BACHELOR OF ENGINEERING (HONS.) ELECTRICAL (EE220) POS PERFORMANCE ANALYSIS BASED ON OBE-ANAS MEASUREMENT TOOLS

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ABSTRACT

Nowadays, Outcome Based Education (OBE) is a vital practice for empowering the education system and requires no introduction to any academician. In the OBE, one of the important elements is measuring and monitoring the programme outcomes (POs). The process of collecting data has always been tedious and is required to be improved. In this paper, the mechanism of analyzing the program outcomes as one of the fundamental factors for the accreditation in FKE UiTMPP is presented. The tool was developed by the OBE committee unit and known as OBE-ANAS system to obtain the overall program outcomes performance of EE220 program in UiTMPP. The system was designed using oriented programming C# as graphical user interface (GUI) and the server system involves Microsoft SQL Server 2012 (MSSQL 2012). The OBE-ANAS system must comply with the Key Performance Indicators (set by the top management) as targeted indicator where students are expected to achieve a score as a minimum 50% or level 2 to attain the respective PO. At the end of the process, the tool provides better platform for observing and measuring POs parameters such as POs average, POs density, individual POs and Degree of Programme Achievement (DPA) achievement analysis. The developed system is believed to benefit the faculty in terms of accreditation and achieving the KPI.

1. INTRODUCTION

Outcome based education (OBE) is an organizational structure which provides the structure contents to lead the products with the aims that learners master the desire result for specific skill, knowledge or behavior. It was recognized as an education theory to improve upon educational system all the way through the outcomes. As stated by Spady (1993), "Outcomes-Based Education means clearly focusing and organizing everything in an educational system around what is essential for all students to be able to do successfully at the end of their learning experiences". It is basically guiding the students by giving an initial overview of what is important to do and to be met throughout the study. (Garimella & Nalla, 2014).

According to Rashid (2012), OBE is an educational process that is focused on achieving certain specified outcomes in terms of individual student learning. Outcomes are the key substances which students should understand and be able to do successfully at the end of their learning experiences. Both ideas encourage the student's accomplishment upon graduation. However, in the OBE curriculum, student's development and enhancement progress are only feasible whenever related data are gathered from the PO (Kanmani & Babu, 2015).

The OBE system has greatly changed the concept of learning from the conventional studies concept into student self oriented studies concept and methods are introduced for independent study competency (Mahmood et al., 2015). The intention is to initiate a lifelong learning approach and to educate themselves to be more competent and ready to catapult in to a more competitive working environment.

2. FUNDAMENTAL PROGRAM OUTCOMES FOR ACCREDITATION

A Self Assessment Report (SAR) is a report that provides the plan, implementation, assessment and evaluation of the programme conducted by the Faculty of Electrical Engineering UiTM Pulau Pinang (UiTMPP). It is a reflection on the processes with results obtained used in a continuous quality improvement at all levels of the programme activities.

During the Engineering Accreditation Council (EAC) SAR Bachelor of Engineering (Hons.) Electrical (EE220) accreditation in UiTMPP, twelve POs have been reviewed and some changes have been made to fulfill the requirement of EAC as stated in 2012 EAC manual (Engineering Accreditation Council, 2012). The SAR is a reporting tool to collect all the evidences, including survey from industrial towards graduates' performances whether they are well-equipped in terms of theoretical and practical knowledge in various electrical engineering areas. In order to make sure UiTMPP's graduates are adequately prepared for the broad engineering industries, achievement and attribution of graduates can be observed and assessed through these assessments and evaluations.

Regarding the ABET Criteria 2015 – 2016 (ABET, 2015), POs statements describe what students are expected to know and be able to perform or attain by the time of graduation. Table 1 shows the programme offered by FKE UiTMPP (FKEPP) that has been designed to produce a skillful, knowledgeable and ethical engineer. It is expected that graduates should possess these attributes upon their graduation.

Table 1: Programme Outcomes for Bachelor of Engineering (Hons.) Electrical (EE220)

Programme Outcomes (PO)	Attributes
PO1	Ability to apply knowledge of mathematics, science and engineering fundamentals to the solution of engineering problems.
PO2	Ability to communicate effectively on engineering activities in written and oral form.
PO3	Ability to apply specialised knowledge to solve complex electrical / electronic engineering problems.
PO4	Ability to identify, formulate, and analyse complex electrical / electronic engineering problems.
PO5	Ability to design solution for complex electrical / electronic engineering problems with appropriate consideration for public health, safety and environmental considerations.
PO6	Ability to use the techniques, resources and modern engineering tools necessary for complex electrical / electronic engineering activities.
PO7	Ability to recognize and apply ethical standards in engineering practice.
PO8	Ability to engage in life-long learning.
PO9	Ability to apply managerial, entrepreneurship and leadership skills in multidisciplinary projects.
PO10	Ability to work as both an individual and in a team on multidisciplinary projects.
PO11	Ability to apply knowledge of contemporary issues and appreciate the impact of professional engineering solutions in the contexts of environment and sustainable development.
P012	Ability to conduct investigation into complex problems using research based knowledge and research methods.

The overall process of completing the SAR for the accreditation involving programme level, course level and stakeholders. The programme level used to identify the continuous performances on the programme outcomes as part of the continuous quality improvement (CQI) process under the OBE. Figure 1 shows the process where the performance was reviewed continually on the PO as part of the continuous quality improvement (CQI) process under the OBE. The reviewing of POs was determined by the top management council department, besides feedbacks from the stakeholders such as the industrial demands, employers, alumni and parents (Engineering Accreditation Council, 2012).
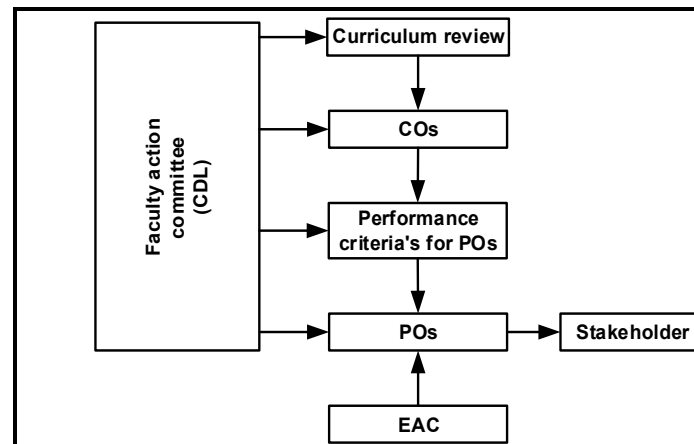
Figure 1: The process of reviewing POs

The faculty action committee takes the ownership and responsibility of the curriculum after gaining some feedbacks from the stakeholders. The information gathered was discussed and evaluated to review the curriculum, course outcomes (COs), Performance Criterias (PCs) and Programme Outcomes (POs) at the programme level during the annual CDL workshop or alternatively, can be done by top management if immediate actions are needed. The faculty action committee noted that the assessment and evaluation processes should identify strengths and weaknesses of a learning programme for improvement.

3. ASSESSMENT OF THE PROGRAMME OUTCOMES

The assessment evaluation mechanism was modified according to OBE implementation where lecturers would assist the students correspondingly. A well-constructed continuous improvement process should consist of a process describing the activities, the assessment of the student learning outcomes, the evaluations of the attainment of the targeted outcomes and the results of the activities for the program improvements. For an effective continuous quality improvement process, the program faculty should provide the evidence through the quizzes, tests, exams, laboratory works assessment, case studies, mini projects, and industrial training (Rahman-Harun et al., 2016).

Then, the faculty evaluated the evidence of the assessments by reviewing and observing the student work related to the program requirements. In preparation for reviewing a program's continuous improvement process of students' outcomes, it is important to note that there should be a well–constructed process to enable continuous improvement related to program-level the students are learning (Najadat et al., 2016).

The assessments have been set as an important role in OBE implementation. The achievement of OBE can be identified with support from the POs, COs and PEOs. In order to execute the OBE, the proposed tool utilized to access the PO in which linked to COs as well as assessments measurements. The importance of Cos is that it provides a verdict on improving the learning and teaching process of students and lecturers. The course outcomes provide a detailed scope or statements to set out the range of what students expected to know and able

to do at the end of each course (Mousami et al., 2015). The COs should be mapped with POs to access the performance of each student during their studies. The importance of course outcomes assessment in OBE practice besides providing the information to PO,is that it also benefits in term of the assessment to improve the weak students (Chandna, 2015).

The OBE-ANAS tool was developed to ease data analysis which is required for SAR accreditation. This tool provides better platform for faculty action committee to observe and analyse the outcomes of students' performances and at the same time as a faculty indicator purposes. The PO achievement needs to attain the key performance index (KPI) which has been set by the UiTM. This tool is believed to facilitate the accreditation process, which has managed the FKE of UiTMPPto get a five year a full five-year long accreditation by the EAC.

4. SYSTEM METHODOLOGY

The overall PO's performance of EE220 program was measured by using OBE-ANAS system. This system was developed by using object oriented programming C# as a graphical user interface (GUI). This GUI was used as interface component or tools between user/instructor and server. Figure 2 shows the system diagram of user/instructor and server. The server system that was used in these mechanisms involves of Microsoft SQL Server 2012 (MSSQL 2012). MSSQL 2012 is a database management system developed by Microsoft. The main function of this system is to store and retrieve data that is stored permanently on the hard-drive and provide access to the software applications that are either the same computer (local host) or connected with other computers that are in the chain (intranet).
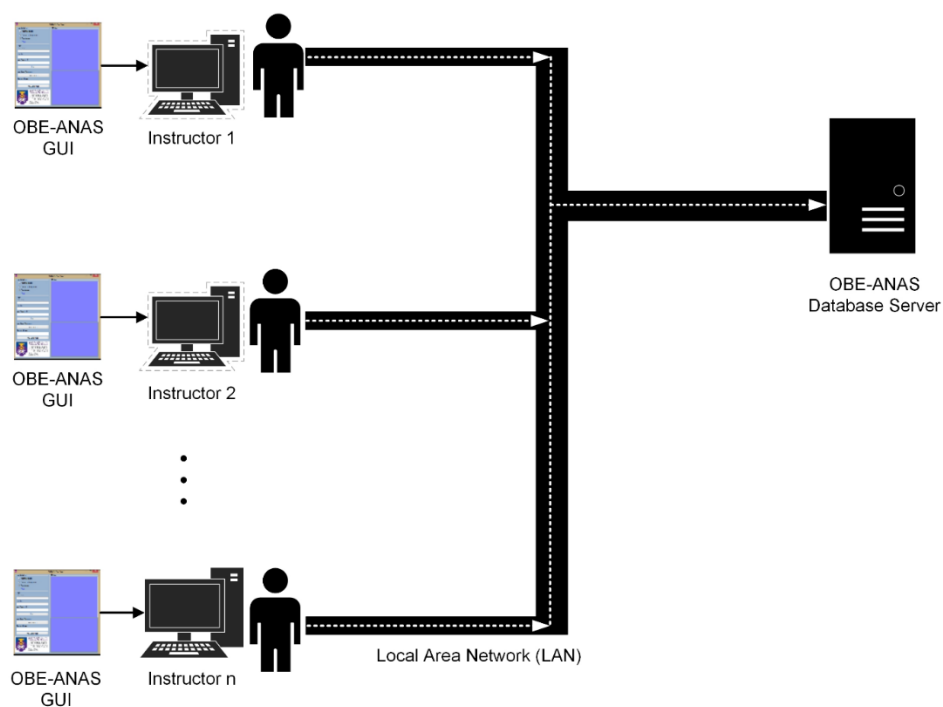

Figure 2: User/Instructor and Server system.

The courses which are offered every semester are analysed based on OBE concept. In this study the, COs and POs distribution marks of each student in the courses were analysed. From the assessment marks such as Quiz, Test, Final Exam, Lab/Mini Project assessment, the CO - PO course template was utilized by the instructor in order to fill the student marks. From this template overall student distribution marks was automatically generated, hence instructor would upload this assessment marks into OBE-ANAS database server. Figure 3 shows the beginning process from obtaining the student CO - PO marks until the upload process is completed.
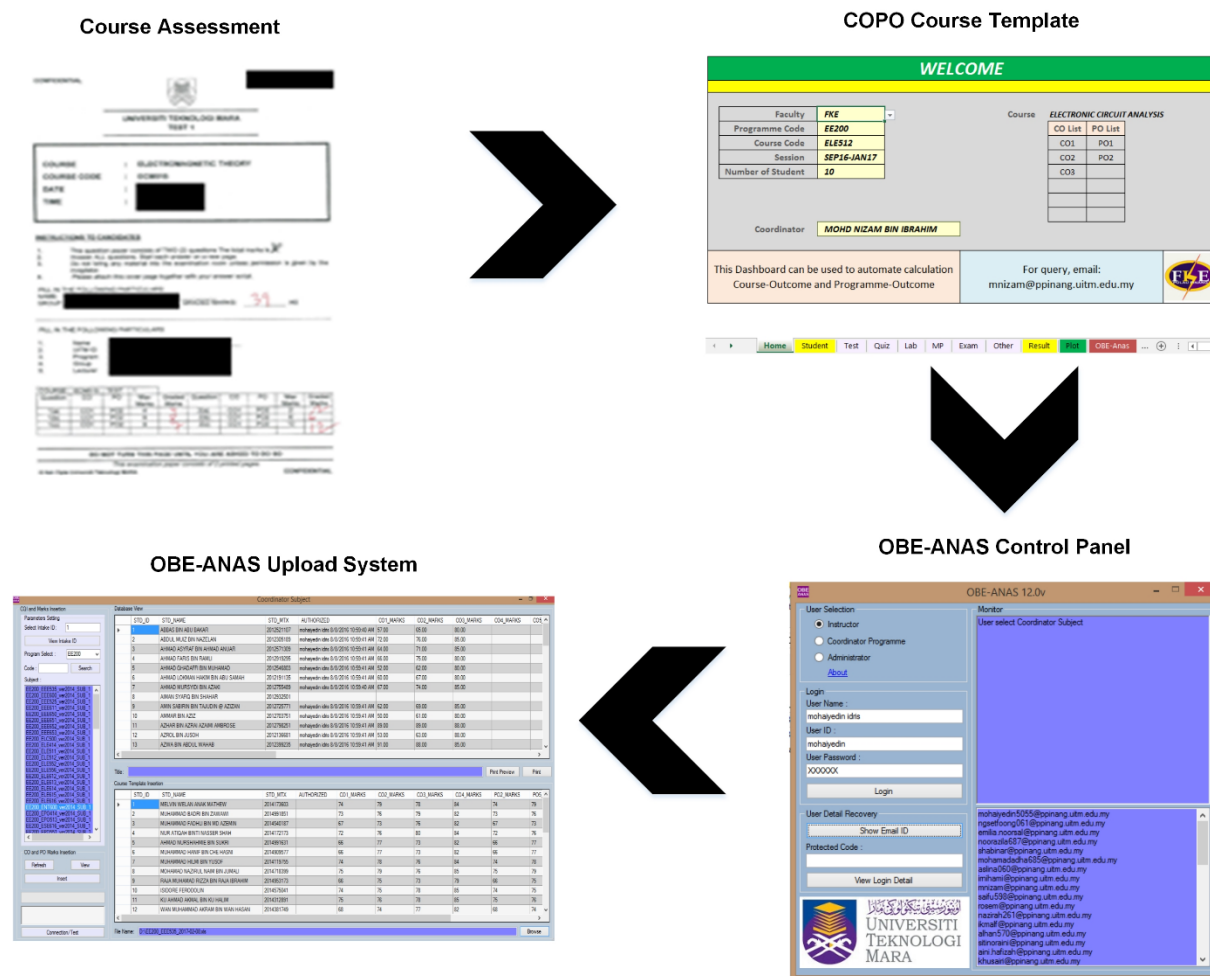

Figure 3: Upload process from COPO course template preparation until OBE-ANAS tool usage.

Figure 4 shows the procedure or flow of uploading marks into the database server by using OBE-ANAS tools. On top of this, the setup was divided into two main sections inclusive if the setup parameters and upload process. In the parameter setup, the instructor was required to select certain courses listed in the OBE-ANAS database. After that, the course coordinator

would find corresponding CO - PO template file to be imported into the OBE-ANAS tools. The uploading process would be implemented, where the students' details such COs and POs would be recorded into database.
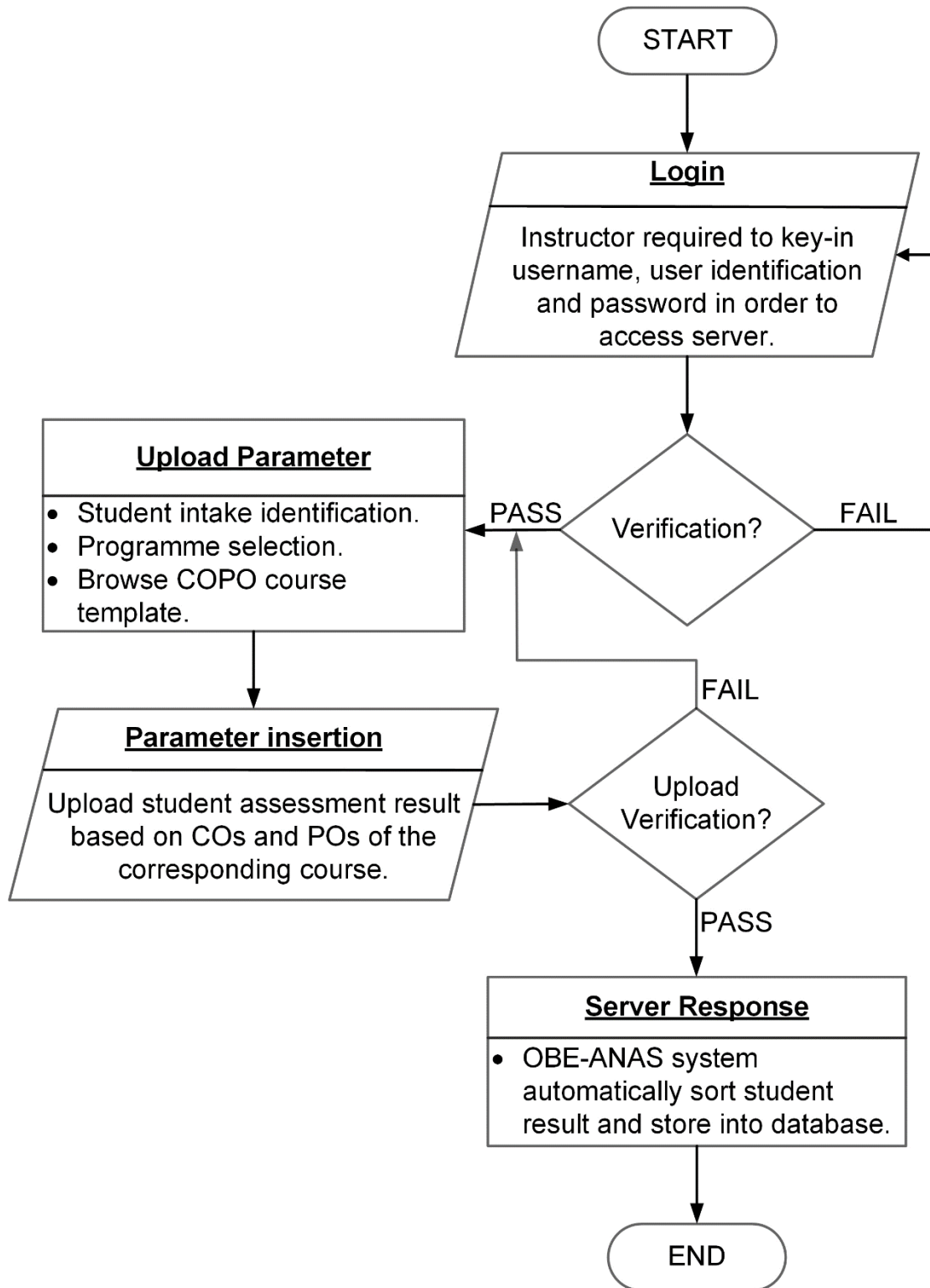

Figure 4: OBE-ANAS upload flow.

After all courses were uploaded into OBE-ANAS database server by the course coordinators, the programme coordinator would analyze the POs achievement on the corresponding semester by utilizing the same OBE-ANAS tool. Figure 5 shows the OBE-ANAS POs dashboard which was utilised to determine individual student POs achievement, overall POs average and POs density analysis based on selected courses or all courses. As in the figure, section one (1) shows courses offered by the EE220 programme which was retrived from the OBE-ANAS database. Section two (2) shows cohort selection for analysis based on student intake. Section three (3) shows sample of student results based on POs achievement. This result was generated according to courses that are mapped to the corresponding POs. For example, PO5 mapped with five (5) courses such as ECE412, ELE414, ELE515, ELE612 and ECE616 thus, the average from this PO5 was calculated through this OBE-ANAS tools. In the section four (4) and section five (5), from individual students result which was analysed in section three (3), the overall POs average and POs density were analysed. The POs density analysis shows the frequency of students who scored more or equal than 50% of the POs average with respect to total amount of the students, which is recorded in the section three (3).
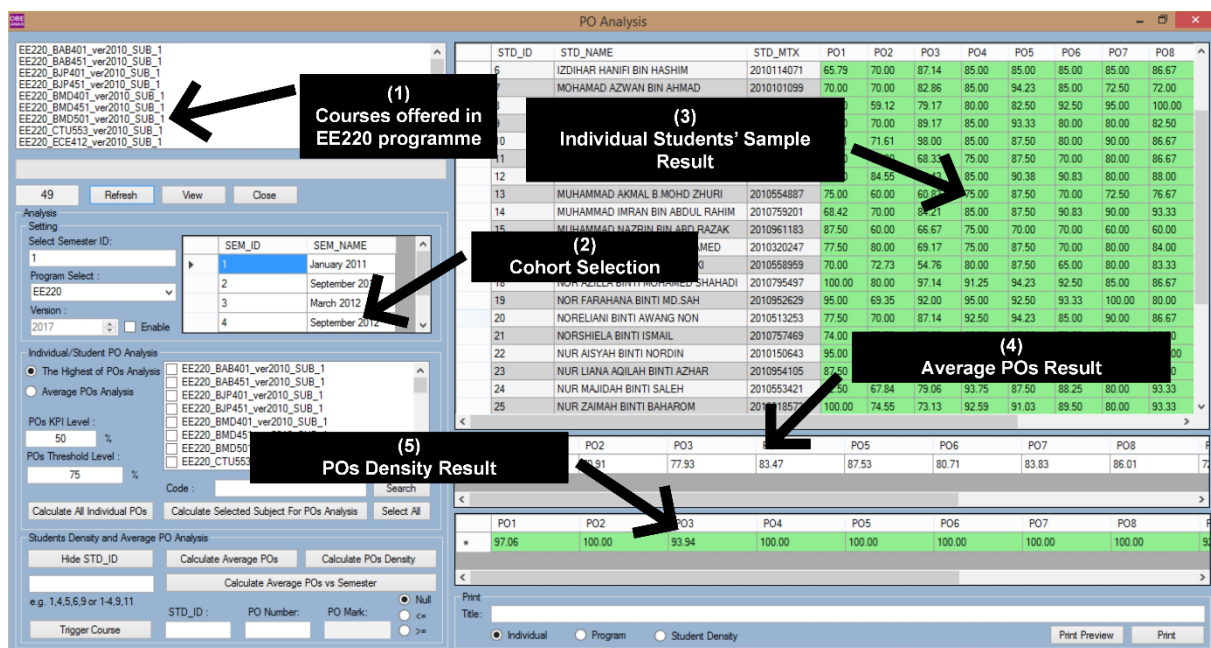

Figure 5: OBE-ANAS POs analysis dashboard.

5. RESULT AND DISCUSSION

POs achievement for EE220 program is implemented in several stages according to the method prescribed by the faculty members. The POs average and students' density are used to evaluate the programme performance. This POs achievement is based on actual data according to students' cohort by using the OBE-ANAS system. In addition, there are two

KPIs used as described in Table 2 and Table 3. From Table 2, each student is expected to achieve a score of at least 50% (Level 2), in order to attain the respective PO for each course. This table is also used in the OBE-ANAS analysis whereby each student was expected to achieve a score of at least 50% (Level 2), in order to attain the respective PO. The KPI for PO density is divided into noncompliance (lower than 75%) and compliance (greater and equal 75%).

Table 2: KPI for PO average achievement.

KPI RANKING	
PO(%)	LEVEL
0	1
50	2
65	3

Table 3: KPI for PO density achievement.

KPI RANKING	
Benchmarking (%)	LEVEL
0	NC: Non-Compliance
75	C: Compliance

Next, the average students' density for each PO contributed by the various courses stated in the EE220 study plan wascomputed based on the DPA. The DPA is introduced as an important measurement element which is to determine the programme level by referring to the benchmarking rubric scale as in Table 4. The result of average POs attainment which had exceeded at least 75% of the students' population was analysed as targeted KPI benchmarking.

Table 4: Rubric scale – Evaluating DPA.

Scale	Number of POs Achieved KPI
1 -Very Concern	If 1 - 3 bars exceed KPI benchmark
2- Concern	If 4 - 5 bars exceed KPI benchmark
3 -Good	If 6 - 7 bars exceed KPI benchmark
4 -Very Good	If 8 - 9 bars exceed KPI benchmark
5 -Excellent	If 10 – 12 bars exceed KPI benchmark

Figure 6 shows the average POs attainment by cohorts from January 2011 until September 2012. From the graph, the January 2011 cohort (blue bar), showed almost twelve POs had been attained. While for the other cohorts, some of the POs were still not evaluated. This is due to the courses addressing the respective POs are offered in higher semesters.
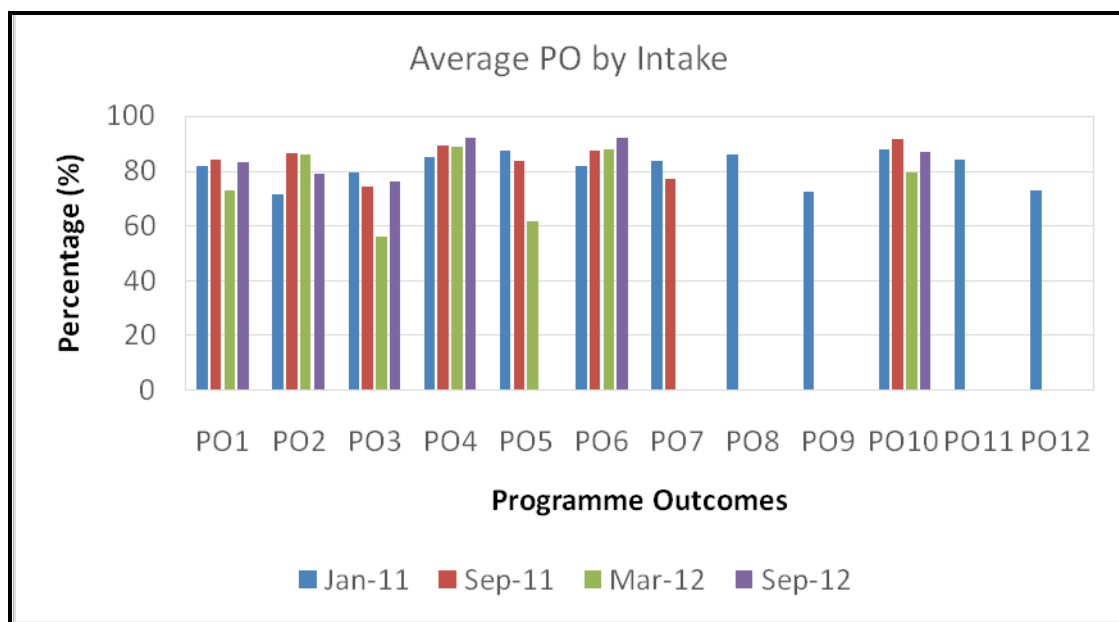

Figure 6: Average PO Attainment Based on Intake (January 2011, September 2011, March 2012 and September 2012).

Figure 7 shows the PO density score based on the four cohorts; Jan '11, Sep '11, Mar '12 and Sep '12. The PO density score was calculated based on Table 2 at KPI of level 2 (50%). With respect to the mentioned KPI in Table 3 as being represented by the red line, the January 2011 cohort had met the 75% student density score for PO1 until PO11. The degree of programme

achievement for the academic component at the FKEPP was considered to be 'Excellent' condition with respect to Table 4, where all POs had met the KPI for the first cohort.
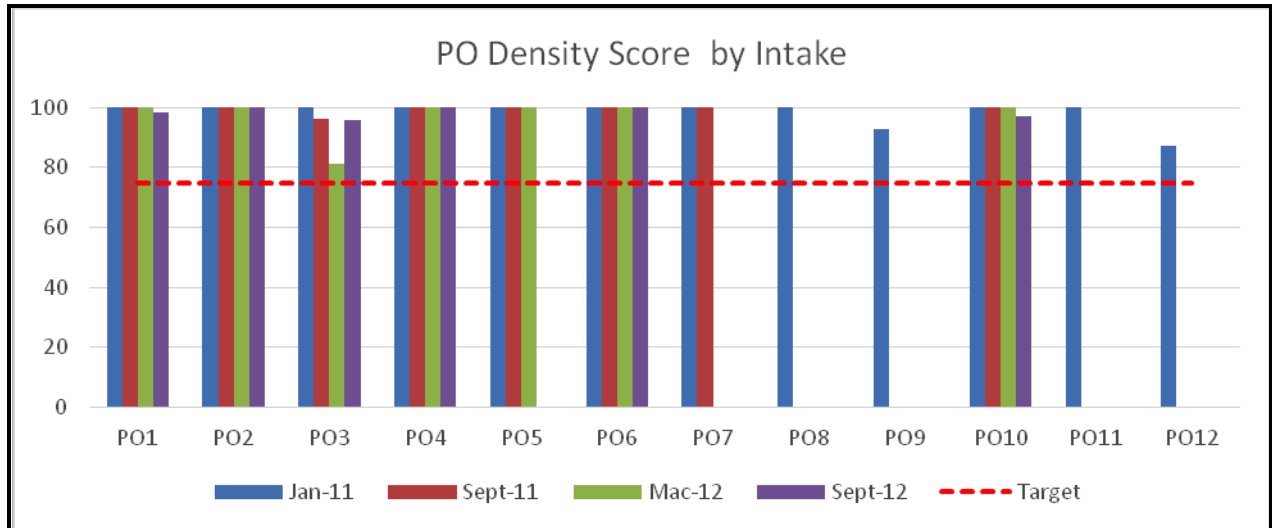

Figure 7: PO density score based on intake. (The dotted line showed the target 75%).

Figure 8 shows samples of students' POs performance of five randomly selected students from January 2011 intake. Each bar in the graph represents student matrix number and the red line represents a KPI of 65% and most of the students achieve the KPI target which has been set by the faculty. Thus, by monitoring each student on the corresponding cohort achieve the KPI level, therefore the targeted performance POs of the programme attain the KPI standard which is set by the FKEPP.
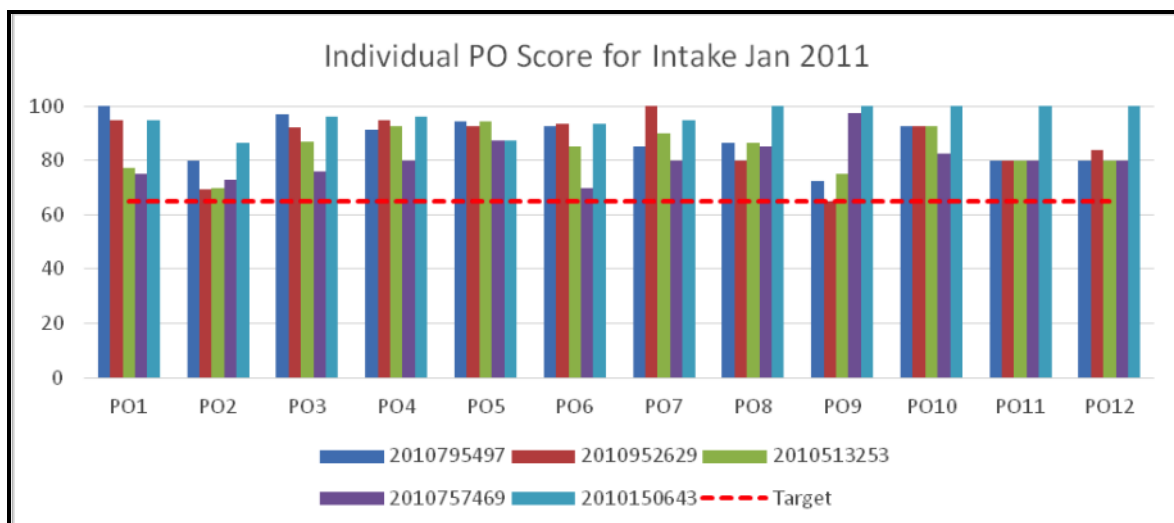

Figure 8: Sample of Individual PO score for intake January 2011 (First batch).

6. CONCLUSION

In the process of accreditation, POs measurement represents the important elements for evaluating the performance and clearly demonstrate the respective result of a program in the faculty. The developed tool known as OBE-ANAS tool provides a better platform for uploading course information based on OBE such as COs and POs into the database server. In addition, this tool is also used as a measurement of POs parameters such as POs average, POs density, individual POs and DPA achievement analysis. The results and evalutions are positioned with KPI benchmarks which has been agreed by the faculty members. The KPI benchmark is referred as a targeted indicator for the faculty to observe the program performance from time to time. The targeted indicator indirectly detect/observe any inefficienct result and provide better solutions to improve the POs attainment to achieve desired outcomes. The developed system is believed to benefit the faculty to achieve the KPI.

7. ACKNOWLEDGMENTS

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