Abstract: - Engineering education plays a vital role in building the society with good quality of knowledge in young generations. Enhancing the quality of engineering education is not a liability of a single entity instead it is a self liability of each engineering universities, colleges, educators and students. This paper aims to focus on the different challenges that are currently facing in extracting a quality of education at different hierarchy of engineering education. This paper also summarized the possible outcomes that should be focused while transforming engineering educations to enhance the quality, along with the challenges this paper focuses on the need of learning objectives like nature of applications and outcomes of the various engineering concepts.

Key words: Engineering Challenges, Quality, Objectives, Learning Outcomes, Skills

1 Introduction

Engineering is a fundamental to successful, sustainable progress in the development of the better society. The young generations are the future engineers so that we must give them the best possible foundation to their professional lives, ensuring that engineering graduates can adopt the practical and theoretical knowledge in solving industrial problems by exhibiting their theoretical understanding, creativity and innovation, team-working, technical breadth and business skills. Engineering education requires a transformation to meet the needs of employers and the challenges facing the profession communities due to the rapid development of technology, the demands of large and complex projects and the need for socially responsible multidisciplinary innovation. Development of professional competence is typically stated in the goals of engineering education programs but seldom communicated in the description of the individual course units of the same programs [1]. There is general agreement between industry, universities and accreditation bodies that learning-by-doing process that should be given more emphasis in engineering education [2][3][4][5][6]. Engineering fundamentals like theoretical and analytical concepts seem to sink in better when linked to applications and engineering design methodologies. The challenge is to emphasize design without compromising basic principles. So transforming engineers to achieve the objective of engineering degree must keep pace and updating with the changing requirements of industry.

2 Challenges in Transformation in Engineering

In introduction we discussed the need of transformation of engineering education and some of the major shifts in past years. However transformation of engineering will be very difficult task for universities to implement. The change for transformation required includes balancing the research teaching emphasis, changing educational strategies from lecturing to learning objectives, changing program structures to project structures.


At the organization level

- The main problem which was identified at the industry organization was that the many employers are not satisfied with the potentiality of many engineering graduates.
- Many Engineering graduates lack in multi-disciplinary knowledge, due to educational syllabus of the universities are overloaded with specialised technical detail with no practical knowledge of the learning objectives.
- Universities Program content does not develop the skills essential for practical or social development.
- Universities are not aware of the latest technologies and failed to adopt the latest courses in the engineering syllabus.

At the Student level
Many students consider engineering education to be boring.
Engineering education fails to attract the students
Many students are not aware of the professional ethics of the Engineering Education

3. Trends And Shifts In transformation
In Engineering

With respect to the need in the change of the industry, new courses and technologies are incubated in the curriculum, which help in binding the gap between the industry and institutions. The study shows that the significant effort that has been devoted to engineering curriculum reform across the world. It also underlines the difficulties experienced by the ‘lone champions’ who are currently driving reform in engineering schools and departments across the world, where changes often prove limited and short-term. The evidence points to the importance of departmental leadership and widespread faculty engagement in a process of reform which is informed, coherent and ambitious. Distilling strategies employed in successful change endeavors, some recommendations for the consideration of engineering schools and departments wishing to embark on curriculum reform. It closes with three recommendations for the engineering education community, to help to ensure that curriculum reforms stand the best possible chance of achieving a positive and sustainable change.

The five major shifts [8] in engineering education that have occurred during the past 100 years are:

1) A shift from hands-on and practical emphasis to engineering science and analytical emphasis;
2) A shift to outcomes-based education and accreditation;
3) A shift to emphasizing engineering design;
4) A shift to applying education, learning, and social behavioral sciences research;
5) A shift to integrating information, computational, and communications technology in education.

The first two shifts have already occurred, but they continue to have implications for engineering education. The latter three are still in process, and sustained influences on practice are difficult to forecast. In carrying out these shifts, there should also be change in the syllabus with considerable change adhering to new technologies, so that the concept learnt in the theory can be implemented practically. Earlier the syllabus framing was based on the two formats CDIO (Conceive-Design-Implement-Operate) and The Taxonomy of Engineering Competencies [9].

CDIO (Conceive-Design-Implement-Operate) is a collaborative reform initiative that is actively seeking to “shape the future of engineering education”. The driving force behind the CDIO initiative is to address “how universities can continue to provide quality education in technical fundamentals while simultaneously imparting a sense of engineering professionalism.” More particularly, the concern is to close the gap between engineering education and engineering practice. This gap is the result of a shift that occurred in the middle of the last century in the way that engineering was taught [10, 11].

The foundational premise on which the CDIO initiative is built is the conviction that design is at the heart of what it is “to engineer” [10]. The reform strategy involves (a) expanding the design modules that exist in all engineering curricula (b) ensuring that many of these have the strong practical dimension that accompanies actually building what has been designed, and (c) reorganizing the design part of the curriculum so that students participate in several major team-based, design-and-build projects during the course of their undergraduate career.

The initiative behind the Taxonomy of engineering was to identify and addressed all related issues which has the problem of high attrition rates. The first problem is to do with the nature and dynamics of the obstacles to learning that will occur in the first year program. This was a teaching and learning issue. The second was a curriculum design issue that had to do with the challenge posed as there are students with a wide diversity in the kind of learners they are and in their educational and social backgrounds, maturity, preferred language, experience and expectations.

4. Learning Outcomes

Learning outcomes play a vital role in building the good engineers in a specific field, as most of the students are not aware about this and their main focus is only on university examination. The engineering learning objectives must not be limited only to the syllabus but it should be towards the social development outside the campus also. Many students are not aware of the outcomes of their learning technology whether it
may be practical or theory and application of these technologies in real time scenarios. Learning is the process whereby knowledge is created through the transformation of experience [12] [13]. So, a methodology is very much necessary for evaluating and assessing these learning outcomes.

A methodology for student learning outcomes evaluation and improvement has been developed based on both course and program level assessment. The process is continuously refined to improve achievement of students’ learning outcomes through the course and program. The approaches to provide the concrete experience differ ranging from the traditional paradigm [14], where a lecturer presents information to a group of students, to problems based learning, where students themselves have to seek out the information that they have to solve. Successful student learning outcomes valuation and improvement processes require the accomplishment of the following tasks by faculty members:

1. Prepare the class materials in a manner that facilitates students’ understanding of course contents.

2. Develop course tasks so as to stimulate students’ critical thinking, problem solving, and communication and teamwork activities.

3. Collect/grade assigned tasks and identify low, average and high achievers in the course.

4. Introduce adequate action plans that can improve learning outcomes of low achievers through the course tasks.

5. Develop a teaching strategy and adapts new tool and technology that are beneficial to all students taking the course.

Most of the Engineering colleges are affiliated to various universities. As a university, it should have vision in enhancing the engineering education like:

- Improving Teaching and Learning
- Technology-Enhanced Training
- Development of Professional Competencies
- Knowledge Management
- Prolong to the Section on Engineering Educations
- Qualitative Research in Engineering Education

With the advent of new technologies and new learning objective that focused on the growth of engineering with good quality of knowledge, students are not showing much interest due to some of the reasons stated are:

- Engineering is not a well understood profession within the community.
- Engineering education programs are reputed to be difficult causing them to be avoided by students.
- Engineering requires multi-disciplinary knowledge, but the educational curriculums of the universities are overloaded with specialised technical detail as a consequence of the technology explosion.
- Program content does not develop the skills essential for practice as a professional engineer.
- The abilities to evaluate, to be creative, to identify what is relevant, to learn as it is necessary, and to apply this learning responsibly and efficiently, are not adequately addressed.
- Universities have not utilised the opportunities provided by the Information Technology revolution.
- Engineering education research has proven some very positive approaches which can improve the effectiveness of student learning, but they have not been widely adopted.

4 Conclusion

Transformation of Engineering Educations is the liability of all the engineering governing bodies. This papers conclude the challenges facing in transformation of engineering at all levels by focusing on the various learning objectives and outcomes like quality teaching approaches, updating the engineering syllabus simultaneously to the changes in industries, focusing on the outcomes and nature of application of the learning technologies, focusing on the centre of attention towards the quality of research work to enhance and upgrade the information about the learning concepts. So the transformation of engineering should aims to attract all the governing entities to make it a stable and exciting in building the future generation.

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