STUDYING TO BE A PRACTITIONER: A BRIEF DISCUSSION OF FUTURE STRATEGIES FOR MECHANICAL ENGINEERING EDUCATION

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INTRODUCTION

The technological world is currently changing at a greater rate than ever before. The pace of this change has been staggering. Advancements of Internet technology, extreme competition in the market place, changes in peoples' expectations, are just a few of the many reasons that contribute to rapid changes in the technological field. There is possibly a valid argument that the engineering education system should also be changed to keep up to date with these rapid changes. It is now time to reflect and study whether we are on the right track.

The main objective of this discussion paper is to point out some deficiencies in engineering education system in Sri Lanka and propose new strategies to be considered in future educational reforms. The advantage of introducing a student centered learning culture as a means of producing practitioners with the right skills will be discussed in detail. A new trend in UK engineering education, that is to move away from traditional highly specialised courses to multi-disciplinary degree programmes, will also be explored. It should be noted that the ideas presented in this paper are based on the author's own experience and the discussions the author had with UK university lecturers, practising engineers and fellow researchers. It is hoped that the issues raised in this paper will triggers positive discussion among the conference participants.

STUDYING TO BE A PRACTITIONER

The main goal of Mechanical Engineering undergraduate courses is to produce practitioners equipped with specific skills. These practitioners may be practising engineers, designers, managers, researchers, etc. Communication skills, management skills, creativity, knowledge of basic engineering science, problem-solving skills, team working skills are some of the necessary skills that they should acquire during the studies. However, it seems that students are unaware of the skills that they should acquire to be a proficient practitioner or have a short-sighted approach towards their studies. This may be due to the fact that they possess inaccurate perceptions or we have not properly communicated the final learning outcomes that we expect from the students. According to the author's experience, the main objective of majority of engineering undergraduates is to get through the written examinations. They pay very little or no attention to develop specific skills that a practitioner should possess. One could argue that the students gain those skills implicitly by preparing for traditional examination systems. However, it is imperative that the effectiveness of this traditional method is evaluated.

It is worth examining if the current & proposed Mechanical engineering curricula have been designed so that the students are informed about the

expected learning outcomes of each subject and the course as a whole. The author wishes to ask following questions in this regard:

- Has mechanical engineering course got a mission statement?
- Have the learning outcomes been well articulated in the mission statement?
- Have the subject contents been designed to develop specific skills?
- Are the teaching techniques effective in developing those skills?
- Do the examining methods test if the students have acquired the expected skills?

STUDENT CENTERED LEARNING

It is obvious that one of the major obstacles that hinders the students development into proficient practitioners is the passive teaching systems adopted throughout the Sri Lankan education system. This has been a much debated topic during the recent past. While most of the other countries are reaping the benefits of new active teaching and learning systems, the Sri Lankan system is rooted to traditional methods which could be perceived as being dated. The UK universities have greatly benefited by introducing student centered learning culture in their engineering courses. It helps them to produce practitioners equipped with right skills.

In literature, student-centered learning (SCL) is defined as a learning model which places the student (learner) in the center of the learning process. Students are active participants in their learning rather than passive recipients. SCL develops `learning how to learn' skills such as problem-solving, critical thinking, and reflective thinking. Common methods of SCL include portfolio construction and assessment, collaborative learning and team projects, and learning contracts. Some theories and practices associated with SCL include problem-based learning, resource-based learning, and collaborative/ cooperative learning.

The existing mechanical engineering teaching culture in Sri Lanka can be characterised as "administrative-centered." In many respects undergraduate courses have been designed and organised to maximise institutional administrative requirements and convenience, rather than that of its students. Often this means we are guided more by structure and rules of organisational control than by students' needs. The transition to a student-centered culture keeps students' needs constantly at the center of our attention.

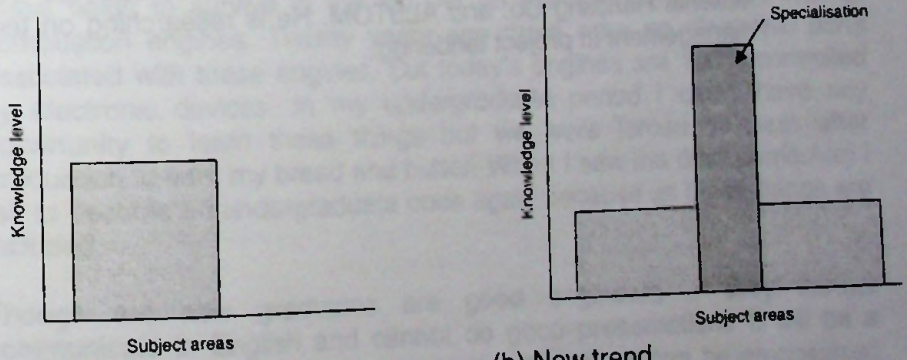
It is obvious that the various limitations like resource limitations (E.g. resource personnel, information sources, etc.), lack of training in active learning techniques, administrative difficulties, etc. will hinder the implementation of 100% SCL culture in Engineering courses. This problem could be overcome by implementing gradual continuous improvement strategy. There are a lot of lessons that we could learn from the UK universities by studying how they shift from traditional teaching and learning methods to SCL methods. Some of the key changes in teaching, learning and assessing methods are:

- group learning exercises as oppose to individual learning
- increased team working (e.g. team projects, team design tasks)
- interdisciplinary projects
- continuous assessment through interviews, course works and project work
- web based teaching and learning [1]
- use of open ended questions, design tasks, etc. for assessments
- well planned industrial visits and lectures from practising engineers / managers

In a student-centered learning environment, students' feedback should be the main mode of measuring the success of the newly implemented learning culture. An increase in positive feedback would be an indication of success. Therefore, a continuous feedback retrieval and monitoring system should be an integral part of the SCL system. The current method of getting students' feedback at the end of the academic year or course has many disadvantages. Firstly, we have to wait until the end of the year or course to measure the success of implemented changes. Secondly, students wish to reap the benefits of the suggestions or comments they made. However, the current system does not support this legitimate expectation. The continuous feedback retrieval and monitoring system would be a feasible way of overcoming those problems.

A NEW TREND

Traditionally engineering degree programmes have been designed to produce highly specialised individuals. The argument is that the individual having in-depth knowledge in a narrow field performs better than the one having broader but shallow knowledge level. However, leading UK industrial advisors have recently pointed out that graduates that possess an extremely good understanding of engineering concepts and principles across a wide spectrum of engineering, but are expert in a particular discipline are highly valued in employment market [figure 1 (b)]. Inspired by this idea, University of Bristol, UK are now in the process of forming a new multi-disciplinary degree programme which aims to educate and train students for future demands in industry [2].



(a) Traditional approach (b) New trend

Figure 1: Knowledge level of an engineer

This degree programme has been designed to give students a broader knowledge in many different disciplines as required by the leading organisations in the world. Students are allowed to select the specific subject area that they want to specialise in depending on their own interest and skills. They will acquire an in-depth knowledge in that narrow field. This will combine the advantages of two approaches and will produce ideal candidates for the top positions of leading companies.

With the introduction of new semester system and the new curricula changes, engineering education system in University of Moratuwa appears to be headed towards a traditional, highly specialised, single disciplinary approach. Therefore, based on the anecdotal evidences presented, it is worth asking the following question. Are we following the correct educational pathway?

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REFERENCES

[1] TAL (Test And Learn) a Bristol bespoke Computer Aided Assessment system which runs over the Internet
http://www.chm.bris.ac.uk/tal/

[2] Web site – Masters Degree in Engineering Design, University of Bristol, UK.
http://www.fen.bris.ac.uk/engdesign/

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