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Continuous Monitoring and Assessment Process of Programme Outcomes Implemented by Engineering Programme in UNIMAS

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Abstract

Since 2004, all engineering programmes across the county are implementing new engineering education approach conforming to Engineering Accreditation Council (EAC) criteria by developing and implementing outcomes-based education (OBE) in the programs. The new approach represents a philosophical and pedagogical shift in teaching and learning from instructor-centered to students-centered approach. With the implementation of this approach, one of the crucial tasks is to assess and monitor the achievement of the expected outcomes. This paper describes an assessment and monitoring strategy and process that has been implemented by Faculty of Engineering, Universiti Malaysia Sarawak. In particular, the paper describes the two monitoring tools that are used to continuously monitor and improve the program outcomes statements. The tools are categorized into two categories which are direct assessment tools and indirect assessment tools. Each of the categories comprises of few tools such as surveys, examiner reports and student's grade. The paper discusses how each of the tools were established and how the output are used to monitor and assess the POs.

Keywords: programme outcomes, direct assessment tool, indirect assessment tool, surveys

1. Introduction

Engineering Accreditation Council had placed the implementation of outcome-based education (OBE) approach as one of the key elements for accreditation purposes. Since then, OBE has become the main focus in the teaching and learning activities. It represents a philosophical and pedagogical shift in teaching and learning from instructor-centered to students-centered approach [1]. In relation to the new implementation, monitoring, reviewing and improving processes of the programme outcomes statements has become big tasks to all engineering program across the country[2]. To comply with the requirements, Faculty of Engineering, UNIMAS has identified and adopted two tools to carry out the monitoring and reviewing process. The tools are categorized as direct assessment tools and indirect assessment tools.

The direct assessment tools are tools that directly measure the importance as well as achievement of the outcomes statements. It also provides data regarding strength and importance of the programme outcomes statements. The tools are named as direct assessment tools because the respondents are appointed experts and students. The direct assessment tools comprise of Industrial Advisory Panel (IAP) Survey, Programme's External Examiner Report, Adjunct Professor Report, International Advisors Report and student's grade.

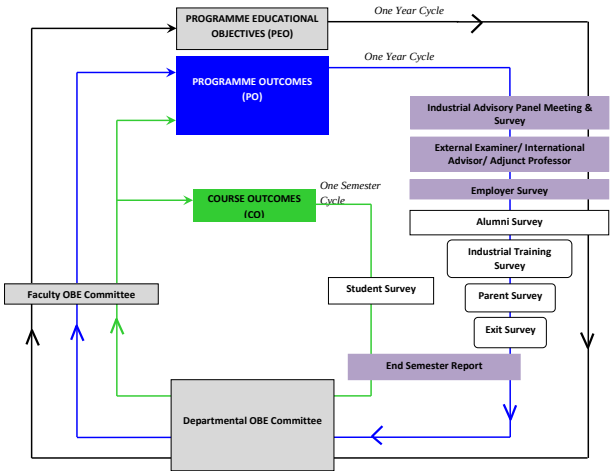

Figure 1 Assessment tools and process of programme outcomes

On the other hand, as the name indicates, the indirect assessment tools are does not directly indicate the achievement level POs in the sense where respondents are randomly chosen and it could involve respondent personal judgment. The tools used are mainly surveys and questionnaires

distributed to different stakeholders. Currently the faculty is employing five surveys to gather feedback from the stakeholders; course evaluation survey which is known as Student Survey, Industrial Training Survey, Exit Survey, Alumni Survey, and Parent Survey. Figure 1 summarizes the assessment tools and process adopted by Faculty of Engineering.

2. Direct Assessment Tools

2.1. Industrial Advisory Panel (IAP) Survey

IAP survey is a survey designed to assess the importance and relevancy of POs to students' career developments. Respondents for the survey are appointed engineering practitioners that are invited for a meeting with the faculty to review and give feedback regarding the curriculum. The result of the survey is directly used in the processes of establishing, monitoring as well as revising the POs statements in order to ensure the statements are up-to-date and comply with the market needs. Appendix 1 shows an excerpt from the survey form.

The survey is expecting two outcomes. First outcome is the data regarding the suitability and importance of the Programme Educational Objectives (PEOs) and Programme Outcomes (POs) to the current engineering market needs. The second outcome is suggestion from the industrial advisory panel on how the Faculty of Engineering can improve the existing PEOs and POs in order to produce graduates who are able to meet the current and future market needs. After the data are analyzed, the outcomes are discussed in a meeting with department members and further action is taken if necessary.

2.2. External Examiner, Adjunct Professor and International Advisor Report

External Examiner, Adjunct Professor and International Advisor are three experts appointed by the faculty to evaluate the programme curriculum as well as other elements such as adequacy of facilities, student-lecturer interaction, and research opportunities. The appointment is made based on the conditions outlined by EAC.

The experts are to produce a written report regarding their outcomes after reviewing the programme processes. Comments in the report is highlighted and forwarded in a meeting for further action. Any improvements done based on the feedback are documented in a follow-up report. Appendix 2 shows an excerpt of the follow up report.

2.3. Students' Grade

Beginning in 2008, faculty members are required to use the End Semester Report (ESR) to evaluate the students PO achievement with regards to their grade. The ESR gives two inputs which are students' success and capability in achieving expected outcomes and the appropriateness of teaching delivery and assessment methods used for that semester. The first of these is intended as a benchmark to monitor the overall programme POs achievement. The data also offer a comparison between the students self-reflective assessment which is done using the Student Survey. In the evaluation of the appropriateness of teaching and assessment methods, faculty members are asked to review the methodology used in assessing specific outcomes so that it can be improved or made more effective. Based on the evaluation, decision is made whether to adopt the assessment process for future semesters. Figure 2 shows an example of the evaluation result. The result from all courses is then summarized and tabulated in overall PO achievement as shown in Figure 3.

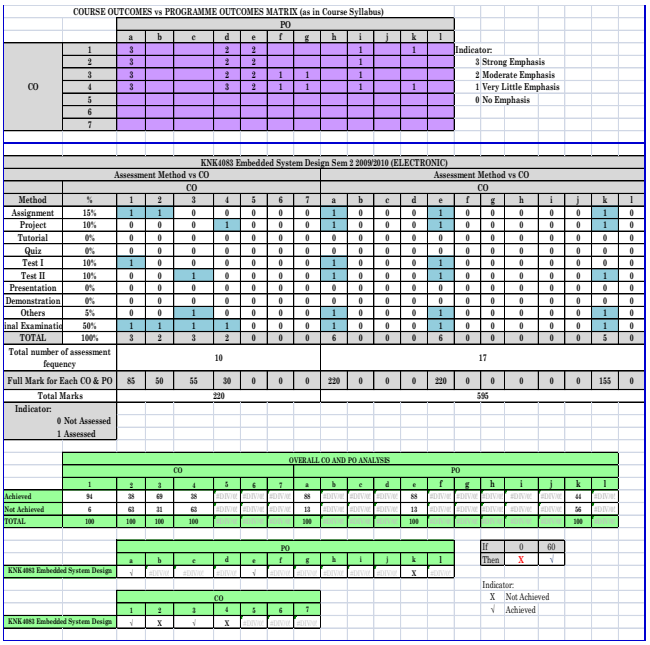

Figure 2 Excerpt of End Semester Report

NO.	CODE	COURSES	Program Outcomes a	b	c	d	e	f	g	h	i	j	k	l
1	KNJ 1013	Statics	X			X								
2	KNJ 1033	Thermodynamics I	√			√		√	√					
3	KNJ 1042	Engineering Materials I	√			√								
4	KNJ 1072	Engineering Drawing	√				√	√						
5	KNJ 1231	Engineering Laboratory I	√	√		√	√	√		√				
6	KNJ 2083	Solid Mechanics I	√			√	√							
7	KNJ 2093	Thermodynamics II	√			√		√	√		√		√	
8	KNJ 2122	Electrical Engineering Technology	X				X	X						
9	KNJ 2152	Electronics												
10	KNJ 2133	Solid Mechanics II	X			X	1							
11	KNJ 2251	Engineering Laboratory III	√	√		√								
12	KNP 3093	Engineering Design	√	√	√	√	√	√		√				
13	KNJ 3163	Instrumentation and Control												
14	KNP 4063	Robotics and Automation	√		√			√		√			√	
15	KNJ 4183	Process Control Systems	√	√	√									
16	KNP 4073	Advanced Manufacturing Systems	√			√		√	√	√	√		√	
17	KNJ 4192	Final Year Project 1	√	√	√		√						√	
18	KNJ 4203	Condition Monitoring and Maintenance Management	√	√		√	√	√		√				
19	KNF 1013	Engineering Mathematics 1	√	√	√	√								
20	KNF 3102	Engineering Ethics							√	√	√	√		
		TOTAL	17	7	5	12	7	9	4	6	3	1	4	

Indicator X: not achieved
√: achieved

Figure 3 Overall PO Achievement

3. Indirect Assessment Tools

3.1. Course Evaluation Survey (Student Survey)

It is essential for a course to state the course outcomes in clear term. The course outcomes are linked in a matrix that shows the overall expected outcomes of the programme. Students' input is used to measure the outcomes achievement using the Student Survey. Students are asked to indicate their perception of their own performance or ability with respects to each expected course outcome after a period of time. The data serves as comparison or triangulation data with the result from ESR. Appendix 3 shows an excerpt of an example of a Student Survey.

The survey also provides opportunity for students to give opinions on the teaching delivery methods and assessments for the course. The survey is indirectly reflecting which course outcomes require more emphasis and whether the teaching approaches are appropriate or not.

3.2. Industrial Training Survey

As the name indicates, the survey is designed to gather feedback from training supervisor in the company where UNIMAS students are doing their industrial training. From the survey, the faculty is able to see how the students are assessed by the industrial practitioners in accordance to the POs. In addition to this, information on the importance and relevancy of the current POs is also gathered through the survey. Important comments and feedback are forwarded to a meeting and discussed for further action.

3.3. Exit Survey

Exit Survey is another tools used to gather input from the students. The respondents of the survey are graduating students. Upon completing their four year study in the faculty, they are asked to self-evaluate themselves of their success in attaining each programme outcomes. The output from the survey offers a general overview on the strengths and weaknesses of the programme outcomes design. Outcomes with low achievement should be revisited and improved.

3.4. Alumni Survey

Alumni Survey is widely used nationwide to gather feedback from graduates. As for the faculty, the survey was designed in a manner where respondents are requested to give feedback in terms of the degree of importance of each outcome to the graduates' current position and the degree of UNIMAS preparation. The data offer a general overview whether the faculty had prepared their graduates well before they enter the profession world or not. Indirectly, output from the survey serves as a reflection to the programme design.

3.5. Parent Survey

Faculty of Engineering also welcomes input from the parents. One of the channels initiated by the faculty is Parent Survey. The survey aims to provide an opportunity for parents to share their opinions regarding the suitability and relevancy of the programme outcomes from a more general perspective.

4. Conclusion

Assessment and evaluation are crucial in the feedback and improvement of educational programmes [2][3]. To cater with the need, the faculty has developed several tools and processes and it requires each faculty members to together review and evaluates the output from the processes. Some of the tools are still new and it is anticipated that some of it require revision. At this point, the faculty is still in the phase of turning the processes into part of routine assessment review. It is fully expected that as the system matures, standardized reports will evolve and can serve as continual monitoring process for programme outcomes.

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5. Reference

1. K.Swami, Student Outcome portfolios for the Course & Program Assessment, Proceeding of American Society for Engineering Education Annual Conference & Exposition, 2002.
2. Z.T. Deng et al, Evaluation of Assessment Tools for Outcome Based Engineering Courses, Proceeding of American Society for Engineering Education Annual Conference & Exposition, 2003.
3. R. M. Gloria and J.K. Sando, Stepping Ahead: An Assessment Plan Development Guide, Terre Haute, IN: Rose-Hulman Institute of Technology, 1996.

Appendix 1 Excerpt of IAP Survey

PART B: PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Programme Educational Objectives (PEOs) are statements that describe the features which should be achieved by graduates 5 years after completion of study from the Faculty.
The Engineering Accreditation Council (EAC) criteria require that the faculty expresses programme educational objectives in a manner that allows evaluation and that the faculty measures performance against these objectives along with expected outcomes.
The faculty aspires to develop future engineers with the following educational objectives.
Please rate the following objectives according to their representation of importance to the industry. The rating scales are as listed below:

Not Relevant	Not Important	Slightly Important	Important	Extremely Important
1	2	3	4	5

	Programme Educational Objectives (PEO)	Rating	Comment on the PEO (Suitability & importance of the PEO to the current engineering need/ market)
1	Graduates of Mechanical & Manufacturing Engineering Department will be well prepared to Uphold the professionalism and ethics of the Mechanical and Manufacturing Engineering profession in national or international arena.		
2	Graduates of Mechanical & Manufacturing Engineering Department will be well prepared to Enhance knowledge by practicing independence and life-long learning in order		

Appendix 2 Excerpt of Adjunct Professor/ External Examiner/ Industrial Advisor Follow-Up Report

LAPORAN PEMERIKSA LUAR DAN CADANGAN PELAN TINDAKAN JABATAN/FAKULTI

Fakulti: Kejuruteraan
Jabatan: Kejuruteraan Mekanikal dan Pembuatan

Nama Pemeriksa Luar : Professor Dr. Mohd Nasir Tamin
Dan Institusi : Universiti Teknologi Malaysia

Bidang : Kejuruteraan Mekanikal dan Mekanik Gunaan
Tarikh Lawatan : 21 – 22 Disember 2006

Ringkasan Komen/Perkara Dari Laporan Pemeriksa	Cadangan Penambahbaikan/Komen oleh mesyuarat 'Curriculum Review' yang diadakan pada 7 Mac,4, 11, 18 April 2007/ Komen oleh mesyuarat OBE Jabatan yang telah diadakan pada 11 Januari 2008 dan 25 Mei 2007	Ulasan Naib Canselor
A. **Kurikulum** • skop dan struktur program *Struktur program yang ditawarkan boleh dibahagikan kepada 2 iaitu Kursus Teras Kejuruteraan dan Kursus Pelengkap.* *Jumlah jam kredit yang ditawarkan bagi kursus teras kejuruteraan sebanyak 81 jam adalah bersesuaian dengan kelayakan kurikulum sesebuah program kejuruteraan mekanikal dan pembuatan* • kursus-kursus yang ditawarkan *Taburan kursus-kursus teras dan pelengkap yang ditawarkan dalam program Kejuruteraan*		

Appendix 3 Excerpt of Student Survey

Course Name	
Lecturer	
Program	Mechanical & Manufacturing Engineering
Session	2
Year	2009/20010

Please [√] the rate according to your level of course outcome achievement for this subject.

No.	Course Outcome	Strongly achieved (5)	Achieved (4)	Uncertain (3)	Not achieved (2)	Strongly not achieved (1)
1.	Ability to **define** and **explain** the principles associated with concept of fluid as a continuum, pressure distribution in a fluid and kinematics of fluid motion.					
2.	Ability to **apply** and **work** with the energy equations expressed in terms of heads to solve problems					