Enhancing the Learning Process in Engineering Education: An Overview

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Abstract: The engineering education scenario is changing due to the integration of technology in education. The development in technology and information technology are playing important role in improving the learning process. For the effective learning process for the students from diverse backgrounds, the institutes have to adopt the effective learning methods. The goal of this paper is to give the overview of some of the methods to improving the quality and relevance of teaching learning process in engineering education. .
Keywords: Teaching learning process, Information Communication Technology (ICT), Creativity Education, Computer Simulation.

INTRODUCTION

While teaching in itself is a challenging task, one can only commiserate with a teacher who has to handle a generation that has outgrown the traditional ways of learning. With the development of new information technologies and advancement in the existing technologies, the learning methods have become very effective. Information Communication Technology (ICT) enabled pedagogy entails that the teachers take on newer and challenging roles to facilitate an effective teaching-learning process. The people have come to expect more advanced approaches in engineering education based on creative thinking in resolving social and technological problems. In addition to professional knowledge, engineering demands creativity in order to infer creative problem-solving skills. Creative thinking allows going beyond restrictions or limitations of thinking in relation to problem-solving methods [1]. The creativity development classes of the engineering department are oriented towards a common academic goal, but the effectiveness of the approach they use for the creative engineer training must be evaluated.

The effectual methods of practical teaching reform include expansion of experimental content, optimization of teaching method, construction of practical teaching platform, perfection of experimental evaluation, enhancement of teacher's comprehensive quality. In addition, the emergence of information technology provides a new opportunity to teaching reform under the new situation. The reform of teaching method can improve overall quality of students, so that they can adapt to the industry's demand [2]. Computer simulation methods are feasible and effective in real classes because they increase both the learning interest in engineering courses and the performance in hands-on

ability of engineering students [3]. Increasing classroom interactions between teacher and students and among students has been found to be an effective way of helping student learning. For this purpose, three approaches have been employed. They are embedded group labs, open-discussion quizzes, and in-class exercises with student presentations of problem solving procedures [4]. In the following sections some approaches to enhance the learn capability of engineering students are briefly described.

METHODOLOGY
Different Approaches to Improve Learning Process

It is a challenge for the teachers to engage engineering students of 21st century in the learning process. To make the learning process more effective the teachers required to develop multiple teaching-learning objectives hat will enhance a learner's level-of-learning and to enhance the skills such as investigative/critical reasoning, ingenuity, communication, right decision-making etc [5]. A well-designed teaching-learning method can help one achieve multiple teaching-learning objectives as it provides the flexibility and opportunity to learners as compared to traditional teaching methods.

A. Creativity Education Approaches

Teaching of creativity using the integrated approach involves knowledge and the thinking function during the student's problem-solving process. During the given thinking activities, students are taught to creatively recompose the given knowledge in problem-solving processes, thereby educating them to independently produce creative results. As the contents of creative thinking can be integrated into existing educational programs depending on the interest and capacity of the students, the teacher can simultaneously

teach the contents of subject and creativity. The greatest advantage of this approach is that teaching is not a process separate from the educational process, but is naturally achieved within the knowledge taught by the teacher [6]. Independent approach involves an independent course that is established to enhance creativity by dealing with the contents of creativity, such as theories and activities, for one semester. The advantage of the independent approach in relation to creativity is to have the executive opportunity to familiarize oneself with various creative thinking skills and strategies as well as to find viewpoints and perceptions that differ from standard methods, rather than finding the logical and suitable answer that is expected in standard problem-solving methods.

B. Practical Training to Improve The learning Ability of Students

There are effective means of practical teaching reform including expansion of experimental content, optimization of teaching method, construction of practical teaching platform, perfection of experimental evaluation, enhancement of teacher's comprehensive quality and informatization of practical teaching. This practical teaching method, which has stereotyped idea and places the students in a passive state, not only barely increases student's innovative spirit of students, but also hardly stimulates their learning initiative and enthusiasm. In order to satisfy the requirement of talent training and improve the level of practical teaching, the construction and management of laboratory must be strengthened. The establishment of perfect regulation gives a guarantee to the normal and orderly operation of laboratory work. More advanced equipments should be introduced into practical teaching, owing to updating of experimental apparatus as well as elimination of obsolete equipments. In addition, the practical teaching resources in institute should be allocated appropriately [8]. Make full use of experimental equipment and teaching resources during practice teaching. It's necessary to establish good operation of laboratory management to provide a high-level practical teaching platform for the analysis of experiments in engineering courses.

C. Computer Simulation Teaching Methods in Engineering Education

In recent years, computer simulation has been gradually used in education [3]. Computer simulation, as a rising outcome of the computer science increases the teaching efficiency as well as students' ability of putting theories into practice remarkably.

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation [3]. MATLAB is applied to many engineering designs in the area of control systems, digital signal processing,

communication systems, image processing and many more. The powerful functions of MATLAB helps to develop student's scientific strength and practical skill and inventive realization, pay attention to the problems of engineering practice, and modeling ability training in colleges. There are numerous computational problems in the engineering curriculum. The powerful calculation simulation capability and number of toolboxes of MATLAB gives solutions for these problems. Various kinds of algorithms are feasible to be implemented with MATLAB modeling. As a result, plenty of practical experiences will be obtained and the student's computer application ability also can be developed rapidly [8]. With MATLAB software it is easy to realize the engineering problems that help to activate student interest in learning.

Engineering courses are the combination of theories and projects related with many, which are not possible to be displayed in classrooms. To take over these problems computer simulation is needed. Computer simulation helps to visualize experiments which are not possible to be explained only by mouth. With computer simulation methods engineering curriculum becomes refined and systematic. The access to different sources of information and software applications and the use of animation, graphics and sound increases the effectiveness computer simulation methods.

Computer simulation methods contribute in the teaching learning methods in the following ways:
- ➤ It makes the learning process to certain extent flexible and individualized.
- ➤ The analysis of algorithms and theoretical methods is easily done graphically and mathematically.
- ➤ These methods allow the students to take control over their learning process to a great extent.
- ➤ The Students are able to take hold of key concepts and design techniques in a "learn by seeing and doing" manner.
- ➤ These methods help teachers to improve their teaching skills.

D. Information Communication Technology (ICT) Based Teaching Learning

Information technologies can promote the opportunities of restructuring the teaching learning process. These can transform teaching and learning by offering alternatives to the teacher provided information, access to virtually unlimited resources and opportunities for real world communication, collaboration and competition [9]. A well-designed ICT-enabled teaching-learning method enables the teachers to take on newer and challenging roles to facilitate an effective teaching-learning process. ICT will help to bridge the gap between teacher and students that the education system in general and the classroom

teachers in particular need to address [5]. The teaching method based on ICT can contribute to the ways of learning knowledge, skills and attitudes, although this is dependent on previously acquired knowledge and the type of learning activity.

ICT changes the characteristics of problems and learning tasks, and hence play an important task as mediator of cognitive development, enhancing the attainment of basic cognitive competencies as essential for life in our knowledge society [10]. The ICT environment has been developed by using different software and also the extended experience in developing web based and multimedia materials. ICT enhance the teaching and learning process in engineering education in the following ways:

- The integration of information and communication technologies can help revitalize teachers and students.
- ICT helps to improve and develop the quality of education by providing curricular support in difficult subject areas.
- ICTs by their very nature are tools that encourage and support independent learning.
- Students using ICTs for learning purposes become immersed in the process of learning

CONCLUSION

A well-designed teaching-learning method enables the teachers to take on newer and challenging roles to facilitate an effective teaching-learning process and will help to bridge the gap between teacher and students in engineering education. With the new classroom response system model, teachers get the information of how many students understand the class more efficiently, which is good to improve the interactions between students and teachers. Computer simulation has been popularly used in education as a way to motivate students in their learning and help teachers to improve their teaching level. This paper has discussed four teaching-learning methods for engineering students. These methods can positively enhance the learning ability of students in engineering education and develop students' hands-on skills. Furthermore, it may be interesting to determine the influence of web based resources on the students' ability to carry out the research and thus achieve the required learning outcomes.

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