

# **The Shift Culture in Engineering Education: Are We Ready?**

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## **ABSTRACT**

*The culture in engineering education needs to be shifted from the conventional method to a more effective one. Graduates cannot fulfill requirements from industry because they lack of soft skills and this is one of the unemployment issues in Malaysia recently. A shift culture is, therefore, needed to improve curriculum in higher learning institutions. Thus, the Outcome-Based Education (OBE) is introduced in engineering programmes as an initiative pilot study solicited by Ministry of Higher Education (MOHE). This paper discusses the need of change affected by the programme accreditation, needs from the industry and Continual Quality Improvement (CQI). The paper also focuses on the programme administration. Several actions have been taken by the Faculty of Civil Engineering (FCE), UiTM towards the implementation of OBE. These include the awareness of the changes from all engineering education parties, the sharing of UiTM experiences, and the practice on developing skills and standardisation. A few recommendations have been proposed such as the need of experts, details for student qualification and the need of regular discussions among lecturers to enable the transition of culture shift embraced in harmony.*

**Keywords:** *Engineering education, Outcome-Based Education (OBE), shift culture*

## **Engineering Education: The Malaysian Scenario**

Until the year 2000, the teaching methodology in higher institutions has been based on traditional method. Lecturers normally stood in front of the class, copying from notes onto board and repeating aloud what had been written. On the other hand, students sat passively, copying from the board, reading, working on homework for the next class or daydreaming. Once in a while the lecturer would ask a question, and the students sitting in the front row would usually feel obliged to answer almost every question; the others simply avoided eye contact with the lecturer. At the

end of the class, students would be assigned with several problems that required doing something similar with examples given by the lecturer in the classroom. All above are the usual classroom scenarios explained by Rugarcia et al. (2000) and it is analogous to Malaysia situation.

Time is changing and so is the education scenario. Concerns that the education system cannot adequately prepare students for life and work in the 21<sup>st</sup> century have prompted people across the country to explore new ways of designing education. For example, as reported in the year 2001, there was a shortage of skilled workers in some technical fields. Engineers and high-tech workers were needed to meet the demand. This had resulted in a labour shortage and this problem seems to continue overtime until today. Table 1 shows the shortage of technical employee in the year 2001.

Table 1: Shortage of Technical Employees

Type of manpower	Demand	Supply	Shortfall
Engineers	30,100	21,000	9,100 (30%)
Engineering Assistants	122,900	84,070	38,830 (31%)
Asst./ Technical Craft Skills	394,000	230,000	164,000 (24%)

Source: Ministry of Human Resources (2001)

The statistics from Table 1 shows that the engineering industry is crucial for the development in the country. Thus, the main focus in this paper would be the engineering education that will supply all the players in engineering industry. As a result, the scope of jobs for engineering graduates has also increased as the engineers are always expected to have all the skills to perform duties outside the conventional, especially related to engineering technical work and soft skills.

Thus, it is the right time to implement Outcome-Based Education (OBE) in universities, particularly for the Faculty of Civil Engineering. The shift toward OBE is seen as similar to the total quality movement in business and manufacturing.

### **Anecdote of the Changing Force**

Every reform results from the needs of changes. In the engineering education, particularly in UiTM, there is a lot of concerns which involve directly to the engineering industry. Some of the changing forces which are regulatory and accreditation, the industrial needs, continual quality

improvement and the issue of separate governance are briefly discussed in the paper.

### *Regulatory and Accreditation*

Recent development in the engineering education indicates only one major concern; respond with changes is mandatory. This will lead to the incorporation of OBE as the replacement to the traditional teaching. The driving stimulus in implementing OBE is the accreditation required by the recognising bodies including the Malaysia Qualification Agency (MQA) and Quality Assurance Division (QAD) which are directly connected to the Ministry of Higher Learning Education (MOHE), the Malaysian Qualification Framework (MQF) and the Engineering Accreditation Council (EAC) from the Board of Engineers, Malaysia (BEM). Each of the respective bodies provides the required accreditation to public or private universities to be recognised as the institutions that fit with both national standard and relevant stakeholders. In the company of the accreditations, the public confidence will enhance in terms of standard of qualifications and delivery of the programmes. As for MQF that directly incorporated with multilevel and multisectoral local and foreign stakeholders, the recognition means cultivating the confidence in providing labour based on market demand.

### *The Industrial Needs*

In some aspects, OBE reflects the clarity of outcome, designing back the curriculum and expended opportunity for outcome achievement. In short, OBE leads to pre-set of end product. Public will perceive OBE as a rigid structure of education system as it sounds but in practice, this system guides to dynamic way of learning. The system will allow the introduction of more effective and innovative teaching, always being alert on the quality of graduates and, thus, allow more industry input. As a consequence, the industrial needs, if not fully fulfill, will be partially met.

### *Continual Quality Improvement (CQI)*

The benefit anticipated with the practice is Continual Quality Improvement (CQI). Any changes of industrial needs will then very much monitored as well as the requirement from the accreditation bodies. It is forecast that there will be demand from the stakeholders for higher quality graduates with multi-skills and talents from time to time. Thus, the practice of CQI is definitely inevitable.

### *Focus in Programme Administration*

As all of the issues are merely technical, the major concern is the focus on programme administration between Universiti Teknologi MARA Shah Alam, which is known as UiTM Malaysia and the branch campuses that will be recognised as State UiTM (i.e. UiTM Pahang, UiTM Perlis, UiTM Pulau Pinang and UiTM Sarawak). As far as the accreditation is concerned, only UiTM Malaysia is allowed to offer the bachelor's degree programme in Civil Engineering. The state UiTMs are only allowed to offer the diploma level for the same program. The Diploma in Civil Engineering is offered throughout the Peninsular and East Malaysia in four campuses; Pahang, Pulau Pinang, Perlis and Sarawak. The management towards the OBE concerns with the slight differences that might occur between UiTM Malaysia and the state UiTMs. As for the degree programme, the responsibilities are more towards fulfilling the accreditation required by professional bodies which is BEM.

The diploma programme is now obliged to look forward in having the approval by MQA. The accreditation requirement is not as critical to approve the degree programme in Civil Engineering. Consequently, OBE is a must as prerequisite to gain the accreditation to ensure graduate students can be accepted to pursue their study, not limited in UiTM Malaysia but other universities as well; local and abroad.

### **The Culture Shift**

Whether the key player in the engineering education is aware or not, the culture shift is not avoidable. Some of the culture change includes the awareness of the changes from all engineering education parties, sharing experiences, and the practice of developing skills and standardisation.

#### *Awareness of the Change*

Malaysia was admitted to the Washington Accord through Engineering Accreditation Council (EAC) as a provisional member in 2003 with the United Kingdom and Australia as the nominators. The Washington Accord is a multinational agreement which recognises the substantial equivalency of an engineering degree programme accredited by the responsible bodies in each of the signatory countries.

The need for a genuine shift within the engineering education system from the conventional system towards an OBE system is the most significant requirement that became clear from Malaysia's Washington Accord application. Prior to this, educational elements based on

objectives and outcomes for continuous programme improvement are mentioned in at least two regulatory documents which are EAC Manual and the Code of Practice for Quality Assurance (Ministry of Higher Education Malaysia).

Apart from meeting the above regulatory requirements, it is clear that by initiating and sustaining a genuine shift towards OBE, the engineering programmes can anticipate real benefits and improvement, including:

- a) resulting in a more directed and coherent curriculum,
- b) producing graduates with attributes more relevant to industry stakeholders, and
- c) achieving Continual Quality Improvements (CQI) as an evitable consequence.

(Basri, 2004)

An awareness of these significant benefits should provide a powerful motivating force for engineering faculties to be committed in the implementation of OBE. The Malaysian engineering education system will necessarily be driven towards continually improving programmes quality in meeting the Washington Accord requirements.

## The UiTM Experience

The Faculty of Civil Engineering (FCE) has taken the first step to implement OBE as regulated by the Ministry of Higher Education on February 15, 2005. FCE has put into action the revision of the old syllabus towards the implementation of OBE into three (3) organised workshops. The details on the event is shown in Table 2.

**Table 2: Events Organised by FCE**

<b>Date</b>	<b>Event Description</b>
10 – 11 May 2005	Introduction to OBE which involved academic administration staff. The workshop successfully produced the Programme Education Objectives (PEO), the Programme Outcomes (PO) and PEO-PO matrix.
13 – 15 Jan 2006	Revised curriculum and syllabus workshop which included all academic staff from UiTM Perlis. The representatives for the workshop were the academic staff from UiTM Pulau Pinang, UiTM Pahang, UiTM Sabah, UiTM Sarawak and academic

**Table 2 (continued)**

<b>Date</b>	<b>Event Description</b>
20 – 23 June 2006	management staff from UiTM Shah Alam. The workshop successfully produced new curriculum which directly includes OBE and course outcome-programme outcome (CO-PO) for each course offered.  The workshop on Guideline for the Implementation of OBE has been organised at UiTM Pulau Pinang which gathered representatives of academic staff from UiTM Shah Alam, UiTM Pulau Pinang, UiTM Pahang, UiTM Sabah and UiTM Sarawak. The workshop was organised to introduce the techniques and evaluation system towards OBE

### *Developing Skills*

Engineering students should equip themselves with problem-solving, communication, teamwork, self-assessment, change management and lifelong learning skills to prepare them into the real engineering world. These soft skills are used in the application of knowledge complete with the value of attitudes. The degree to which students develop these skills determines how they solve problems, write reports, function in teams, self-assess and do performance reviews of others, go about learning new knowledge and manage stress when they have to cope with changes (Woods et al., 2000).

Many research about skills developing have been carried out and one of them suggests that the development of any skills is best facilitated by giving students practice and not by simply talking about or demonstrating what to do (Woods et al., 1997). Woods et al. (2000) list eight basic activities to promote soft skill development. One of the basic skills recommended is students should understand the relevance of the skills to their professional success developed from their course syllabus such as problem-solving and teamwork skills. These skills should be allocated in the course syllabus with appropriate activities and time that will provide practice.

Involving students in research can also develop them with confidence in communication, teamwork during research process, assessment including self-assessment, lifelong learning and change management. Furthermore, the knowledge from the research will be shared and they can apply their theory in class into research.

feedback form be used across the curriculum with departmental instructors deciding on the assessment criteria.

### *Standardisation*

The issue of standardisation is also another focus in any UiTM particularly since the recent practice of OBE in the Faculty of Civil Engineering. For accreditors, the concern is each student who is entitled for certificate either at degree or diploma level, regardless of the campus they are studying in, should gain, at least similar experience from one to another, if not the same.

The revision of the curriculum and the production of the new curriculum, has raised some concerns on the grading scheme. Conventional practice is straight forward. Students are graded by the achievement from tests, submitted assignments, quizzes and final exams. Some lecturers may introduce a special project for the semester which requires students to perform special tasks and present the project at the end of semester. However, this practice is not compulsory. By adapting OBE, the grading based on soft skills is stated in the curriculum. This means the grading scheme in evaluating students must not only be based on the cognitive aspects but also on the qualitative performance. Lecturers who share the same codes (within and between campus) must, therefore, coordinate to ensure students will be graded in comparable means.

Another concern is the topics covered. Based on previous practice, lecturers may cover only selected topics that are related to the final exams. This suggests that the education experience is ambiguous among campuses. With the adaptation of OBE, the need of interaction among lecturers is compulsory to state the standard; how lectures should be delivered, the topics covered according to the level needed by the students and many others. With these practices, the monitoring of the quality of final examinations and common tests can be done closely. Therefore, the key players to set the common tests and final examination questions can achieve the required level.

Engineering education is not only concerned with theoretical practices only. The essential of engineering education, apart from learning in the classroom is the participation for laboratory training programme. Thus, the administration for engineering programme should ensure that the laboratory equipment provided is up to the standard. The equipment is expected to be complete for each course that offers laboratory training. Having complete apparatus is not the only concern. Equipment should also be provided by reasonable ratio to students. Students will have real time experience rather than to become passive team member as the result of inadequate laboratory apparatus.

## **Outcome-Based Approaches in Diploma Programme: The Way Forward**

The OBE approach has been implemented for the July intake diploma and degree programmes. As the semester one students were taking more non-engineering subjects than the engineering ones, the engineering academic staff, thus, had more time to prepare what will be needed when these students actually meet them. The way forward to be included are the needs of experts, details for student qualification and regular discussions among lecturers.

### *The needs of experts*

The syllabus design either for diploma or degree programme has been formulated by the expertise from UiTM Malaysia. The academic staff in UiTM Pahang are only the implementer of the design. With the recent development, there is a hasty need for a group of expertise who are well versed in the development of the programme syllabus; they are expected to master the philosophy, the mechanics, the techniques and the purpose of the design programme. This group is also expected to be the recognising body that will monitor the whole programme, including the syllabus, the lecturers, the supporting agencies and all that are relevant to be reported up to the standard required by MQA. This experts will be responsible in the documentations needed by MQA, formulating the strategies to achieve the accreditation, providing with proper training for all lecturers involving directly in the engineering programmes, the supporting lecturers from mathematic and science, the qualified technical staff, ensuring adequate laboratory equipment, relevant computer software, other relevant services that are essential for the learning process (i.e. counseling, library, computer laboratory, health centre, hostel, etc).

### *Details for student qualification*

The major concern is the ability for the students to enroll for degree programme in any universities with the possibility for credit transfer in any similar code, so that they can complete their degree within 1 to 2 years. Thus, the details of the qualification need to be clarified is needed so that the student is clearly directed. The best way is to have a memorandum of agreement among the universities which will secure the graduates if they are planning to further their studies for the degree programme.



### *Regular discussions among lecturers*

As the OBE approach is becoming a culture in the engineering education, more and more discussions among lecturers will be expected. This is because the continuous quality improvement will involve many ways. Some of the practices that are still relevant, should be kept while some of the practices that seem obsolete need to be removed. One of the OBE features concerns the standardization. Thus, discussions is a must and cannot be avoided.

## **Conclusion**

The issue of accreditation is merely important as it is the only key for graduating diploma students to be accepted as degree students in UiTM Malaysia and in any other universities in Malaysia or abroad. Because of this, the shift culture in engineering education by adapting the OBE approach needs to be well understood by the lecturers, supporting departments and staff, as well as students. Applying for accreditation will reflect on the dedication of the educators to provide the best learning experience as well as relevant graduates to the industry. As the accreditation is equal to quality assurance, a team of expertise as the active members to fulfill the need should be formed. This will definitely require commitment, endurance, sacrifice, sincerity and towards the end, will express the democratisation of higher education to redress inequalities to faster national unity and regional integration as well as for enhancing the social and spiritual need of people with longer life expectancy.

## **References**

- Basri, H. (2004). *Malaysia and the Washington Accord: The way forward for engineering education*. Paper presented at the Conference on Engineering Education, Kuala Lumpur.
- Gross, A. (2001). *Malaysian human resources update*. Retrieved May 19, 2006, from [www.pacificbridge.com](http://www.pacificbridge.com)
- Rugarcia, A., Felder, M.F., Woods, D.R. & Stice, J.E. (2000). The future of engineering education. A vision for a new century. *Chemical Engineering Education*, 34(1), 16-25.

Woods, D. R., Hrymak, A. N., Marshall, R. R., Wood, P.E., Crowe, C.M., Hoffman, T.W., et al. (1997). Developing problem-solving skills: The McMaster problem solving program. *Journal of Engineering Education*, 86(2), 75-91.

Woods, D. R., Felder, R. M., Rugarcia, A. & Stice, J. E. (2000). The future of engineering education. Developing critical skills. *Chemical Engineering Education*, 34(2), 108-117.

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