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## ENHANCING PROGRAM OUTCOME 11 ATTAINMENT THROUGH ASSESSMENT REVISIONS: A CONTINUOUS QUALITY IMPROVEMENT CASE STUDY

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### Abstract:

This paper presents the continuous quality improvement (CQI) implementation in outcome-based education (OBE) system at Civil Engineering Studies, College of Engineering, UiTM Cawangan Pulau Pinang. The CQI is key element of the OBE system and consistently practices safeguarding the quality of education program. The effective CQI process executed at a program level identified the issues of Program Outcome (PO) 11 (project management and finance) poor attainment for two semesters consecutively. Short term and long-term solutions were proposed and implemented by improving the assessment components (method and weightage) and PO-course re-mapping respectively. The amendment performed on assessment method was able to quickly turn around the situation with substantial improvements in term of cumulative percentage and percentage of student passing minimum requirement for PO11. The analysis of data proves that percentage of student achieved at least 50% of cumulative PO11 increased from 51% and 61% (before CQI) to 98% and 100% (after CQI) respectively. Both quantity and quality of PO improvement were achieved based on the database of students after the implementation of CQI. In conclusion, the effective CQI implementation play vital role in the quality assurance of OBE system.

**Keywords:**

Outcome-based Education, Quality, Continuous Improvement, Program Outcome, Engineering Education

**Introduction**

Outcome-Based Education (OBE) is a transformative approach in engineering education, emphasizing measurable outcomes and continuous improvement. In line with the directives of the Ministry of Higher Education (MOHE) Malaysia and the Board of Engineers Malaysia (BEM), OBE was implemented in the Faculty of Civil Engineering, UiTM Pulau Pinang since 2004. This educational model focuses on student outcomes, enabling corrective measures to enhance course delivery methods, assessments, and student attitudes. The set of courses is meticulously designed with specific course outcomes (COs), preparing graduates to achieve the program outcomes (POs) upon graduation (EAC Standard, 2020). These POs, formulated in consultation with major stakeholders, including employers, alumni, and students, align with the demands of a dynamic and globalized workplace. The OBE framework ensures that engineering graduates are not only technically proficient but also equipped with the skills and mindset needed to thrive in a rapidly evolving world. Furthermore, OBE enhances student learning outcomes, fosters continuous quality improvement, and contributes to the sustainability of academic programs by ensuring that they remain relevant and effective (Hamsan et al., 2021; Qadir et al., 2020).

Program Outcomes (POs) is a critical aspect of OBE and represent the overall abilities expected of graduates. Ensuring proper alignment of COs and POs ensures that graduates not only earn credits but also acquire the essential competencies necessary for a successful engineering career (Rajak et al., 2019). The OBE system also exposes the students to a more student-centred learning (Keong et al., 2020), therefore, each course within the program should have well-defined COs. Mapping of the COs to POs is nevertheless essential for performance evaluation (Ramchandra et al., 2014). These outcomes specify the knowledge, skills, and attitudes that students are expected to acquire during the course and COs must align with the broader POs of the engineering program. These are the predominant qualities that graduates should possess upon completing their program. POs represent the knowledge, technical and soft skills, and abilities that make an engineering graduate competent and adaptable.

Continuous quality improvement (CQI) is one of the fundamental aspects of OBE in engineering programs. It ensures that educational institutions adapt and enhance their offerings to meet the evolving needs of students and industry. By nurturing effective CQI process, the institutions will enable quality education that ensure graduates are well-prepared for the dynamic challenges of the engineering profession. Continuous improvement in engineering education involves a cyclical process of action, assessment, reflection, and adaptation. It is a cyclic model of continuous improvement focused on assessing the program outcomes to achieve the desired educational objectives (Jakhale & Attar, 2015; Zamri et al., 2010). CQI actions should reflect the outcomes with clear justifications, focus on meaningful improvements, and identify attainment levels to avoid exhaustive efforts (Karman et al., 2011; Liew et al., 2021). Furthermore, implementing OBE in engineering programmes could help restructure educational programs, courses and assessment systems. The CQI framework in the

engineering education system could assist in addressing the skillset mismatches (Tshai et al., 2014), provides comprehensive CQI reports (Namasivayam et al., 2013), that aids in enhancing the teaching and learning processes (Tshai et al., 2014; Yan & Lin, 2015).

The programme outcomes attainment for each semester could help the institution to monitor the students' performance as well as to assess the teaching and learning efficiency for each course (Santhi Rani et al., 2018). This is essential as lecturers or academicians also plays an important role in the students' PO attainments (Mat Isa et al., 2021).

This paper discusses the CQI process involved a specific Program Outcome 11 (PO11) attainment in Bachelor of Civil Engineering program at UiTM Cawangan Pulau Pinang. The poor attainment of PO11 (project management and finance) by undergraduates' student was analysed, and a practical solution was proposed to complete the CQI process.

### Research Methodology

This section details the systematic approach undertaken to address the poor attainment of PO11 within the Civil Engineering program. It focuses on the overall mapping and distribution of PO11 in the program's curriculum. The methodology includes the equations used for calculating PO11 attainment and provides information about the cohort of students involved in the study.

### Program Outcome (POs) Mapping

The designated POs of program are adopted from Engineering Accreditation (EAC) standard 2020 (EAC Standard, 2020) and the mapping of PO11 (Program Outcome 11) and courses for civil engineering program at UiTM Permatang Pauh Campus is shown in Table 1 below. The distribution percentage of PO11 from each course in Table 1 plays an important role in calculating the overall PO11 attainment of the program. The calculation of each PO attainment is based on the number of students achieving at least 50% of overall PO attainment for related courses. The ideal condition is to have a minimum of three courses mapped toward each PO. However, due to unforeseen circumstances, only two courses were mapped with PO11, and this scenario led to the problem in PO11 attainment for the students. The primary contributor to the attainment of PO11 was the Construction Management Project course, accounting for 45%, as compared to the Infrastructure Design Project, which contributed 12%. This distribution underscores the significant impact of the Construction Management Project on PO11 attainment.

**Table 1: PO11 Course Outcome Mapping and Distribution Percentage**

No.	PO statement	PO mapping	POs Distribution	
PO11	Ability to demonstrate knowledge and understanding of civil engineering management principles and economic decision-making in a team to manage projects in multidisciplinary environments.	Construction Management Project	PO1	45 %
			PO9	10 %
			PO11	45 %
		Infrastructure Design Project	PO1	21 %
			PO3	36 %
			PO5	5 %
			PO6	6 %
			PO9	20 %
			PO11	12 %

### Program Outcome Attainment Calculation

Considering the percentage distribution of PO11 in Construction Management Project and Infrastructure Design Project courses in Table 1, the calculation of PO11 attainment of each student is shown in equation 1. The calculation of overall PO11 attainment for the program is determined by averaging the performance of each individual student within each cohort. The calculation process involves computing the average value of the overall PO11 attainment is shown in equation 2.

$$\text{Student1 } PO_{11} = \left[ \frac{(PO_{11} \text{Score}_{C_1} \times Ch_{C_1} \times PO_{11} \text{distribution}_{C_1}) + (PO_{11} \text{Score}_{C_2} \times Ch_{C_2} \times PO_{11} \text{distribution}_{C_2})}{(Ch_{C_1} \times PO_{11} \text{distribution}_{C_1}) + (Ch_{C_2} \times PO_{11} \text{distribution}_{C_2})} \right] \quad (1)$$

Where,

$\text{Student1 } PO_{11}$  = PO11 attainment for student no. 1

$PO_{11} \text{Score}_{C_1}$  = PO11 attainment score for course no. 1

$Ch_{C_1}$  = credit hour for course no. 1

$PO_{11} \text{distribution}_{C_1}$  = PO11 distribution percentage for course no. 1

$PO_{11} \text{Score}_{C_2}$  = PO11 attainment score for course no. 2

$Ch_{C_2}$  = credit hour for course no. 2

$PO_{11} \text{distribution}_{C_2}$  = PO11 distribution percentage for course no. 2

$$\text{Average } PO_{11} = \left[ \frac{\text{Student1 } PO_{11} + \text{Student2 } PO_{11} + \dots + \text{StudentN } PO_{11}}{N} \right] \quad (2)$$

Where,

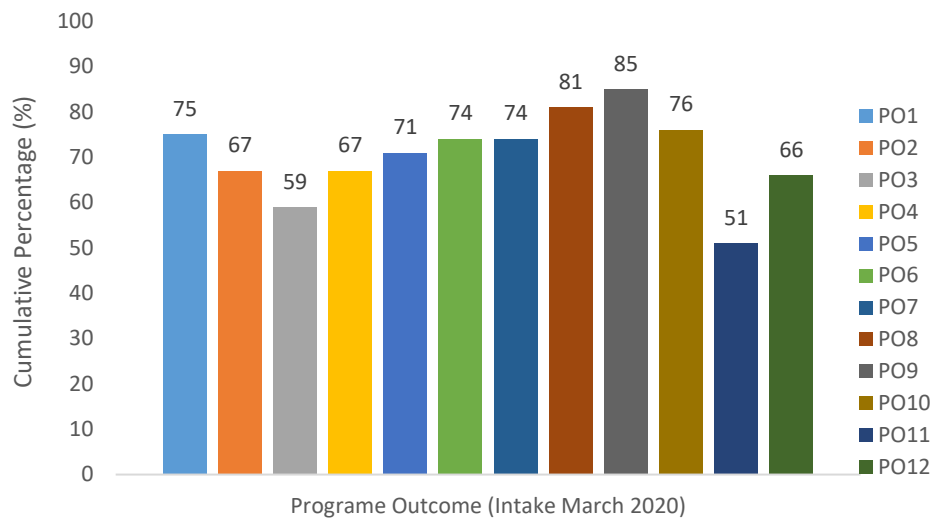
$\text{Average } PO_{11}$  = PO11 overall attainment

$\text{Student1 } PO_{11}$  = PO11 attainment for student no. 1

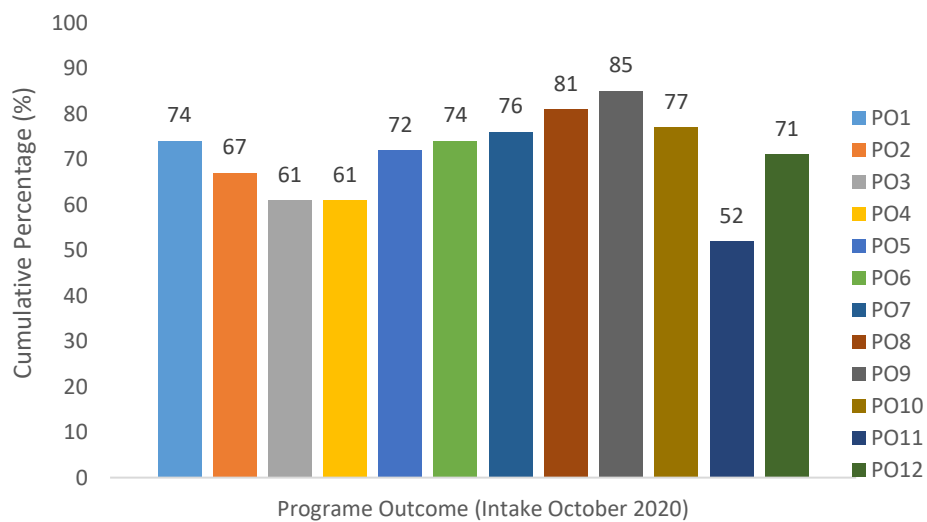
$\text{Student2 } PO_{11}$  = PO11 attainment for student no. 2

$\text{StudentN } PO_{11}$  = number of students

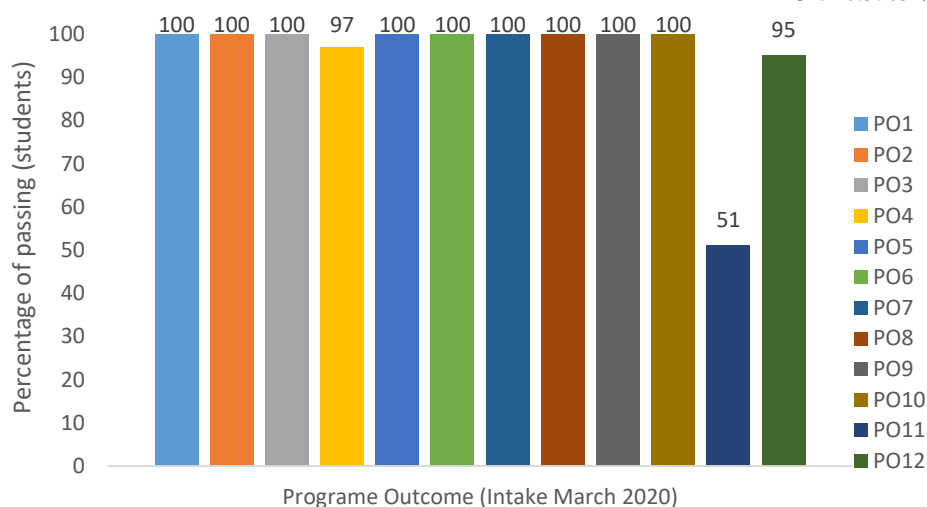
Figure 1 and Figure 2 show the data of cumulative percentage of all POs attainment for the undergraduate students' cohort intake March 2020 and October 2020 respectively. The performance of PO11 cumulative percentage was the lowest with just 51% and 52% respectively compared to all other POs achievement. Figure 3 and Figure 4 present the percentage of student passing minimum 50% of all POs. PO1 to PO3 and PO5 to PO10 have a 100% pass rate, indicating that all students passed these POs. PO4 and PO12 with minimum 95% pass rate meaning that almost all students passed this POs respectively. Lower PO11 pass rate at 51% and 62% for both cohorts compared to other POs revealed a worrying problem with current PO11 attainment process. The poor PO11 performance for two semesters successively indicates a significant challenge in achieving PO11. Thus, the faculty management team urgently seek an appropriate solution for both the short term and long term to address this concern.



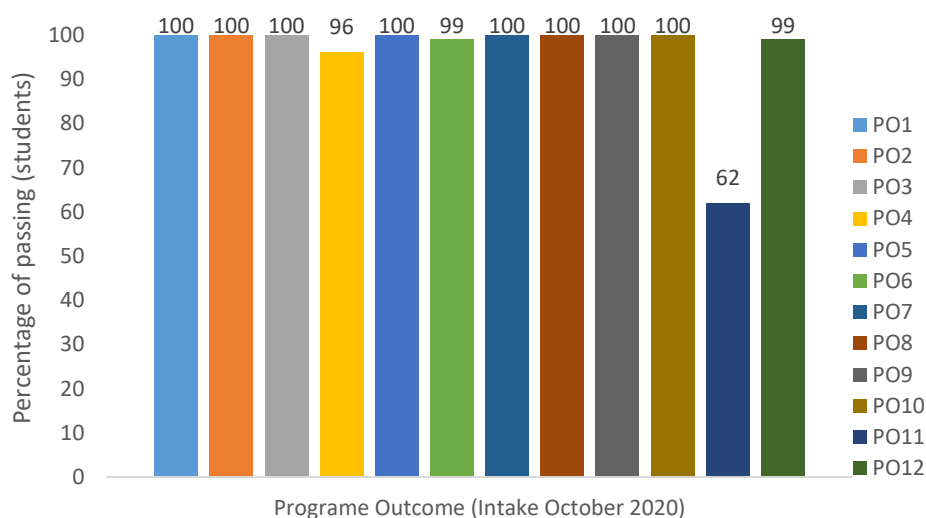
**Figure 1: Cumulative Percentage of POs Attainment for Graduate Intake March 2020 (before CQI).**



**Figure 2: Cumulative Percentage of POs Attainment for Graduate Intake October 2020 (before CQI).**



**Figure 3: Percentage of Student Achieved at Least 50% of Cumulative POs for Graduate Intake March 2020 (before CQI).**

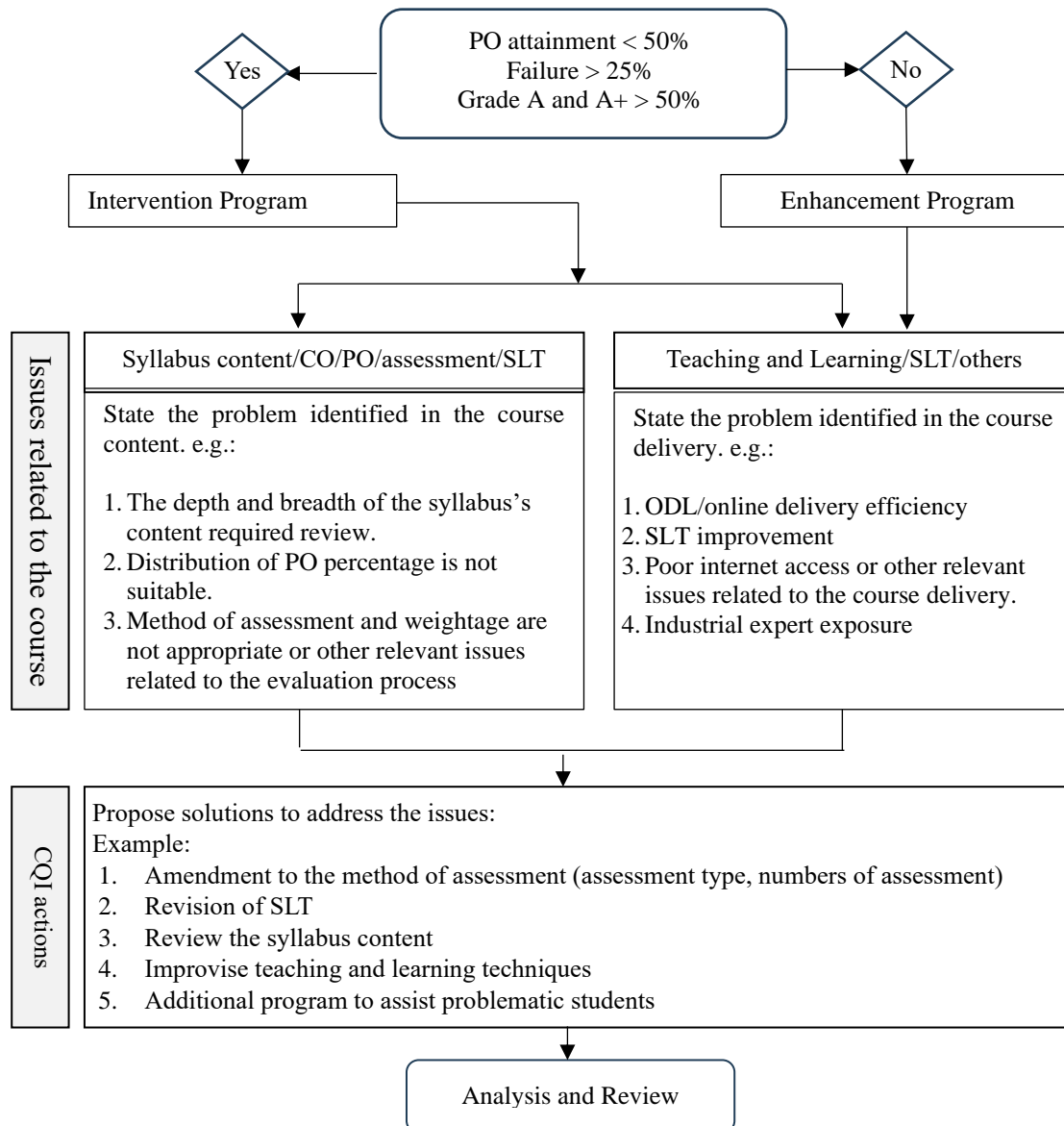


**Figure 4: Percentage of Students Achieved at Least 50% of Cumulative POs for Graduate Intake October 2020 (before CQI).**

### Results and Discussion of Continuous Quality Improvement (CQI)

PO attainment analysis that was performed and presented at the end of every semester is a continuous process practice by faculty's management to ensure the quality of graduates and program. The enrichment and intervention action must be taken in occurrence of any poor performance of PO especially PO that achieved less than 50%. The CQI processes involves re-evaluation of syllabus content, CO-PO mapping and distribution, assessment method and student learning time (SLT). In addition to that, the teaching and learning process, feedback from students and other factors' findings were also re-evaluated. Figure 5 shows the flow chart of CQI process related to the PO attainment issues and other factors. Several conditions were set before the specific CQI process should be enforced to address related issues as mentioned in Figure 5. The Head of department and Program coordinator will appoint the course coordinator (CC), resource person (RP) for the related course as the main person in charge of

CQI. Both CC and RP will have a round table discussion with relevant parties to analysis. The proposal normally encompasses short term and long-term solutions according to the seriousness of the problem.



**Figure 5: Flow Chart of CQI Guidance Processes.**

The analysis of the problem related to the PO11 attainment led to the short term and long-term solutions. In the short-term solution, the adjustment was proposed to the existing assessment components in the Construction Management Project syllabus. The short-term solution to the assessment method will enable quick turnaround for the upcoming semester PO11 attainment. The proposal for long term solution will be carried out with ongoing curriculum review. In the curriculum review any shortcomings will be addressed and action will be taken to ensure that more balanced PO distributions throughout the curriculum.



Table 2 present the assessment components and their weightage before and after CQI measures were implement. The percentage indicate the weightage assigned to each assessment component for the respective COs and POs. The assessment component for PO11 before CQI (total of 40%) was conducted through common test and final examination. The test and final exam assessment methods of PO11 allow student to pass the course without having to answer all questions especially the designated question related to PO11. This scenario jeopardizes the PO11 attainment especially due to the limited distribution throughout the curriculum.

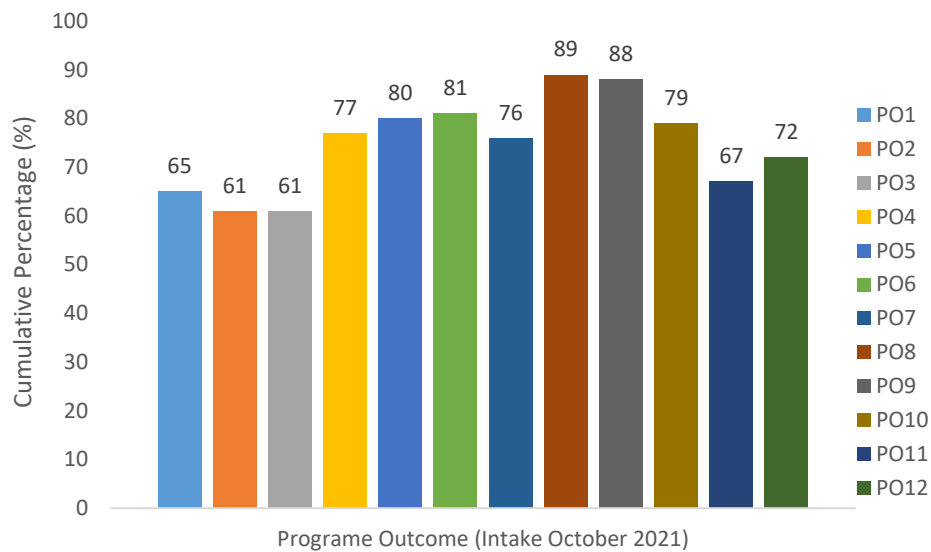
The short-term solution to this situation is to fully assess the PO11 through assignment instead of test and final exam. The assignment weightage was increased from 10% to 40%. This adjustment ensures all students participation in PO11 assessment. The assessment rubric was developed to accurately address the affective domain of PO11. The final exam was dropped from assessment components and replaced by common test and group project was introduced with 40% and 20% weightage respectively. The proposed new assessment components enable quick improvement for PO11 attainment and re-alignment with more explicit assessment method of PO11 as shown in Table 2. The improvement was proposed by RP and CC and approved by faculty administrative meeting before finally endorsed in Committee of Academic State (JAN) meeting for enforcement.

**Table 2. Comparison of New Proposed Assessment Components with Old Version Assessment.**

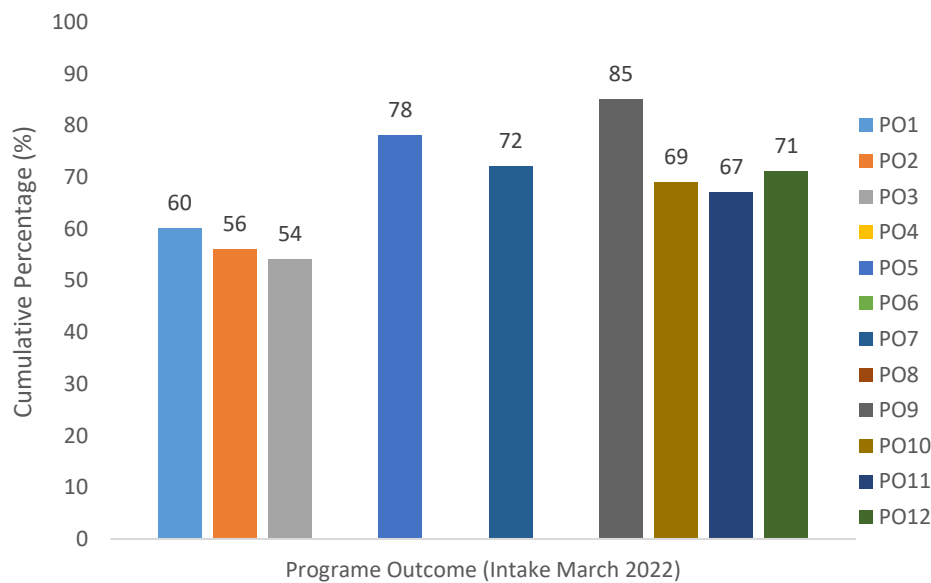
Course Outcome	Assessment Component (Before CQI)					Assessment Component (After CQI)		
	PO9	PO1	PO11	PO1	PO11	PO1	PO11	PO9
	Assignment (%)	Common Test (%)		Final Examination (%)		Common Test (%)	Assignment (%)	Group Project (%)
CO1	0	15	0	30	0	40	0	0
CO2	0	0	15	0	30	0	40	0
CO3	10	0	0	0	0	0	0	20
<b>Total</b>	<b>10</b>	<b>15</b>	<b>15</b>	<b>30</b>	<b>30</b>	<b>40</b>	<b>40</b>	<b>20</b>

Figure 6 and Figure 7 show the cumulative percentage performance of PO11 after the CQI implementation. The cumulative percentage of PO11 significantly improved from just 50% to 67% for graduate intake October 2021 and March 2022 respectively. The performance of PO11 keep on consistent for two semesters consecutively proved that the actions taken for CQI process was successful. Figure 8 and Figure 9 show the number of students passing minimum of 50% for both cohorts were also increased significantly with almost 100 % attained the minimum 50% passing marks. Figure 7 and Figure 9 indicate incomplete overall attainment of POs, with PO4, PO6, and PO8 missing because the students are currently in the middle of their studies. It is anticipated that the overall performance and complete attainment of POs will improve as students' progress to their final year.

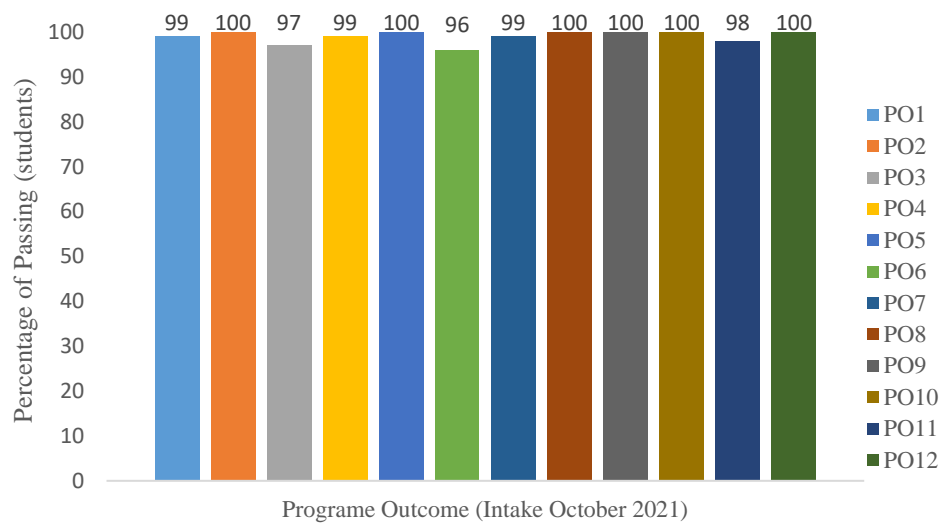




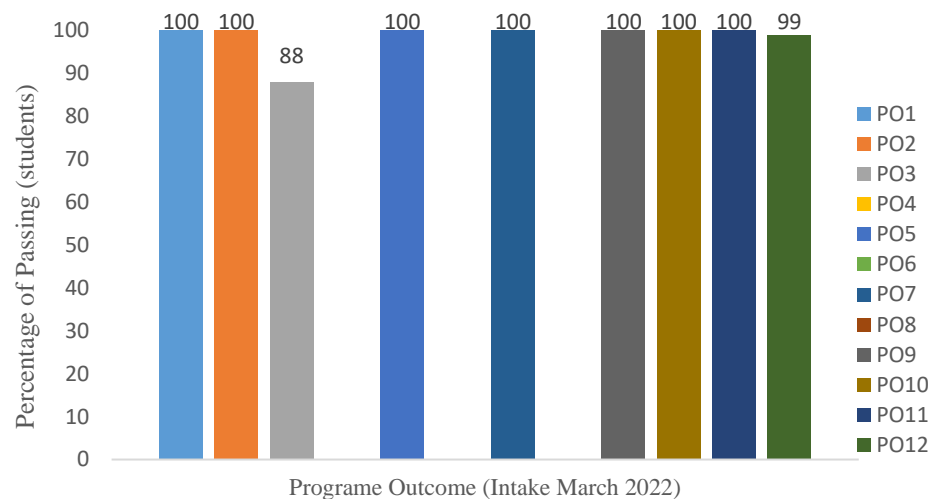
**Figure 6: Cumulative Percentage of POs Attainment for Graduate Intake October 2021 (after CQI).**



**Figure 7: Cumulative Percentage of POs Attainment for Graduate Intake March 2022 (after CQI).**



**Figure 8: Percentage of Students Achieved at least 50% of Cumulative POs for Graduate Intake October 2021 (after CQI).**



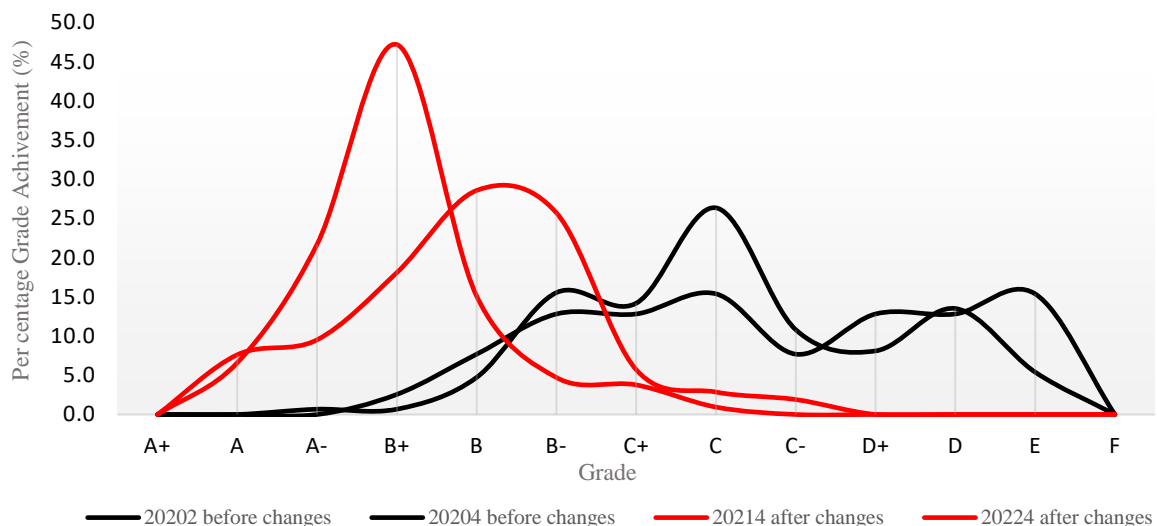
**Figure 9: Percentage of Students Achieved at Least 50% of Cumulative POs for Graduate Intake March 2022 (after CQI).**

The proposed solution to quickly address the poor PO11 attainment was successfully achieved through amendment to the existing assessment components. Assessment the PO11 attainment solely through assignment ensure all students submission compared to the test and final exam where students could skip the questions related to PO11. PO11 attainment was improved based the data presented in Table 3 and Figure 10 after the implementation of new assessment method. The comparison of data between intake October 2020 and October 2021 shows the positive improvement in term of quality and quantity. The percentage of excellent and good category were significantly increased by 8% and 50%. At the same time the satisfactory and weak category were greatly reduced by 22% and 36%. However, the improvement was not tremendous in term of cumulative percentage due to the limited number of courses that addressed PO11 in the current curriculum. In the next long term CQI solution, more appropriate

courses will be selected in curriculum review process to ensure a reasonable representation of PO11 in the curriculum.

**Table 3. Comparative Analysis of Students Achievement for PO11 Before and After CQI Implementation.**

Category	PO Score (%)	PO11 (%) (Before CQI) October 2020	PO11 (%) (After CQI) October 2021	Differences
Excellent (A+, A)	80 - 100	0	8	+ 8
Good (A-, B+, B)	65 - 80	6	56	+ 50
Satisfactory (B-, C+, C)	50 - 65	56	34	- 22
Weak (C-, D+, D, E, F)	0 - 50	38	2	- 36



**Figure 10: Performance of PO11 Attainment Before and After CQI implementation.**

## Conclusion

The finding reinforces the crucial of CQI implementation as stated in one of the compulsory criteria for accreditation. Through the CQI process, the issues could be identified, analysed and solved. The quick turnover was achieved in this PO11 case due the systematic CQI process that has been effectively practiced in the faculty of civil engineering. The short-term solution based on the amendment of assessment components ensure improvement in PO11 cumulative percentage and passing all POs attainment that are important quality assurance of engineering graduate program.

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## References

- EAC Standard. (2020). Engineering Programme Accreditation Standard 2020. In *Engineering Accreditation Council*.
- Hamsan, R. Bin, Mei, C. S., Mohammad, S., & Zaidi, J. (2021). Outcome Based Education Implementation And Continuous Quality Improvement For Diploma In Management. *Psychology and Education*, 58(2), 9731–9740. [www.psychologyandeducation.net](http://www.psychologyandeducation.net)
- Jakhale, A. R., & Attar, A. C. (2015). A Novel Approach Towards Outcome Based Engineering Education for Continuous Quality Improvement: A Case study. *Journal of Engineering Education Transformations*, 29(2), 47–52.
- Karman, S., Hasikin, K., Ting, H. N., Ng, S. C., Abdul Wahab, A. K., Lim, E., Hamzaid, N. A., & Wan Abas, W. A. B. (2011). OBE implementation and design of continual quality improvement (CQI) for accreditation of biomedical engineering program University of Malaya. *IFMBE Proceedings*, 35 *IFMBE*, 20–24. [https://doi.org/10.1007/978-3-642-21729-6\\_11](https://doi.org/10.1007/978-3-642-21729-6_11)
- Keong, S. M., Cai Juan, S., & Ching Wen, K. (2020). A Malaysian Outcome-Based Engineering Education Model: The Implementation and Challenges in Future. *INTI Journal*, 2020(20), 20.
- Liew, C. P., Puteh, M., Lim, L. L., Yu, L. J., Tan, J., Chor, W. T., & Tan, K. G. (2021). Evaluation of Engineering Students' Learning Outcomes: Creating a Culture of Continuous Quality Improvement. *International Journal of Emerging Technologies in Learning*, 16(15), 62–77. <https://doi.org/10.3991/ijet.v16i15.23763>
- Mat Isa, C. M., Mohammad, N. I. A., Saad, N. H., & Preece, C. N. (2021). Programme Outcome Attributes related to Complex Engineering Problem Capability: Perceptions of Engineering Students in Malaysia. *Asian Journal of University Education*, 17(4), 95–105. <https://doi.org/10.24191/ajue.v17i4.16220>
- Namasivayam, S., Al-atabi, M., Hwa Chong, C., Choong, F., Hosseini, M., Andal Gamboa, R., & Sivanesan, S. (2013). A Blueprint for Executing Continual Quality Improvement in An Engineering Undergraduate Programme. *Journal of Engineering Science and Technology, Special Issue on Engineering Education*, 31–37.
- Qadir, J., Al-Fuqaha, A., Lim, K., Yau, A., Shafi, A., Taha, A.-E. M., Ponciano, J., Hussain, S., Imran, M. A., Sheikh Muhammad, S., Naveed Bin Rais, R., Rashid, M., & Tan, B. L. (2020, June). Outcome-Based Engineering Education: A Global Report of International OBE Accreditation and Assessment Practices. *2020 ASEE Virtual Annual Conference Content Access*. <https://doi.org/10.35542/osf.io/rde62>
- Rajak, A., Shrivastava, A. K., Bhardwaj, S., & Tripathi, A. K. (2019). Assessment and Attainment of Program Educational Objectives for Post Graduate Courses. *International Journal of Modern Education and Computer Science*, 11(2), 26–32. <https://doi.org/10.5815/ijmecs.2019.02.04>
- Ramchandra, S., Maitra, S., & MallikarjunaBabu, K. (2014). Method for estimation of attainment of program outcome through course outcome for outcome-based education. *2014 IEEE International Conference on MOOC, Innovation and Technology in Education (MITE)*, 7–12. <https://doi.org/10.1109/MITE.2014.7020231>

- Santhi Rani, C., Raja Sekhara Rao, K., & Eliah, K. (2018). A Simple Approach to Calculate CO and PO Attainment Levels by Direct and Indirect Methods. *Journal of Emerging Technologies and Innovative Research*, 5(12). [www.jetir.org](http://www.jetir.org)
- Tshai, K. Y., Ho, J. H., Yap, E. H., & Ng, H. K. (2014). Outcome-based education - The assessment of programme educational objectives for an engineering undergraduate degree. *Engineering Education*, 9(1), 74–85. <https://doi.org/10.11120/ened.2014.00020>
- Yan, K. Y., & Lin, C. P. (2015). From Outcome-Based Education (OBE) to Continual Quality Improvement (CQI): A Case Study of Teaching Mechanical Engineering at University of Newcastle, Singapore. *15th South East Asian Association for Institutional Research (SEAAIR) Conference*.
- Zamri, M., Mohd Yusof, T., & M.S. Reza. (2010). Assessment Method for Course Outcome and Program Outcome In Outcome Based Education (OBE). *Malaysian Technical Universities Conference on Engineering and Technology*, 1-4.