results indicate that it can improve the students' comprehensive abilities, and also enrich their life in and after school, as well as arousing their interest in learning.

INTRODUCTION

In the 21st Century, innovative talent is much discussed and greatly valued. This is a worldwide phenomenon and is consequent upon the development of knowledge economy and the progress of modern society. As the future developers and builders of science and technology, contemporary college students' innovative spirit and ability has great practical significance [1].

Mechanical engineering has a direct connection with science and technology in the engineer's thought processes, professional knowledge and the jobs in industry. Therefore, it is crucial to discuss mechanical engineering students' innovative ability.

The 2lst Century is a century of education, with great attention paid to the quality of students and education itself. In higher education teaching reform attention should be paid to a quality education, and the cultivation of practice and innovative ability. The teaching reform must be creative, so that college education can promote innovation, be competitive and be efficient. By doing this, students' creative design ability can be developed, together with the ability to analyse and solve problems.

PROBLEMS IN THE TRADITIONAL TEACHING OF MECHANICAL ENGINEERING

Problems in the traditional teaching of mechanical engineering are as follows (see Figure 1). Mechanical engineering students have a heavy course workload and do not have enough time to become involved in extracurricular activities. Some universities do not have an academic environment and campus culture that encourages students to take part in scientific and technical innovative activities. There is a lack of effective incentive mechanisms, management and teacher support for innovation by mechanical engineering students [2].

Mechanical engineering courses are mainly taught in class, with knowledge gained from books. The student role in teaching is passive. The students' practice and innovative abilities are weak and their basic knowledge is shallow, which inadequately prepares them for specialised study. On the specialised courses, students will come into contact with mechanisms and operation principles they do not properly understand.

It is commonly believed that mechanical engineering courses cannot produce quality, innovative graduates through classroom teaching and a few experiments alone; the practical activities to encourage students to think and act independently are lacking. Practical teaching is arranged inside class, with the experimental purposes and steps laid out by the teachers according to the syllabus. The student role is largely passive and does not encourage independent thinking and practice.

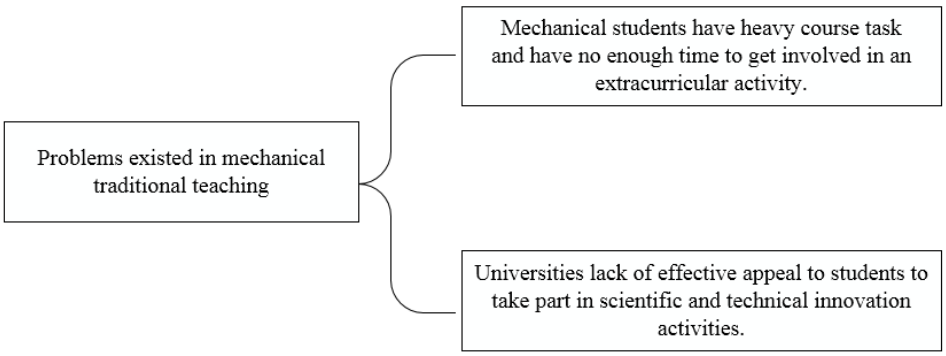

Figure 1: Problems in traditional mechanical engineering teaching.

IMPORTANCE OF CREATIVE CLASSROOM TEACHING IN MECHANICAL ENGINEERING

Schooling can be divided into classroom education and extracurricular education (the creative classroom teaching) [3]. As the main channel for students in gaining knowledge, much attention is paid to classroom education. Time, teaching facilities, teachers, and so on are scheduled for classroom teaching, while extracurricular education often is ignored.

Classroom education is important, but has limitations. Students' cognition and professional ability are addressed through classroom education, while knowledge and experience of society, social practice, good personality, and co-operation, as well as the cultivation of scientific research innovation ability need to be addressed through creative classroom education [4].

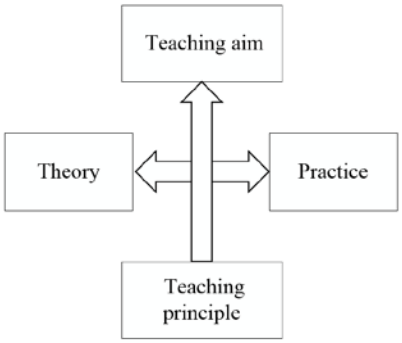

Figure 2: Relationship between theory and practice.

Normal classroom teaching focuses on theoretical knowledge with fewer hands-on opportunities for students, whereas practical mechanical engineering creative classroom teaching enhances students' engineering consciousness and ability to solve problems. The relationship between theory and practice is shown in Figure 2.

The creative classroom activities include application and expansion of mechanical engineering knowledge, social practice and voluntary service, innovation and entrepreneurship. As a supplement to classroom teaching, it has the characteristics of arousing interest, autonomy and being participatory. The creative classroom activities can be organised in various ways, e.g. by class, by team, an interest group; teams and groups may have three- to-five members. Group members can communicate face to face, which avoids one-way communication, and helps to develop personality and interpersonal skills.

The combination of comprehensive knowledge development, practical exercises and promotion of quality is a unique advantage of creative classroom teaching as a supplement to classroom teaching. To formulate a complete creative classroom teaching system requires long-term consideration, paying attention to society at present and to future developments.

Looking at social developments and market demand determines the kind of talent to train, what kind of ability they should have and the required support. In turn, this determines the kind of system that is needed and how to build that system. The creative classroom system must be cognisant of mechanical engineering jobs when determining the creative classroom system, since this will broaden the students' employment channels and employability.

CONSTRUCTION OF A CREATIVE MECHANICAL ENGINEERING CLASSROOM SYSTEM

The reform required to produce a system of creative classroom education will include the management mechanism, practical platform, tutoring system and results evaluation. Construction of the mechanical engineering creative classroom system is shown in Figure 3.

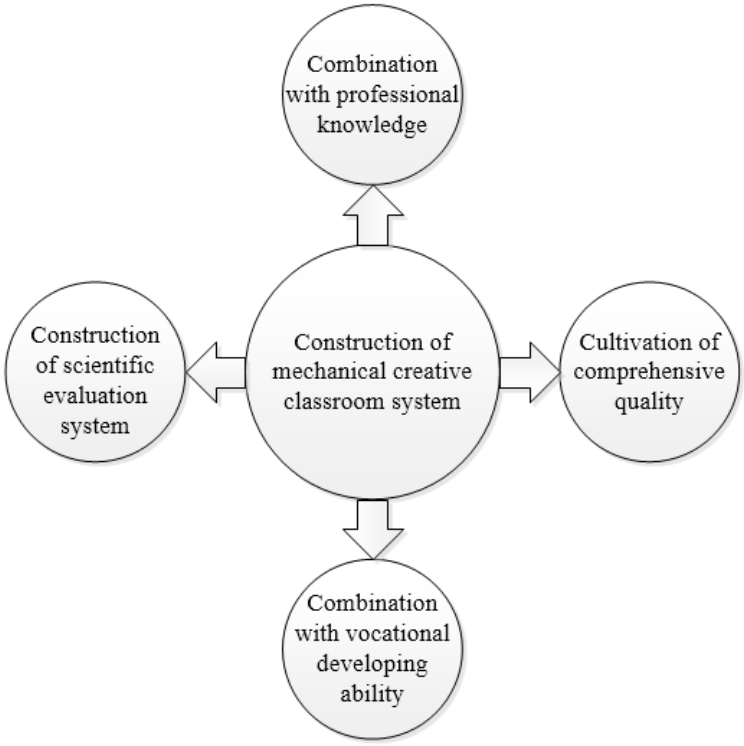

Figure 3: Construction of a mechanical engineering creative classroom system.

Combine with Professional Knowledge

The creative classroom builds on the normal classroom mastery of professional knowledge and skills. The training in the creative classroom is based on students having a full understanding of professional knowledge. The creative classroom activities reflect the needs of society. Investigation and discussion about the required quality, knowledge and capacity of mechanical engineering practitioners should be carried out by interview, as well as investigation of employers and of alumni.

Cultivation of Comprehensive Quality

The aim of the creative classroom is to cultivate interest, develop humanistic qualities, and promote active, involved students. Attention should not only be paid to human communication, social practice and academic knowledge, but also to personality development, emotions and human concerns, so that students are self-motivated [5].

Combine with Vocational Development

With global competition increasing, universities should focus on students' competitiveness for employment and their vocational development. This is a focus of the creative classroom education. By constantly paying attention to employability and employment competitiveness, students will be able to make steady progress in their future careers.

Construction of the Evaluation System

The credit system should be introduced for creative classroom education. Quantitative evaluation should replace qualitative evaluation, and objective evaluation should replace subjective evaluation. Credits goals should be set to promote students' active participation in the creative classroom.

EFFECTIVENESS OF THE MECHANICAL ENGINEERING CREATIVE CLASSROOM

The mechanical engineering creative classroom has been implemented in the Wuhan University of Science and Technology in Wuhan, China. As a result, the enthusiasm of students in activities has improved. The number of students who participate in social activities, recreational activities, subject competitions, youth volunteer campaigns and academic reports has increased. Originally, such activities were participated in by a group of selected students and no other students who lacked an awareness of these kinds of activity.

The creative classroom system has made students realise that these activities are important for their development. The students' practical and innovative abilities have improved significantly. Through systematic education and training, their perceptual knowledge has been transferred into rational knowledge; understanding of theoretical knowledge has been enhanced; and the flexible use of theoretical knowledge improved.

CONCLUSIONS

Mechanical engineering education is very complex. The construction of the creative classroom is a systematic project, which needs to be explored and developed in the long-term, based on experience.

Teachers should use modern teaching methods that can cultivate students' innovation and creativity, as well as other relevant professional skills.

Teachers also should keep pace with the times, constantly updating knowledge, and improving students' professional and cultural quality. Only by doing these can highly skilled and creative talent be cultivated.

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