

Is There a Dilemma in Implementing OBE?: A Case Study in Department of Chemical Engineering, Universiti Malaya

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Abstract

Presently Outcome Based Education (OBE) is being touted as an ideal approach to impart engineering education by various accreditation bodies. For those who had been accustomed to the old school of teaching where 'lecture and tutorial' method are the mantra of the day, OBE seems to be a tall order. To them it seems like the engineering education syllabus and teaching methodology is going through a major overhaul. Is such a perception justified? In the first part of the paper, the authors will use Department of Chemical Engineering, Universiti Malaya as a case study to assess if such a perception exists in this Department. As there are many challenges being faced by engineering institutions in implementing OBE in their respective institutions, the second part of this paper discusses how the Department overcomes some of the challenges.

Keywords: *OBE, Accreditation, EAC, Engineering Education*

1. Is OBE a tall order to implement?

1.1 Introduction to Department of Chemical Engineering

The Department of Chemical Engineering, Universiti Malaya is the first chemical engineering department in Malaysia. The first batch of students graduated in 1974. To date more than 850 students have obtained their degree from the Department and presently the total enrolment is about 70 students per year. Since its establishment in 1972, the Department has gone through various changes and evolution. Table 1 below summarises the major changes or events since 1972.

1.2 Review of syllabus

Since its establishment the Department has undergone six major syllabus reviews. The first review was conducted in 1985 to include some of the emerging areas like biotechnology and to cater for introduction of the Two Tier System. Structures of laboratory, design and research courses were also streamlined to reflect the accreditation criteria at the time. The second syllabus review occurred in 1993 where this review was conducted to update the curriculum with usage of

computer simulation packages. Environmental and safety subjects were also introduced. The implementation of research and design project also changed significantly with this review.

The third review in 1995 was done to cater for change from Term System to Semester System. The fourth syllabus review was conducted in 1998 to cater for various requirements by accreditation bodies with relation to the implementation of Semester System. The fifth syllabus review occurred in year 1999 to cater for reintroduction of four year system and finally the sixth review was done in year 2004 to include fusion and separation of various courses in line with accreditation criteria by the Malaysian Engineering Accreditation Council (EAC).

1.3 Outcome Based Education, OBE

After going through six reviews, the curriculum in term of content and structure are updated and inline with the latest development in chemical engineering curriculum worldwide. The question to ask now is "if so why there is a need for introducing OBE?".

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When the OBE concept was first introduced in the Department, there were temporary voices of scepticism from the academic staff. After several road shows and explanations such scepticism slowly disappeared where it was realised that implementation is required as a fulfilment for a multinational agreement for mutual recognition of engineering degrees. The staff also agreed unanimously that the present system have following shortcomings at the Department:

- Most of the syllabus reviews (from first to the fifth) were conducted based on the Department's own analysis and with comments from external examiner and accreditation bodies. The comments and opinions of stakeholders (industry, students, parents, government, academics) were obtained from personal interviews and were limited in numbers. It was important to get stakeholders feedback but was not considered mandatory. However with the introduction of OBE and by being the signatory for Washington Accord, feedback from stake holders are heavily considered in deciding the programs.
- Prior to 2002, it can be concluded that the accreditation process gave too much emphasis on the content and process. The objective of the programs was very prescriptive. Emphasis was given on factors such as number of credits, type of subjects and coverage of specific subjects. Emphasis were not given to the teaching pedagogy (such as Problem Based Learning and Cooperative Learning), in order to archive the desired outcome capabilities in every graduate.

The Department of Chemical Engineering has a good mix of senior and junior staff which provides the expertise, strength and leadership to take the path of OBE. Furthermore one can see from Table 1 that the staff is accustomed to various changes and adopting OBE would not be much of a problem. There is also a great realisation among the staff that OBE is not a overhaul of the education system but it is more focused on the pedagogy of teaching which ensures the learning and teaching process are conducted effectively.

Table 1 also shows that the Department has been adopting components of OBE through the implementation of critical thinking course, implementation of PBL for selected subjects and making industrial training compulsory. So even though OBE is a new word for this Department, the spirit of OBE has been systematically introduced as early as year 2000.

Furthermore the implementation of OBE can be conducted with existing infrastructure in terms of class room, computer and laboratory facilities. Introduction of ISO 9001:2000 System is also not a hindrance to the implementation of OBE. The Department may require some modification to existing quality documentation and probably would also need formality approval from the Faculty's and University's administration. In summary, the Department is ready for the implementation of OBE. The Faculty's management support the implementation and have set target for various activities related to OBE. The detail of implementation strategy is as given below.

Table 1. List of major changes in the Department since 1972

Year	Changes introduced or abolished
1972	The Department was established in the Faculty of Engineering and a four year Chemical Engineering Course was introduced.
1973	Accreditation of the course by IChemE (UK)
1974	First batch of students graduated from the Department. (For the first two years the students went through the Industrial Chemistry Course in the Faculty of Science).
1985	First syllabus review
1985	Department begun to get students directly into first year. Prior to this the students joined the Department after going through a one year common engineering program in the Faculty.
1986	Introduction of Two Tier System. The students were allowed four years to complete the first part (first and second year) and another four years to complete the second part (third and fourth year). Previously, the students need to pass all the subjects for a particular year with average of grade C. Resit of three maximum subjects were allowed. Students failing to achieve a minimum pass were required to repeat the whole year including the passed subjects.
1987	Reaccreditation by IChemE
1993	Second syllabus review
1994	Reaccreditation by IChemE

1995	Third syllabus review
1996	Introduction of the Semester System and three year engineering program (SPTT)
1996	Reaccreditation by IChemE
1998	Fourth syllabus review
1999	Final batch of students of Term System graduated
1999	Abolishment of compulsory industrial training under SPTT
1999	Fifth syllabus review
2000	Reaccreditation by IChemE
2000	Re-introduction of eight semester (four year) system (SPET)
2002	Introduction of ISO 9001:2000 in the University
2003	Reintroduction of compulsory industrial training under the SPET
2003	Promotion of Critical Thinking course
2004	Promotion of Problem Based Learning (PBL)
2004	Sixth syllabus review
2005	Accreditation by EAC
2005	Introduction of OBE

2. OBE implementation in the Department

2.1 Awareness program and training

Two coordinators were appointed by the Department as representatives to the Faculty's OBE committee and as Department's OBE coordinators. Both representatives attended the OBE workshop conducted by the Faculty on 21st March 2005 to decide the direction of the Faculty with relation to OBE implementation. It was decided that the Faculty and all the Departments would adopt OBE and make appropriate preparation for its implementation for 2005/2006 intake. These representatives gave an OBE workshop at the Department level to introduce OBE and create awareness about the need to implement OBE and to set out Program Educational Objectives (PEO) and Program Outcomes (PO).

Subsequently it took two more workshops and numerous meetings to convince everybody in the Department about implementing OBE and a timeline were drawn toward implementation of OBE.

2.2 Program educational objectives (PEO)

After taking into consideration the results of various surveys (students, alumni, industry) the Department staffs agreed that the program objective of the Chemical Engineering Undergraduate Course are given in Table 2 below.

An exercise was also conducted to compare the newly defined program objective that will be used to implement OBE. Table 3 below shows the mapping of program objectives as defined by other criteria. The item marked \checkmark are items that overlap with the Department program objectives. It can be seen that the new program objectives satisfy the University's, ABET's, EAC's and IChemE's criteria. This would position the Department in no contradictory position with EAC criteria and University's aspirations. Furthermore it will also assist the Department to meet the accreditation process by EAC and IChemE. The Department is currently under discussion with IChemE to conduct an accreditation process in the early part of 2006. It is envisaged that OBE would be a great help in realising the new program objectives.

Table 2. Program educational objectives of the Department

No	Program educational objectives of the Department
1	The graduates will have strong knowledge in scientific & engineering principles
2	The graduates will have good interpersonal and communication skills
3	The graduates will be technically competent
4	The graduates will be ethically and socially responsible
5	The graduates will be equipped with research skills

Table 3. Comparison of Department program objectives compared to others

Type	Department Program Objectives*	1	2	3	4	5
University Objective	2.3 To be at forefront in knowledge	√		√		√
	2.4 To produce high-quality graduates	√	√	√	√	√
	2.5 To produce excellent scholars	√	√	√	√	√
	2.6 To produce graduates with universal human values				√	
ABET Criteria	1. Engineering principles	√		√		√
	2. Able to conduct experiments	√		√		√
	3. Able to design	√		√		√
	4. Able to work with multidisciplinary teams	√	√	√	√	
	5. able to solve engineering problems	√		√		√
	6. Professional/Ethical		√		√	
	7. Good Communication skills		√		√	
	8. Able to fit in globally and local society		√		√	
	9. involved in lifelong learning	√	√	√	√	√
	10. Participate in contemporary issues		√		√	√
	11. are taught with appropriate tools	√		√		√
EAC Criteria	1. Engineering fundamentals	√		√		√
	2. Communication skills		√		√	
	3. Technical skills			√		√
	4. Solve engineering problems	√		√		√
	5. Design	√		√		√
	6. Manager/team member		√		√	
	7. Social, cultural, global and environmental		√		√	
	8. Lifelong learning	√	√	√	√	√
	9. Experiments	√		√		√
	10. Multi-disciplinary teams	√	√	√	√	
	11. Contemporary issues		√		√	√
IChemE Criteria	1. Chemical engineering principles.	√		√		√
	2. Mathematics & Sciences	√		√		√
	3. Social, environmental, ethical, economic		√		√	
	4. Creative & innovative			√		√
	5. Quantitative science and engineering tools	√		√		√
	6. Design	√		√		√
	7. Solve engineering problems	√		√		√
	8. Practical skills/ laboratory	√		√		√
	9. Communication skills		√		√	
	10. Time management		√			
	11. Team working		√		√	

* Refer to Table 2

2.3 Program outcome

As for the program outcome, the Department decided to adopt the EAC criteria as the way forward. Evaluation was done on program outcome for all the eleven program outcome for each subject where for each outcome three levels were allocated (1= addresses outcome slightly, 2 = addresses outcome moderately and 3 = addresses

outcome substantively and 0 if a particular program outcome is not addressed). An evaluation process is currently taking place to harmonise the content of the course to achieve required program outcome which will ensure the objective of the program will be met.

2.4 Other preparation

Various steps are being taken to implement the OBE to its full advantage. Among the steps being enforced/introduced or implemented immediately are as following:

- (i) Input, suggestion and comments from various stake holders

The Department recently conducted an exit survey among the graduates (2005/2005 session). Some interesting comments and observations were made. These comments and feedback were analysed and appropriate action will be taken. Such survey will be documented as a part of Department's ISO procedures and remain as a permanent feature. A similar survey was also conducted among the Alumni and industries that they are attached with. From the feedback, the Department is gaining proper feedback on the success of the program. Plans are also being drawn out to put the evaluation process methodology as a standard procedure and it will be also a permanent feature.

- (ii) Dissemination of information

The students are also being informed about OBE through special explanatory sessions. Students are being informed about the progress, advantages and requirement of OBE. Even though there are lot of reservation among students on OBE, at least at this stage many of them are aware of intended objectives of OBE. Students are also being exposed to more industrial activities through plant visits and seminars and workshops by industrial representatives. The Alumni and Industrial Linkages Unit set up in the Department coordinates these activities with the assistance of the student club. The Department finances these activities. Dialogue with industries are being planned to obtain their perspective of OBE implementation.

- (iii) Design and Research Projects implementation.

Design and Research Projects are given additional review to ensure both the courses will achieve the intended course objectives. The Department have successfully implemented design project in collaboration with selected industries. The representative from a particular plant will assist the students through involvement in obtaining basic data, attending presentations and finally involved in course evaluation process. In the

recent review (2005), the credit hour for Research Project was increased from two to four credits.

- (iv) Industrial training

Industrial trainings are compulsory for the students from the 2000/2001 intake. Choosing appropriate industries, visiting the students during the training by staff and evaluating their report are being coordinated by a dedicated staff in the Department. Detail attention is given on industrial training program to ensure the students obtain the maximum exposure to the industry. In the recent review the industrial training duration was increased from 10 weeks to 6 months.

3. Conclusion

The Department of Chemical Engineering, Universiti Malaya believes that OBE is the way forward. Even though there was some scepticism initially about the effectiveness of OBE, these have disappeared and the potential of OBE as an effective teaching approach has been accepted. The implementation of OBE has been made simpler in the Department as many of the OBE components and requirements are already in place. Committees have been formed to prepare the necessary documents. Seeking stake holders' opinions, designing appropriate course structures, training the academic staffs, dissemination of information to the students and seeking appropriate accreditations are some of the activities that are ongoing. The Department has started implementing the OBE for its first year intake of 2005/2006. The Faculty and University Management are fully supportive of these activities and have provided necessary approvals, resources and motivation to implement OBE.

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