Direct Assessment Tool of Undergraduate Engineering Programs at University of Selangor (UNISEL)

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Abstract

In this paper, the details of MyOutcomes (MyO) systems as a direct assessment tool at course and program level to assess the students’ Course Learning Outcomes (CLOs) and Program Learning Outcomes (PLOs) attainments was developed. This system was developed and practiced in the Department of Engineering, Faculty of Engineering and Life Sciences (FELS), UNISEL. The PLO is being assessed upon graduation and indicates the achievements of program students in their studies. Since Outcome-Based Education (OBE) practice is getting more attention in Institutions of Higher Learning (IHL), suitable tools are required to support the whole OBE process throughout the planning stage until evaluation stage for quality assessments and ongoing program quality enhancement. Thus, a measurement of attainment of PLOs and CLOs are an important tool which provides a benchmark for visualizing how far an institution has succeeded in delivering what it visualized. This paper provides a method by which the attainment of PLOs and CLOs can be quantified by using a novel MyO system as our OBE measuring engine and some results from MyO implementation were presented. MyO is an excel software application that automatically calculates the student’s individual CLOs and PLOs attainment based on their respective course’s assessments mark. A CLO or a PLO is said to be achieved if the student’s total assessment mark is greater than or equal to a defined Key Performance Indicator (KPI) related to that CLOs or PLOs. All academic staff needs to key in their course marks. The results of MyO system are used by the staff members for the attainment of PLOs, CLOs and for improving the overall teaching learning process.

Keywords: Direct Assessment Tool, OBE, CLO, PLO

Introduction

Currently all IHLs were implemented “outcome-based” learning in their curriculum development. The UNISEL has paved the way towards the introduction of an OBE Engineering curriculum in Malaysia. Nowadays, engineering education shifts its focus from the traditional method into the outcome-based method, more detailed assessments of student’s learning outcomes are required. OBE is being implemented and become the standard of practice in IHL since 2005. Undergraduate curriculum needs to be transformed into OBE in order to meet the requirements of both the Engineering Accreditation Council (Council, 2012) and the Malaysian Quality Framework introduced by the Malaysian Qualification Agency (Agency, 2010)
OBE refers to an educational system that focuses on what the students are expected to be able to do within the specified period of learning (Mohamad, Tukiran, Hanifa, Ahmad, & Som, 2012). OBE system can be defined as a process that involves an approach to planning, implementing, assessment and evaluating the extent to which achievement objectives and 'outcomes' of a study program can be achieved (Zulfadli, Mokhtar, Puteh, & Anuar, 2015). Outcome-based evaluation, sometimes called outcomes measurement, is a systemic way to determine if a program has achieved its goals. Thus, OBE implementation is very important and one aspect of the approach is measurement of learning outcomes attainment which is called Course Learning Outcomes (CLO) and Program Learning Outcomes (PLO) (Mokhtar, Zulfadli, & Anuar, 2015). The overall accomplishment of OBE requires assessment of Program Education Objectives (PEOs), Program Learning Outcomes (PLOs) and Course Outcomes (CLOs) (Mahesh, 2015).

Each course has its own set of CLOs and PLOs. At the end of each course, the CLOs and PLOs need to be assessed and evaluated to check whether it has been attained or not. A computerized system (Abidin, Anuar, & Shuaib, 2009) developed to utilize data obtained from students’ course assessment marks and to hasten the analysis process. Based on these results, faculty members will then determine if these outcomes are being achieved, and they will utilize the information collected during the assessment process to improve the curriculum of the program.

This paper discusses the tool used for the assessment of CLO and PLO in our department. Direct tools are used for the CLO and PLO assessment. The system was developed using Microsoft excel software. This method is evolved and practiced in the Department of Engineering, FELS since practicing OBE concepts.

Background of Study
The UNISEL in particular fully supports and implements OBE in its engineering programs. Guided by EAC Manual (2012), the FELS crafted its own Program Educational Objectives (PEO) and PLOs to do OBE assessment and Continuous Quality Improvement (CQI) implementation in its engineering programs according to the OBE model shown in Figure 1.

Program Outcomes are statements which describes what students are expected to know and achieve by the time of graduation. The FELS refers the Program Outcomes (POs) as stated in the EAC manual, as “Program Learning Outcomes (PLOs)”. The new
PLOs were formulated based on EAC Manual 2012. The PLOs are formulated based on established PEOs, which were developed according to the attributes suggested by EAC and Malaysian Qualifications Framework (MQF) Domains. The PLOs were carefully formulated to address each of the generic attributes with more concise statement that reflects the Bachelor of Engineering (Hons.) programs. Table 1 lists the current PLOs statements and Table 2 and 3 illustrate the linkages between the new PLOs with EAC attributes and MQF Domains.

Table 1

<table>
<thead>
<tr>
<th>Domain</th>
<th>PLOs</th>
<th>Bachelor of Engineering Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>KNOWLEDGE</td>
<td>PLO 1</td>
<td>to apply knowledge of mathematics, science, engineering fundamentals and other related fields to the solution of complex engineering problems</td>
</tr>
<tr>
<td></td>
<td>PLO 2</td>
<td>to design solutions for complex engineering problems that meet specified needs with appropriate consideration for public health and safety, societal, and environmental considerations</td>
</tr>
<tr>
<td></td>
<td>PLO 3</td>
<td>to conduct investigations into complex problems using research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions</td>
</tr>
<tr>
<td></td>
<td>PLO 4</td>
<td>to apply reasonable and practical knowledge of legal, health, safety, legal and cultural issues and the consequences of actions relevant to professional engineering practice</td>
</tr>
<tr>
<td></td>
<td>PLO 5</td>
<td>to explain the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development</td>
</tr>
<tr>
<td>SKILLS</td>
<td>PLO 6</td>
<td>to develop, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations</td>
</tr>
<tr>
<td></td>
<td>PLO 7</td>
<td>to develop, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations</td>
</tr>
<tr>
<td></td>
<td>PLO 8</td>
<td>to function effectively as an individual, as a member or leader in diverse teams and in multidisciplinary settings</td>
</tr>
<tr>
<td></td>
<td>PLO 9</td>
<td>to communicate effectively in complex engineering activities with the engineering community and with society at large</td>
</tr>
<tr>
<td></td>
<td>PLO 10</td>
<td>to demonstrate knowledge of engineering, management and financial principles in multidisciplinary environments</td>
</tr>
<tr>
<td></td>
<td>PLO 11</td>
<td>to demonstrate ethical principles and commit to professional ethics and responsibilities and norms of engineering practice</td>
</tr>
<tr>
<td></td>
<td>PLO 12</td>
<td>to recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change</td>
</tr>
</tbody>
</table>

Table 2

The Linkages between PLOs and EAC Attributes

<table>
<thead>
<tr>
<th>EAC Program Outcome (EAC-PO)</th>
<th>PLO of B. Eng(Hons)</th>
<th>KNOWLEDGE</th>
<th>SKILLS</th>
<th>ATTITUDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply knowledge of mathematics, science, engineering fundamentals and engineering application to the solution of complex engineering problems</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, societal and environmental consequences</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct investigations into complex problems using research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions</td>
<td>✓</td>
<td></td>
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</tr>
<tr>
<td>Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations</td>
<td></td>
<td>✓</td>
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<tr>
<td>Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequences of engineering action relevant to professional engineering practice</td>
<td></td>
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<td>✓</td>
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<tr>
<td>Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development</td>
<td></td>
<td></td>
<td>✓</td>
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</tr>
<tr>
<td>Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice</td>
<td></td>
<td></td>
<td>✓</td>
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</tr>
<tr>
<td>Communicate effectively in complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentation, and give and receive clear instructions</td>
<td></td>
<td></td>
<td>✓</td>
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</tr>
<tr>
<td>Function effectively as an individual, as a member or leader in diverse teams and in multidisciplinary settings</td>
<td></td>
<td></td>
<td>✓</td>
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</tr>
<tr>
<td>Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in teams, to manage projects and in multidisciplinary environments</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
Table 3

The Linkages between PLOs and MQF Domains

<table>
<thead>
<tr>
<th>MQF Domain</th>
<th>PLO1</th>
<th>PLO2</th>
<th>PLO3</th>
<th>PLO4</th>
<th>PLO5</th>
<th>PLO6</th>
<th>PLO7</th>
<th>PLO8</th>
<th>PLO9</th>
<th>PLO10</th>
<th>PLO11</th>
<th>PLO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>Practical Skill</td>
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<td></td>
<td>Y</td>
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<tr>
<td>Social Skill and Responsibilities</td>
<td></td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>Ethics, Professionalism and Humanities</td>
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<td>Y</td>
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<tr>
<td>Communication, Leadership and Team Skills</td>
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<tr>
<td>Scientific Methods, Critical Thinking and Problem Solving Skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td>Y</td>
<td></td>
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<td>Y</td>
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<tr>
<td>Lifelong Learning and Information Management</td>
<td></td>
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<td>Y</td>
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<tr>
<td>Entrepreneurship and Managerial Skills</td>
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<td></td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

Course Learning Outcomes (CLO)

CLOs define the qualities attained by the students on completing the particular course on a subject (Mahesh, 2015). The Table 4 shows the list of CLO for a specific course (Engineering Mathematics I).

To measure the attainment of CLO and PLO, EAC has given guide that the CLO should be mapped to PLO. The method of mapping is left to each program owner as long as it can show that the achievement of CLO will contribute to that achievement of PLO.

Table 4

A sample list of Course Learning Outcomes (CLO) for the course ‘Engineering Mathematics I’

<table>
<thead>
<tr>
<th>Course Outcomes (CLO) for Engineering Mathematics I (KFS1113)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Solve complex number operations, conversion in polar form, exponential form and by using De Moivre’s theorem.</td>
</tr>
<tr>
<td>2 Apply the concept of differentiation and evaluate the differentiation by using several methods.</td>
</tr>
<tr>
<td>3 Evaluate indefinite and definite integrals and integrate the given functions by using several methods.</td>
</tr>
<tr>
<td>4 Evaluate the beneath curve, volume of revolution and the length of curves.</td>
</tr>
<tr>
<td>5 Solve matrices operations, inverse of matrices and apply Cramer’s Rule.</td>
</tr>
</tbody>
</table>

Course Level

At the beginning of the semester, students are provided with a Course Information (CI) by the lecturer that guides them on how the course will be delivered throughout the semester. The CI contains the weighted assessment components, CLO-PLO mapping, and assessments-CLO mapping among others. Students’ mark was accumulated from the assessments and will use it to measure the students learning outcomes through a MyO system. The detailed report of attainment can be seen in Course Assessment Review Report (CARR). This system will generate the CLO and PLO attainments based on the individual student’s CLO and PLO attainments marks. These results will be applied by lecturers to prepare the course review and compared with the previous semester, which is to identify the part that has been improved and need to improve wholly. This complete Continuous Quality Improvement (CQI) process in the course level is depicted in Figure 2.
### Purpose of the Study

The purpose of this study was to develop the effectiveness method that is used to analyze or evaluate the attainment of specific learning outcomes which are Course Learning outcomes (CLOs) and Program Learning Outcomes (PLOs) for all courses using MyO system. MyO is an excel software application that automatically calculates the student’s individual CLOs and PLOs attainment based on their respective course's assessments mark. The following research questions were formulated in order to achieve the aims of the study.

### Research Questions

The research questions for this study are as follow:

1. How do we know if the program was effective?

As researcher can perceive, learning to measure outcomes is only a first step in the process towards making sure that our programs are having the impact that we desire. However, it is still a crucial step in the process. With first cultivating an evidence-based approach, IHLs can move forward to proper program effectiveness evaluation.

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**Figure 2. Course Level Process Flow**

<table>
<thead>
<tr>
<th>Actions by</th>
<th>Flow Chart</th>
<th>Evidence(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HODs and all Lectures</td>
<td>Teaching Workload prepared and PLOs’ activities are planned to all Lectures</td>
<td>1 month before the semester starts</td>
</tr>
<tr>
<td>All Lectures</td>
<td>Current Lecture of the course get the CLO from the previous lecture of the course</td>
<td>2 weeks before the semester starts</td>
</tr>
<tr>
<td>All Lectures</td>
<td>Current Lecture do the planning to improve the performance of the course</td>
<td>3 week before the semester starts</td>
</tr>
<tr>
<td></td>
<td>Implementation of the planning</td>
<td>Week 1 to week 7</td>
</tr>
<tr>
<td></td>
<td>Evaluation Process</td>
<td>Week 1 to week 7</td>
</tr>
<tr>
<td>HODs and lecturer Appointed</td>
<td>Current Lecture upgrade the mid performance and Teaching Effectiveness Evaluation</td>
<td>Week 6 to week 7</td>
</tr>
<tr>
<td>HODs and all Lectures</td>
<td>Discussion of lecturer’s and student’s Performance</td>
<td>Mid Term Break</td>
</tr>
<tr>
<td>All Lectures</td>
<td>Implementation of the mid CLO proposed</td>
<td>Week 8 - week 16</td>
</tr>
<tr>
<td></td>
<td>Evaluation Performance of students</td>
<td>Week 8 - week 14</td>
</tr>
<tr>
<td>HODs and lecturer Appointed</td>
<td>Teaching Effectiveness Evaluation</td>
<td>Week 13 - week 14</td>
</tr>
<tr>
<td>HODs and all Lectures</td>
<td>Proposed action plan for next semester</td>
<td>Week after semester</td>
</tr>
</tbody>
</table>

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2. What requirements does the system need to fulfill?
   We talk a lot about outcomes, but the truth is that performance measurement doesn’t mean anything without the proper assessment and evaluation. The system described in this study need to fulfill these requirements such as identify and document the outcomes, activities, and indicators to be evaluated, and assess the quantity and quality of the program’s achievements. The determination of desired outcomes, activities, and indicators should take place during the planning stages of system development.

3. How does the system develop students’ achievement in program?
   MyO system was designed to measure students’ achievement in the program. This system was developed to assign proper assessments and evaluate the attainment of CLO and PLO students per courses to ensure that students are able to distinguish and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviors that students acquire as they progress through the program. Besides that, the outcomes from the system help in monitoring the quality of the program and for continuous quality improvement.

**Methodology**

This paper will now present the details of CLO and PLO attainments from the course level up to the program level using MyO system. The MyO system was developed using Excel worksheets which automatically calculate the course’s CLO and PLO attainments at the end of the semester. The following Figure 3 shows the process of MyO system.

The students’ raw marks were used as input, which automatically generates the respective CLO and PLO assessment marks. The outputs the comparative CLO and PLO attainments for the previous and current semester that serves as the basis for CQI plan. MyO results from all courses were then collected and used at the program level to calculate the student’s PLO attainments upon graduation. Details of the MyO process flow are shown in Figure 4 to 10 using a MyO file of Engineering Mathematics I that the author handled in the January 2016 semester (1/16/34). To start a new assessment of a teaching course, the lecturer should select the program offered either for bachelor of engineering or diploma in engineering program as shown in Figure 4.
DIRECT ASSESSMENT TOOL OF UNDERGRADUATE ENGINEERING

Course Information (CI)
Course Learning Outcome (CLO)
Assessment Component (AC)
Program Learning Outcome (PLO)
AC-CLO Mapping
CLO-PLO Mapping

PLAN AND MARK EXCEL WORKSHEET
Course Code
Course Name
Semester
CLO-PLO Mapping
AC-CLO Mapping
Course Coordinator
Verified Person
Date
Max Mark & Weightage Distribution
CLO & PLO Mark Criteria
Students’ ID & Name
Students’ Raw Marks
Normalize Actual Marks, % Score & Grade
Students’ Performance
CLO & PLO Analysis

CLO PER STUDENT EXCEL WORKSHEET
Course’ CLO Assessment
Normalized Actual CLO Marks
Students’ CLO Attainment Result

PLO PER STUDENT EXCEL WORKSHEET
Course’ PLO Assessment
Normalized Actual PLO Marks
Students’ PLO Attainment Result

CARR WORKSHEET
Comparative CLO & PLO Attainment for Previous Semester & Current Semester
Course Analysis & CQI PLAN

Figure 3. MyO Process Flowchart

Figure 4. Starting Page of MyO Application
Figure 5. CLO-PLO Mapping

From the mapping matrix CLOs and PLOs for one course as shown in Figure 5 where PLOs are mapped to one or more CLOs, but only one CLO is mapped to one PLO. Lecturers are given flexibility to plan the mapping based on their preference where each assessment component can be mapped to one or more CLOs and need to enter full mark and weightage percentage distribution for each assessment component based on 100% marks as shown in Figure 6. These assessment marks are automatically generating the total percentage of each CLO mark covered and each PLO emphasis in the course. The CLO and PLO emphasis are generated automatically using equations (1) to (8).
DIRECT ASSESSMENT TOOL OF UNDERGRADUATE ENGINEERING

\[ CLO_n = \sum AC : CLO_n \quad (1) \]

PLO emphasis:
\[ PLO_n = \sum CLO_{shared} : PLO_n \quad (2) \]

According to Figure 6 and using equation (1), CLO1, 2, 3, 4 and 5 are calculated as:

\[ CLO1 = \sum AC : CLO1 \]
\[ = Quiz1 : CLO1 + Test1 : CLO1 + FinalExam : CLO1 \]
\[ = 5 + 1.87 + 12 = 18.87\% \]

\[ CLO2 = \sum AC : CLO2 \]
\[ = Test1 : CLO2 + FinalExam : CLO2 \]
\[ = 13.13 + 12 = 25.13\% \]

\[ CLO3 = \sum AC : CLO3 \]
\[ = Quiz2 : CLO3 + FinalExam : CLO3 \]
\[ = 5 + 12 = 17.0\% \]

\[ CLO4 = \sum AC : CLO4 \]
\[ = Test2 : CLO4 + FinalExam : CLO4 \]
\[ = 9.4 + 12 = 21.4\% \]

\[ CLO5 = \sum AC : CLO5 \]
\[ = Test2 : CLO5 + FinalExam : CLO5 \]
\[ = 5.6 + 12 = 17.6\% \]

Based on Figure 6, and using equation (2), PLO1 and 2 are calculated as:

\[ PLO1 = \sum CLO_{shared} : PLO1 \]
\[ = CLO1 + CLO2 + CLO3 + CLO5 \]
\[ = 18.87 + 25.13 + 17 + 17.6 = 78.6\% \]

\[ PLO2 = \sum CLO_{shared} : PLO2 \]
\[ = CLO4 \]
\[ = 21.4\% \]

This result shows CLOs emphasis contributes to PLOs emphasis which is:

\[ \sum CLO_n = \sum PLO_n \]
\[ = CLO1 + CLO2 + CLO3 + CLO4 + CLO5 \]
\[ = PLO1 + PLO2 = 78.6 + 21.4 = 100\% \]

After generating the CLO and PLO emphasis, the lecturer is now ready to key-in the students’ individual assessment mark. The students’ marks are tabulated according to the assessment types by CLOs. Figure 6 shows the individual student’s raw marks distributed to respective CLOs with corresponding CLO marks. These marks are then used to calculate the CLO and PLO attainment as shown in Figure 8 to 10.
Figure 7. Students’ Raw Assessment Marks

Figure 8. Students’ CLO Assessment Marks

Figure 9. Students’ CLO Attainment
DIRECT ASSESSMENT TOOL OF UNDERGRADUATE ENGINEERING

After the calculation, the new CLO and PLO mark for each outcome for each student is tabulated in a new table, as shown in Figure 9 and 10. In these figures, the CLO and PLO marks for individual student according to each CLO are presented. The student CLO and PLO assessment marks are generated automatically using equations (3) to (8).

$$CLO_n: \text{AssessmentMark} = \frac{CLO_n: \text{RawAssessmentMark}}{CLO_n: \text{MaxAssessmentMark}} \times \% \text{weightage}$$ (3)

$$CLO_n: \text{AttainmentMark} = \sum CLO_n: \text{AssessmentMark}$$ (4)

$$CLO_n: \text{Attainment} = \frac{CLO_n: \text{AttainmentMark}}{CLO_n} \times 100\%$$ (5)

$$PLO_n: \text{AssessmentMark} = CLO_n: \text{AssessmentMark} \times \text{sharedPLO}$$ (6)

$$PLO_n: \text{AttainmentMark} = \sum CLO_n: \text{AttainmentMark} \times \text{sharedPLO}$$ (7)

$$PLO_n: \text{Attainment} = \frac{PLO_n: \text{AttainmentMark}}{PLO_n} \times 100\%$$ (8)

For example, for the student with ID of 4161003671 in Figure 7, CLO1 and PLO1 attainments are calculated as:

$$\text{Quiz1: CLO1} = \frac{25}{28} \times 5\% = 4.46\%$$

$$\text{Test1: CLO1} = \frac{5}{5} \times 1.87\% = 1.87\%$$

$$\text{FinalExam: CLO1} = \frac{10}{20} \times 12\% = 6\%$$

$$CLO1: \text{AttainmentMark} = \text{Quiz1: CLO1} + \text{Test1: CLO1} + \text{FinalExam: CLO1}$$

$$CLO1: \text{Attainment} = 4.46 + 1.87 + 6 = 12.33\%$$

$$PLO1: \text{AttainmentMark} = CLO1: \text{AttainmentMark} + CLO2: \text{AttainmentMark} + CLO3: \text{AttainmentMark} + CLO5: \text{AttainmentMark}$$

$$PLO1: \text{AttainmentMark} = 12.33 + 17.85 + 10.30 + 14 = 54.48\%$$

$$CLO1 \text{Attainment} = \frac{12.33}{18.87} \times 100\% = 65.34\%$$

$$PLO1 \text{Attainment} = \frac{54.48}{78.6} \times 100\% = 69.31\%$$

Department of Engineering decides the target attainment level for each CLO, PLO
and for each student is set 50% as KPI and passing mark for the programs. A CLO or PLO is said to be attained if at least 50% of the students obtain 50% of their assessment mark related to that CLO or PLO. In the example above, it is shows that student has attained CLO1 and PLO1.

Once the marks are keyed in, the system will automatically calculate the CLO and PLO attainment. The result is shown as graph form as depicted in Figure 11 and 12. The graph shows the percentage of CLO and PLO attainment for previous and present semester that are generated in the course.

From the Figure 11, it is found that only CLO1, CLO2 and CLO5 have scored more than 50% for both semesters. Hence, some of the CLOs attainment levels were improved and there are those that decreased considerably. Besides that, some CLOs although improved did not reached the KPI. Analysis of these results will lead to CQI action plan that can be implemented in the next semester cycle. Similarly, Fig. 12 shows the comparative PLO attainment results for the previous and the current semester. It can be observed that the two PLOs improved from the previous semester to the current semester. PLO2 was not attained, which is a direct result of the CLOs not being attained. Implementation of action plans to improve attainment of all CLOs is required to improve attainment of the related PLOs as well.

The course coordinator or lecturer prepares the CQI action for the next semester by fulfills CQI-CARR Form as shown in Figure 13.
Program Level Assessment

Every semester, the Program Division compiles the PLO attainment data for all courses and analyzes it to obtain the overall level of PLO attainment for the particular semester. All MyO-CARR files from semester 1 to semester 7 were collected. PLO with low attainment will be highlighted during department meeting. Any courses mapped to this PLO will need to revise its delivery and assessment methods. Figure 14 and 15 gives sample of the summary of PLO attainment for Bachelor of Engineering (Hons.) Mechanical for semester 41434 and 11534. From Figure 14 it is seen that all PLOs have been attained. For example, PLO 2 which is the attribute related to ability to solve the complex problem can be improved by increasing discussion time and expose the students with the problem analysis rather than lectures.

This is carried out for each course and is also compiled for each student as shown in a randomly selected student sample seen in Figure 15. Result and analysis of PLOs data are consisting PLOs’ achievements of courses per semester. This data is obtained from the MyO-CARR compiled by each lecturer teaching the courses. The compilation is carried out at the end of each semester and action plan is discussed.

Figure 13. CQI-CARR Form

Figure 14. PLOs attainment for semester 41434
In addition, it is also useful to get an alternative insight by calculating PLOs’ achievement per student as shown in Figure 16 (randomly selected student as a sample) for a year of 2014. This result is obtained by collecting data of PLOs’ achievement of all courses throughout the selected student’s study to be carried out annually. It can be seen that overall, the results thus far for both PLOs assessments are encouraging where it shows all PLOs are achieved with (having values greater than 50%).

The staff member needs to analyze the results of direct assessment gravely for the PLOs which are not attained. This analysis is used to close loop the old PLOs in order to develop the assessment plan and action plan for new PLOs. Performance analysis of CLOs, PLOs, CQI have been conducted manually by the Program Division of the department and the current activities are tedious and time consuming. The CLOs and PLOs assessment and analysis are conducted and recorded based on students’ admission and enrolment. Therefore, OBE Online System is proposed to automate the task of Program Division and ease the documentation work for the program.

**Conclusion**

As a conclusion of this paper, a successful and effective MyO system as a tool for faculty-driven, direct assessment of student attainment of program outcomes that can be
used to ensure quality of education and preparation of engineering program is appropriate and at a good level. MyO system results shows the strong relationship between CLO and PLO in improving the course delivery through regular assessments, monitoring, CQI action planning, and implementation thus ensuring better quality graduates equipped with desired capabilities ready face the complex challenges of their respective field of profession. The analysis of result of PLO attainment will help the lecturer to improve the teaching learning process.

However, MyO system need to review and improve in a various aspect such as automatically calculate PLO attainment at the program level and online database management system to store all MyO results from all courses to generate PLO attainment for each of student, cohort and semester in the database. As whole, MyO system was found to be an essential tool which can be for continuous quality improvement.

References