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A REVIEW PAPER ON TEACHING REFORMATION FOR MECHANICAL GRADUATE STUDENTS

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Abstract

The mechanical engineering graduates learning skills goes well beyond the basic skills which required in the traditional engineering. It is responsibility of academic institution to develop "core values" in their students so that constituents serve best to the society. Feedback from industry highlights the need for students to understand more about the area of creativity and innovation in the context of industry and business environment. This is done by implementing creative class room theory to the students.

Introduction

In a rapid changing industrial environment, it is necessary for both academia and industry to combine their efforts to produce competent engineers. In order to do so, it is important to evaluate the existing educational and teaching systems and to assess the qualities of graduate engineers. 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 21st 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 analyses and solve problems. [1]

It is necessary to define both innovation and creativity for this paper and then show the Connection. A definition of creativity is given as:

Creativity: "Creativity is the ability to produce something new through imaginative skill, whether a new solution to a problem, a new method or device, or a new artistic object or form. The term generally refers to a richness of ideas and originality of thinking. Studies also show that intelligence has little correlation with creativity; thus, a highly intelligent person may not be very creative."

The interesting words in this definition are to "produce something new through imaginative skill" and that "intelligence has little correlation with creativity." This seems counterintuitive. As for innovation:

Innovation: Innovation is generally understood as the successful introduction of a new thing or method. Innovation is the embodiment, combination, or synthesis of knowledge in original, relevant, valued new products, processes, or services."

The key phrase from this definition is the "successful introduction of a new thing or method."

From these definitions it follows that innovation and creativity are linked and the following Thoughts are given to illustrate this connection:

Innovation typically involves creativity, but is not identical to it: innovation Involves acting on the creative ideas to make some specific and tangible difference in the domain in which the innovation occurs.

All innovation begins with creative ideas creativity by individuals and teams is a starting point for innovation.[2]

Problems of traditional engineering education

The above points cause the educational institutions to face difficult decisions and a lot of questions to answer, for example,

- How much material from the basic science and mathematics is required to give the engineer the fundamental scientific background?
- What is the difference between the science and engineering? And what is meant by engineering science?

- How does one really prepare a student engineer in a specific area of engineering before specifically defining that particular area? For example, the mechanical engineering is a very broad area, is it necessary to divide it further into sub disciplines? Will this help in producing a very good specialist engineer?
- How much should the mechanical engineer know about other engineering areas (e g electrical and industrial engineering)?
- Is it necessary to teach engineers psychology to develop their personal character?

What about language and humanities subjects in the curriculum?

Do the universities want to produce an engineer who is very good at a particular task but has a poor performance on other jobs even if they are related to his/her job? Or, to produce someone who is not specialist in any job but has an average performance in most of the them? Of course the best is a combination of the two, best in one job good at others, but unfortunately this is always difficult because of the nature of the education process, the time available, and the continuous change in the technical responsibilities of a given job because of the rapid change of technology. However, the universities usually prefer to produce the second type of engineers and leave the training to a particular job to the employer. The need for a broad technical education is clear is that the courses give much attention to specialisms and too little to the underlying fundamentals which are the only stable element in times of rapid technological change

The other problems of the traditional education are:

- Too much engineering science and too little on engineering as a process.
- Very little about business, commerce, costing, budgeting and marketing.
- Poor social and human skills e g participation in meetings.
- Insufficient time is taken to complete a first degree in engineering. [3]

Objectives

- "To provide the students with the opportunity to specialize in mechanical, manufacturing and maternal engineering "
- "To provide students with a broad knowledge of engineering principles, combined with a sound grasp of analysis and design methods in mechanical engineering " R
- " To give an integrated treatment of mechanical engineering science , design and manufacture " [2,3]

Importance of creative classroom teaching in mechanical engineering

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. Normal classroom teaching focuses on theoretical knowledge with fewer hands-on opportunities for students, whereas practical mechanical engineering creative class teaching enhances students' engineering consciousness and ability to solve problems. The relationship between theory and practice is shown in Figure1.

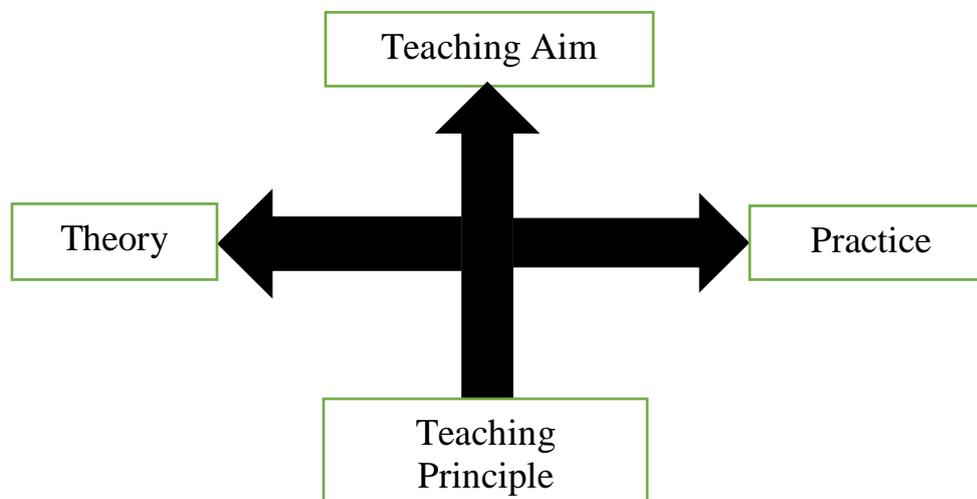


Figure 1. Relation between theory and Practice.

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 organized 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 cognizant of mechanical engineering jobs when determining the creative classroom system, since this will broaden the students' employment channels and employability.[3,4]

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 2.

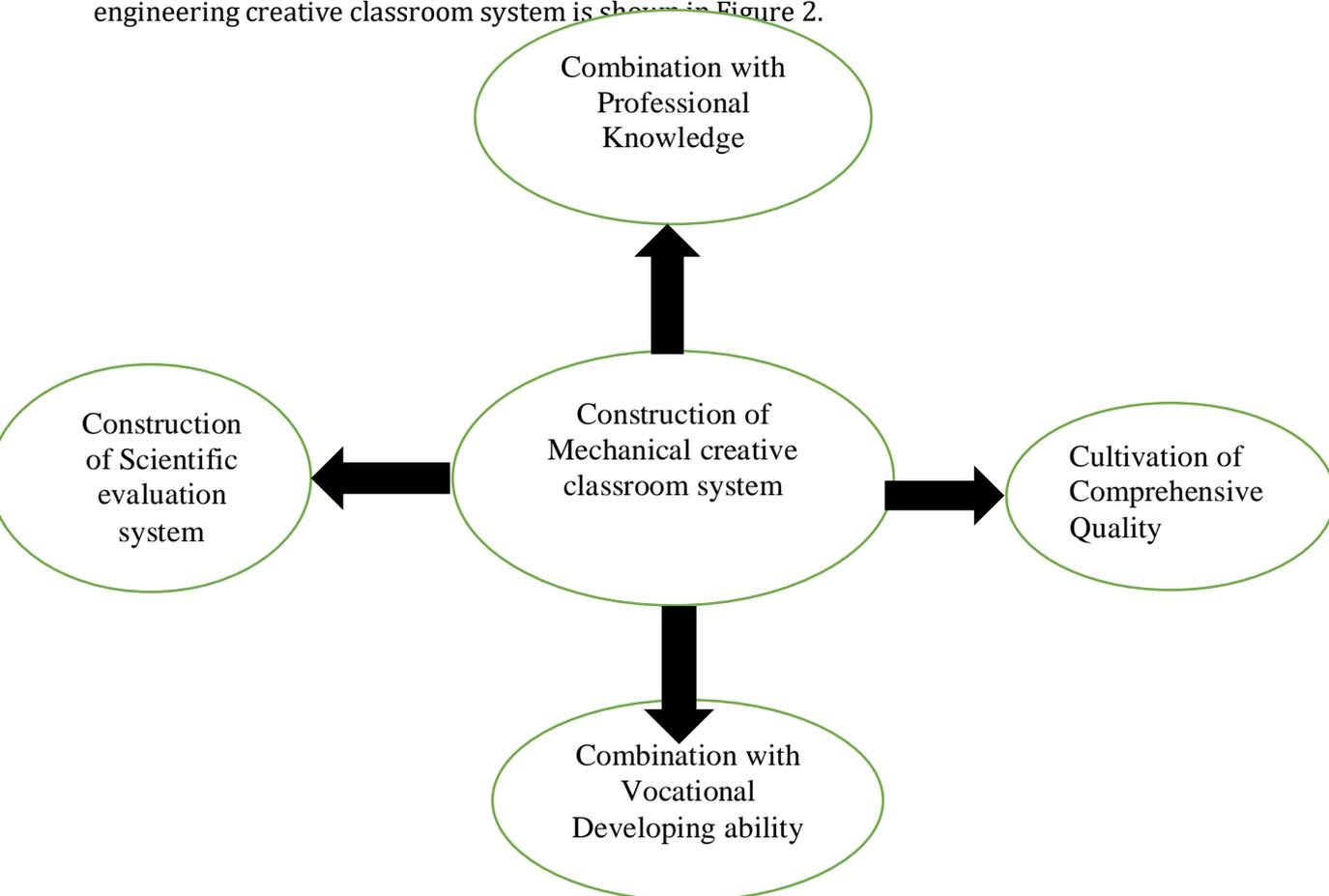


Figure 2. Construction of Mechanical Engineering Creative Classroom System.

- **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.
- 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.[5,6]

Conclusion

Mechanical engineering students expose to the concepts of innovation and creativity in the context of the business environment. This contributes to the objective to graduate engineers equipped with an action-oriented entrepreneurial mind-set who will contribute to business success and transform the workforce. The wide adoption of technology in education is becoming a mandatory condition for the long term viability of educational institutions. Plans targeting this strategic objective should address human and technology factors. In higher education, resistance to integrating technology into learning has traditionally come from faculty. Strategies that address the motivational side of the human element should, therefore, become an integral part of any educational technology deployment plan. Furthermore, it is important to keep in mind that technology by itself does not actually improve learning. Technology coupled with appropriate pedagogical practices does. Educators and instructional designers bear a responsibility to promote the use of technology for improved learning outcomes. Both need to assess the pedagogical value of technology tools and explore different methods of integrating technology with instructional design processes to foster an effective use of technology in teaching and learning.

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