Available online at: https://jurnal-fkip.ut.ac.id/index.php/ijrse/issue/archive
International Journal of Research in STEM Education (IJRSE)
ISSN 2721-2904 (online)
Volume 8 Number 1-1 (2026): Special Issue (August): 42 - 55

Revolutionizing CQI:
A digital leap in OBE management with POSCES

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Abstract

The implementation of Outcome-Based Education (OBE) in engineering programs demands rigorous monitoring of Program Outcomes (POs) and systematic execution of Continual Quality Improvement (CQI) processes. In response to this, the Program Outcomes Monitoring System for Civil Engineering Students (POSCES) was developed as a digital innovation to transform how PO data is captured, analysed, and used for academic improvement. Designed to support the faculty's compliance with the Engineering Accreditation Council (EAC) requirements, POSCES serves as a centralized, web-based platform that facilitates transparent, accessible, and data-driven management of PO attainment across both diploma and degree programs. The system enables academic staff to map PO weightage, track course-level attainment, and document CQI actions, while allowing the OBE unit to conduct deeper, program-wide analysis. By streamlining PO reporting and providing a secure environment for feedback and reflection, POSCES significantly enhances the efficiency and accuracy of CQI implementation. Moreover, recent enhancements, that is the standalone POSCES website and direct CQI report generation; represent a digital leap in educational management. This paper outlines how POSCES integrates seamlessly into the faculty's quality assurance eco-system and presents feedback from OBE committee members and program leaders, underscoring its effectiveness, usability, and potential for broader implementation across academic programs. User feedback indicates that POSCES is highly effective, user-friendly, and well-aligned with OBE and CQI requirements, demonstrating strong acceptance and satisfaction among the faculty members.

Keywords: *Outcome-Based Education (OBE), Program Outcomes (PO) Monitoring, Continual Quality Improvement (CQI), Digital Data Management*

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INTRODUCTION

In the current era of rapid technological advancement and global interconnectedness, higher education institutions are under increasing pressure to evolve beyond conventional instructional models. With the emergence of Education 5.0, aligned with the transformative goals of Society 5.0, universities are expected not only to disseminate knowledge but also to empower learners through personalized, data-driven, and technology-integrated educational experiences. These shifts require robust and responsive mechanisms that uphold educational quality, enable continuous improvement, and strengthen institutional accountability. In the field of engineering education, where learning outcomes are multifaceted and accreditation standards are rigorous, the demand for dynamic, transparent, and technology-enabled quality management systems has become more pressing than ever.

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DOI: https://doi.org/10.33830/ijrse.v8i1-1.14787

At the core of this transformation lies the principle of Outcome-Based Education (OBE) is an educational framework that prioritizes the demonstrable attainment of intended learning outcomes as key indicators of student achievement and institutional effectiveness. In Malaysia, engineering programs are regulated by the Engineering Accreditation Council (EAC), which mandates the systematic assessment of twelve Program Outcomes (POs) encompassing both technical competencies and transversal skills, such as ethics, sustainability, and lifelong learning. These outcomes are closely aligned with global educational imperatives such as Sustainable Development Goal 4: Quality Education, which calls for inclusive and equitable quality education and the promotion of lifelong learning opportunities for all. However, operationalizing these aspirations into concrete, data-driven academic practices remain a significant challenge especially in managing abundance of datasets across semesters, each intake, each course and also the data for each student.

Many engineering faculties still rely on spreadsheets, separate course files and static documentation in tracking PO attainment and performing CQI (Continual Quality Improvement). Such approaches are seen to be less effective as they limit the accessibility to the big data, which is essential for timely analysis. Without an integrated digital infrastructure, institutions face critical gaps in traceability and consistency. These gaps not only jeopardize compliance with accreditation requirements but also constrain the institution's ability to close performance gaps, evaluate long-term program impact, and enable successful CQI.

In response to these challenges, the Civil Engineering Studies of Universiti Teknologi MARA (UiTM) Cawangan Pulau Pinang has conceptualized and developed the Program Outcomes Monitoring System for Civil Engineering Students (POSCES), a web-based platform that centralizes and digitalizes the management of OBE data. As an educational innovation, POSCES exemplifies how digital transformation, anchored in educational principles which can serve as a catalyst for improving quality assurance, promoting stakeholder engagement, and enabling sustainable educational practices. The main aim of the POSCES development is to have a centralized web-based platform for efficient monitoring and management of Program Outcomes (PO) in alignment to the Outcome Based Education (OBE) principles. It also aims to enhance the transparency and data accessibility among stakeholders, i.e. the students as well as the lecturers, the OBE committee and academic advisor. Furthermore, the system is also designed to facilitate CQI reporting which is essential for the program's CQI process.

Research Objectives:

The implementation of Outcome-Based Education (OBE) in engineering programs presents significant challenges in effectively monitoring Program Outcomes (POs) and executing Continual Quality Improvement (CQI) processes. Traditional methods, such as spreadsheet-based systems and fragmented data management approaches, often lead to inefficiencies, limited data accessibility, and inconsistencies in analysis. These limitations hinder timely decision-making, reduce transparency among stakeholders, and pose risks to meeting accreditation requirements. Therefore, there is a critical need for an integrated, digital solution that can streamline PO monitoring, enhance data accuracy, and support systematic CQI practices in higher education institutions. The objectives of the research are as follows

1. To develop a centralized, web-based system (POSCES) for monitoring and managing Program Outcomes (POs) in alignment with Outcome-Based Education (OBE) principles and accreditation requirements.
2. To enhance the efficiency, transparency, and accessibility of PO data management and CQI processes by digitalizing data collection, analysis, and reporting across courses, cohorts, and programs.
3. To evaluate the effectiveness, usability, and user acceptance of the POSCES system through feedback from lecturers, academic advisors, and OBE committee members.

LITERATURE REVIEW

The Engineering Accreditation Council (EAC) and Engineering Technology Accreditation Council (ETAC) in Malaysia, under the Board of Engineers Malaysia, have outlined clear expectations for academic programs to systematically monitor the attainment of Program Outcomes (POs). These POs reflect the graduate attributes that engineering and engineering technology students are expected to acquire upon completion of their studies. The accreditation standards require institutions to demonstrate how each PO is assessed, how attainment is calculated, and how this information is utilized for Continuous Quality Improvement (CQI) (Ibrahim et al., 2025; Liew et al., 2024)These requirements are not only regulatory but are also aligned with global best practices and the principles of Outcome-Based Education (OBE), emphasizing accountability, transparency, and quality in higher education.

An effective PO monitoring system must include systematic data collection and mapping mechanisms. This involves the aggregation of direct and indirect assessment data from various academic activities, including examinations, projects, surveys, and reflective feedback. Such data are used to determine whether students have achieved the intended learning outcomes and to identify areas for pedagogical refinement (Biswal et al., 2025; Nordin et al., 2016). To ensure meaningful interpretation, PO data should be analyzed across cohorts, semesters, and entry streams, enabling comparative performance analysis and evidence-based CQI decision-making (Mahboob et al., 2020; Yorulmaz et al., 2025).

Another critical component is the integration of technological tools to support real-time monitoring, analysis, and reporting. Other methods such as Microsoft Excel-based systems that is effective in managing small scale data, often fall short in managing growing datasets and ensuring consistent stakeholder access (Noaman, 2024). Modern PO monitoring platforms should feature user-specific dashboards, automated attainment calculations, and standardized CQI reporting templates to facilitate compliance with accreditation and audit requirements (Tshai et al., 2014). Furthermore, the system should promote stakeholder engagement by incorporating features that allow students, academic advisors, and industry stakeholders to reflect, provide input, and act upon the results (Liew et al., 2021; Shuaib et al., 2009). In this light, the development of a centralized, web-based PO monitoring system, such as POSCES, addresses these needs and advances the digital maturity of engineering education institutions.

The monitoring and management of Program Outcomes (POs) in Malaysia are deeply rooted in the national commitment to implement Outcome-Based Education (OBE) across higher education, particularly within engineering programs. The Engineering Accreditation Council (EAC) and the Malaysian Qualifications Agency (MQA) mandate institutions to demonstrate systematic attainment of POs as part of accreditation requirements, ensuring that graduates achieve the desired competencies (Mat Isa et al., 2021; Shamsuddin et al., 2014) Institutions have developed a variety of tools and methods to facilitate this process, ranging from Microsoft Excel-based templates at Universiti Kebangsaan Malaysia (UKM), which consistently report over 80% PO achievement, to SAMOBEC at Universiti Teknologi MARA, which aligns examinable course assessment with Bloom's Taxonomy (Md Kamal & Mohd Fuad Latip, 2009; Tahir et al., 2013). These frameworks highlight Malaysia's strong emphasis on student-centered learning and structured assessment methods as part of the OBE ecosystem.

Alongside these tools, emphasis has been placed on fostering a culture of Continuous Quality Improvement (CQI), with analytical approaches such as the Engineering Outcome Analytics tool supporting meaningful evaluation of learning outcomes (Liew et al., 2021, 2022). However, challenges persist, including vague assessment practices, unclear performance criteria, and inconsistent incorporation of sustainability elements in program outcomes (Johan & Turan, 2016; Mohammad & Zaharim, 2012). To overcome these gaps, Malaysian institutions are increasingly turning to technological integration. Systems such as iCGPA with iOBE modules and semantic-based online OBE platforms have been proposed to improve transparency, streamline

assessment processes, and enable better data management (Zaini et al., 2011). Collectively, these innovations demonstrate the nation's ongoing efforts to enhance PO monitoring and management, balancing regulatory compliance with a broader vision of educational quality and sustainable development.

Recent literature highlights the increasing reliance on digital and software-based systems to manage Program Outcomes (POs) in higher education, particularly within engineering disciplines. These systems are designed not only to track attainment at the level of courses, students, and cohorts, but also to ensure institutional readiness for accreditation and Continuous Quality Improvement (CQI). For example, digital teaching assistant systems integrate intelligent evaluation with multi-criteria decision-making models to provide visualized outcome attainment for both students and faculty (Liu et al., 2024). Integrated information systems, on the other hand, minimize human intervention, enhancing both accuracy and efficiency in compliance reporting. Similarly, web-based platforms such as the Online Assessment Tracking System (OATS) and Course Level Assessment System (CLASS) enable program-level assessment while feeding back results to fine-tune curricular practices, thus strengthening CQI processes (Whiteman, 2009).

Technological innovation has further advanced these practices through artificial intelligence-driven systems, which combine assessment functions with reporting and visualization modules to support administrators and faculty in decision-making (Lumdee, 2025). Within the Malaysian context, the iCGPA system has been developed to harmonize with Outcome-Based Education (OBE) quality management systems, offering detailed tracking of program outcomes across multiple domains (Basir et al., 2017; Mohamed-Kassim & Kamaruddin, 2017). These developments demonstrate a clear trend toward digital integration, underscoring the need for systems that can process large datasets efficiently while providing actionable insights for accreditation and strategic planning. Table 1 presents the comparison between the existing PO data management systems with POSCES.

Table 1 Comparison of existing system with POSCES

Aspect	Existing Systems (OATS, CLASS, iCGPA, AI-based tools)	POSCES (UiTM Cawangan Pulau Pinang)
Data Scope	Course-level or program-level attainment tracking; often fragmented across systems (Basir et al., 2017; Whiteman, 2009)	Integrated tracking across students, courses, and cohorts in one centralized platform
Data Management	Heavy reliance on manual inputs and separate spreadsheets; prone to inconsistency	Fully digital, replacing Excel-based POSIMS with a web-based system that automates storage and compilation
CQI Support	Provides feedback but requires additional manual reporting for accreditation (Liew et al., 2021)	Direct CQI report generation with structured documentation for accreditation readiness
System Integration	Challenges in harmonizing models (variations across providers) (Mijač et al., 2024)	Standardized PO calculation framework aligned with EAC requirements, reducing variability
User Accessibility	Requires strong digital literacy; some systems lack user-friendly interfaces (Carvajal-Ortiz et al., 2019)	Designed for lecturers, coordinators, and program leaders, with clear visualization and simplified input
Technological Innovation	AI integration and visualization emerging, but adoption uneven (Lumdee, 2025)	Progressive: standalone website, real-time analysis, and direct feedback for CQI

Moreover, while digital PO management systems offer significant promise for advancing CQI automation and accreditation readiness, persistent challenges related to data integration, staff readiness, and system harmonization highlight the need for continuous refinement. These insights provide a valuable backdrop for examining the role of POSCES as a locally developed innovation that addresses many of these systemic gaps.

It is within this context that the Program Outcomes Monitoring System for Civil Engineering Students (POSCES) was developed at UiTM Cawangan Pulau Pinang. Evolving from the Excel-based POSIMS, POSCES is a web-based platform designed to overcome the limitations of manual and fragmented data systems. It automates PO data compilation, enables calculation at the student, course, and cohort levels, and generates standardized CQI reports that align with EAC requirements. By integrating user-friendly dashboards, automated attainment calculations, and stakeholder engagement features, POSCES exemplifies a digital leap in OBE management which in hand, enhancing efficiency, consistency, and institutional readiness for accreditation while addressing the broader challenges identified in the literature.

RESEARCH METHOD

System Development Approach

The flow of the PO management in the faculty starts from course level, program level and finally the campus level. The flow chart in the PO management system is shown in Figure 1. At the course level, course coordinators conduct PO attainment analysis using i-RAS (Revolution on Assessment for Student Monitoring System) and submit the results to the OBE Unit through the faculty's website. The i-RAS system is Microsoft Excel based and it is macro-enabled. Details on the i-RAS system have been discussed extensively by Samsudin et al., (2020). At program level, the OBE Unit then consolidates and analyzes PO attainment across intake (cohort) and programs, to ensure systematic analysis and documentation for the Continuous Quality Improvement (CQI) for each semester. Finally, at the campus level, the consolidated PO analysis report is submitted to Curriculum Affairs Unit (UHEK) for the overall campus CQI.

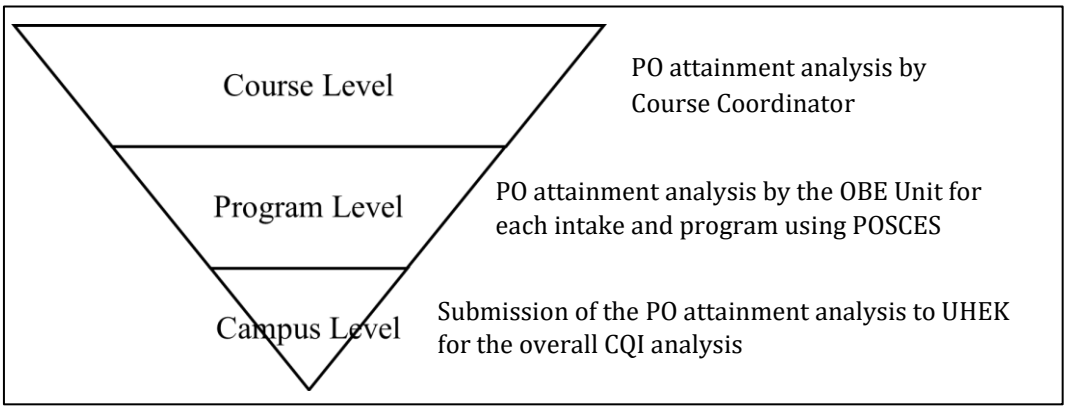


Figure 1. Flow of PO management system in UiTMCPP

The development of POSCES started back in 2015 where the faculty is using the MyCOPO system and POsAMS which are Microsoft Excel based. The Program Outcomes Monitoring System for Civil Engineering Students (POSCES) is originated from an earlier Microsoft Excel–based platform known as the Program Outcomes Student Information Management System (POSIMS). While POSIMS enabled independent tracking of Program Outcome (PO) attainment, its decentralized nature, limited access, and risk of data redundancy necessitated the transition to a more robust, web-based solution. In 2023, the development moves ahead

towards embedding the PO management system into the faculty website. By 2024, POSCES moves further to be a designated system which acts as a one-stop centre for the PO analysis throughout the offered program.

The POSCES system applied weighted averages and cumulative attainment equations to calculate PO achievement at the course, cohort, and program levels. The system was deployed as a web-based platform hosted through the faculty's academic server, ensuring secure access for the academic staffs and the students. The POSCES system was structured into two core components designated for the usage of faculty members and the OBE Committee. The details of the components are shown in Figure 2. Description for each component will be discussed further in the following section of this paper.

PO Attainment Calculation in POSCES

Within POSCES, the attainment of each Program Outcome (PO) is calculated automatically based on the students' performance across all assessment components that contribute to that PO. This calculation method is designed to demonstrate the level of attainment for each PO as part of the accreditation reporting.

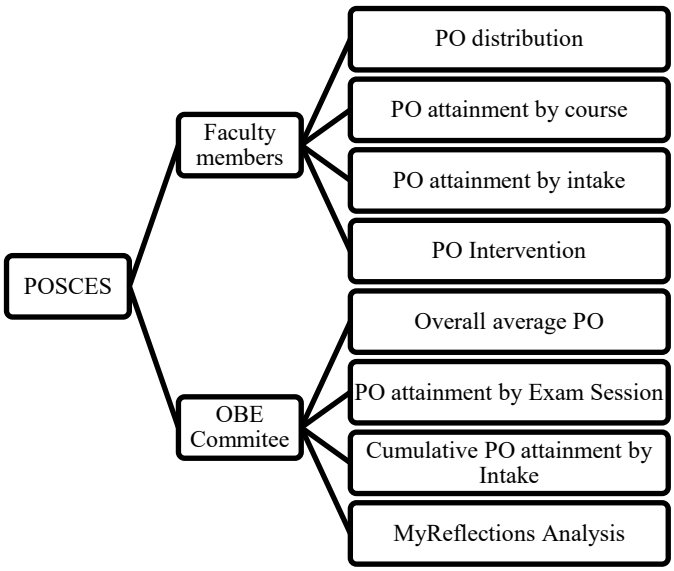


Figure 2. POSCES core components

Input of Student Scores by Assessment Item

All marks obtained by students from various assessment components (tests, exams, assignments, projects, lab work, etc.) are first entered into the system by using i-RAS. The PO data will be entered into the i-RAS system by the course coordinators and submitted to the OBE Unit. The PO data entry follows the designated percentages of the POs for each assessment including the final exam. The PO attainment is calculated for each student, for each course and for each cohort.

1. PO attainment (by student)

PO attainment for each student is calculated in consideration of the credit unit and also the PO weightage measured in the course. The equation used to calculate the PO attainment is shown in Equation 1. This equation is also used to calculate the cumulative PO attainment of the student upon graduation.

$$\text{PO Attainment}_{\text{student}}\ (\%) \quad (1)$$
$$= \frac{\sum(\text{Attainment}_{assessment} \times \text{weightage}_{assessment} \times \text{credit unit})}{\sum(\text{weightage}_{assessment} \times \text{credit unit})}$$

2. PO attainment (by course)

The PO attainment is also calculated at course level. This is carried out in order to evaluate the achievement of all the students taking the course at that particular semester. The attainment is calculated using Equation 2 considering the weightage of the PO in each assessment.

$$\text{PO Attainment}_{\text{course}}\ (\%) = \frac{\sum(\text{Attainment}_i \times \text{Weightage}_i)}{\sum\text{Weightage}_i} \quad (2)$$

Subsequently, the percentage of students achieving the minimum passing criterion (typically ≥ 50%) is calculated. This step quantifies the level of achievement of the POs.

$$\text{PO Achievement} = \frac{\text{No. of students} \geq 50\%}{\text{Total students}} \times 100 \quad (3)$$

3. PO attainment (by cohort)

The overall PO attainment of the students is then gathered and averaged to determine the PO attainment by cohort. This value serves as the primary metric for evaluating the program's effectiveness and for the purpose of CQI actions.

$$\text{PO Attainment}_{cohort}\ (\%) = \frac{\sum(\text{PO Attainment}_{students})}{Total\ number\ of\ students} \times 100 \quad (4)$$

Data Collection and Feedback Analysis

To assess the efficacy of the POSCES system, both qualitative and quantitative feedback was gathered from its principal users: lecturers, academic advisors, and OBE committee members. Data collecting methods comprised of formal surveys carried out among the UiTM branches offering the civil engineering course. This consists of UiTM Cawangan Pulau Pinang, UiTM Cawangan Pahang, UiTM Cawangan Pasir Gudang and UiTM Cawangan Sarawak. The survey had Likert-scale items assessing usability, accessibility, efficiency in CQI reporting, and overall satisfaction, alongside open-ended questions enabling participants to offer comprehensive input on difficulties and possible enhancements. Responses were evaluated to seek chances for future improvement.

FINDING AND DISCUSSION

System Functionality and Features

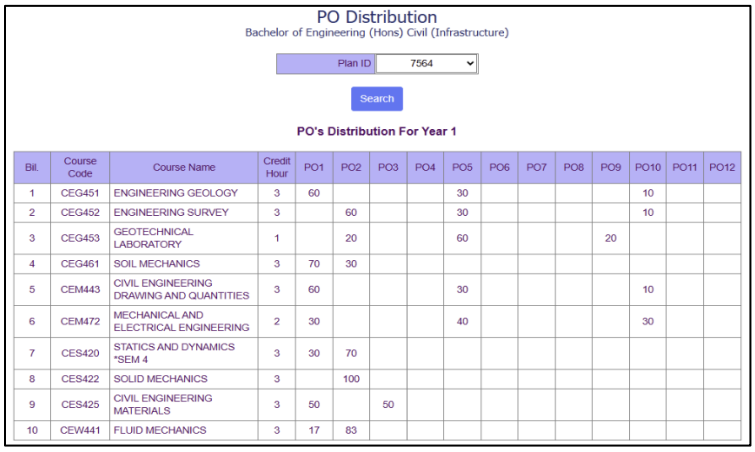
Switching from POSIMS (Excel-based) to POSCES (web-based) made a big difference in how the Civil Engineering Studies manages the Program Outcomes (PO) data. POSCES is a centralized, web-based platform that can be accessed from any device. This is different from its former version, which used many standalone files and manual data handling. This integrated POSCES system gives lecturers, academic advisors, and the OBE committee a single dashboard that lets them automatically access PO attainment and analysis and also able to generate a standardized Continual Quality Improvement (CQI) report. Apart from that, the My Reflections section is a useful feature since it lets students review their PO performance and write reflections, which helps them become more self-aware and this helps with academic coaching. The addition of automated CQI report generation has made it easier to meet EAC requirements, cutting down on the time and work needed to make program and campus level reports for audits and accreditation. Details of the elements in the POSCES are categorized by the accessibility for all faculty members and the OBE committee.

Accessible for faculty members

Below are the features that are available for the access of the faculty members, ie. I) PO distribution; ii) PO attainment by course; iii) PO attainment by intake and iv) Po intervention.

1. PO Distribution

Figure 3 presents the PO distribution for each course offered for each semester. This data is made available for all faculty members, and it is available for all Plan ID. This allows all lecturers to keep track of the percentage of PO's that needed to be measured especially for the course that they are teaching. It also allows everyone to have an overview of the PO distribution across the program.



PO Distribution

Bachelor of Engineering (Hons) Civil (Infrastructure)

Plan ID 7564

Search

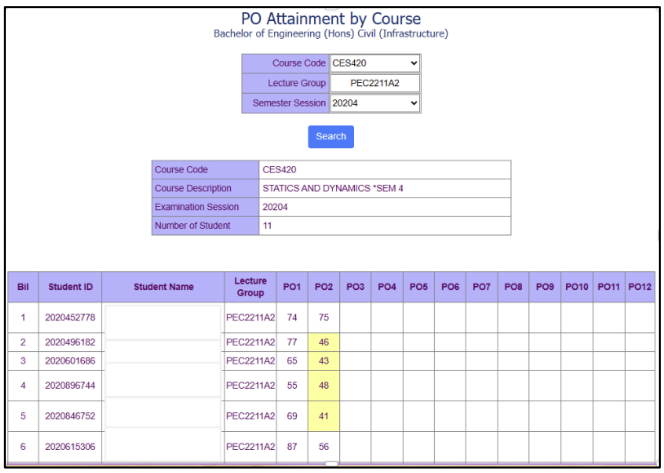
PO's Distribution For Year 1

Bil.	Course Code	Course Name	Credit Hour	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	CEG451	ENGINEERING GEOLOGY	3	60				30					10		
2	CEG452	ENGINEERING SURVEY	3		60			30					10		
3	CEG453	GEOTECHNICAL LABORATORY	1		20			60				20			
4	CEG461	SOIL MECHANICS	3	70	30										
5	CEM443	CIVIL ENGINEERING DRAWING AND QUANTITIES	3	60				30					10		
6	CEM472	MECHANICAL AND ELECTRICAL ENGINEERING	2	30				40					30		
7	CES420	STATICS AND DYNAMICS *SEM 4	3	30	70										
8	CES422	SOLID MECHANICS	3		100										
9	CES425	CIVIL ENGINEERING MATERIALS	3	50		50									
10	CEW441	FLUID MECHANICS	3	17	83										

Figure 3. PO distribution

2. PO attainment by course

Figure 4 displays the result of PO attainment for each course offered for each semester. This data opens room for the course coordinators to plan for their continual quality improvement for their course by doing the comparison with the previous semesters. The PO attainment data can also be viewed in detail for each student taking the course which enables for a more focused analysis.



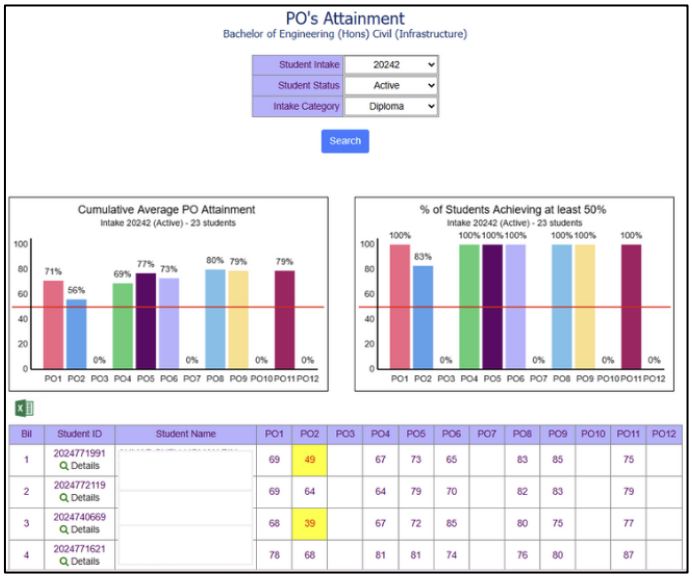
Bil	Student ID	Student Name	Lecture Group	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2020452778		PEC2211A2	74	75										
2	2020496182		PEC2211A2	77	46										
3	2020601686		PEC2211A2	65	43										
4	2020896744		PEC2211A2	55	48										
5	2020846752		PEC2211A2	69	41										
6	2020615306		PEC2211A2	87	56										

Figure 4. PO attainment by course

3. PO attainment by intake

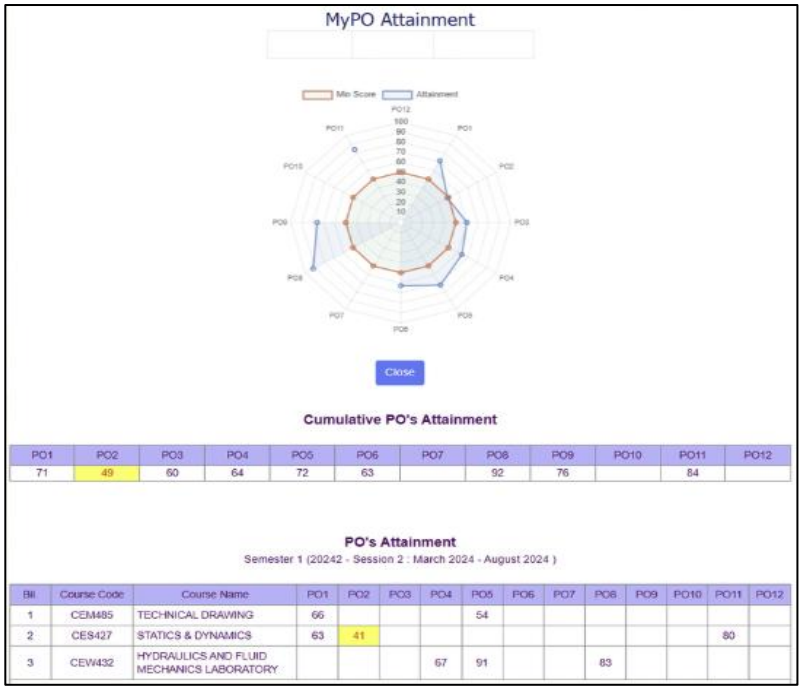
The data and graphs for the PO attainment by intake for that semester are presented in Figure 5a. This attainment is accessible by all faculty members to view the cumulative PO analysis for each intake. Cumulative attainment is calculated based on all the courses that were taken by all the students from similar intake. The data is also categorized based on the Diploma and Matriculation or Polytechnic intake. This is important in distinguishing the starting semester for each student. Students that started from Diploma Programs will start their study years at Semester 3, considering all credit exemptions. On the contrary, students for Matriculation or Polytechnic will have to start at Semester 1.

Under this tab, two graphs are presented, i.e. Cumulative average PO attainment and percentage of students achieving at least 50% attainment for that semester. Details of the cumulative PO attainment by student can also be accessed by clicking "Details". This view is shown in Figure 5b, where the comprehensive PO attainment of the student can be viewed together with the spiderweb. The spiderweb showed how far the student has achieved the required PO attainment from his/her study years.



Bil	Student ID	Student Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2024771991 Details		69	49		67	73	65		83	85		75	
2	2024772119 Details		69	64		64	79	70		82	83		79	
3	2024740669 Details		68	39		67	72	85		80	75		77	
4	2024771621 Details		78	68		81	81	74		76	80		87	

Figure 5a. PO attainment by intake



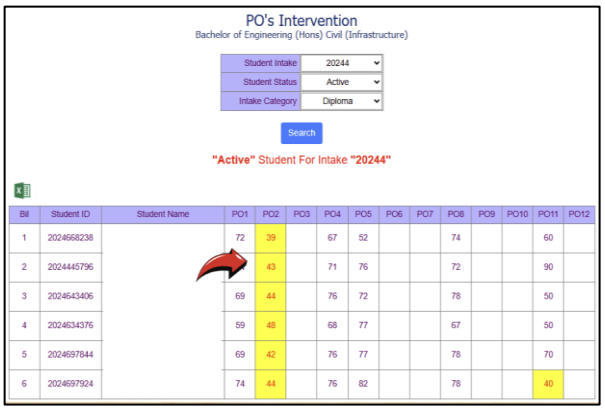
PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
71	49	60	64	72	63		92	76		84	

Bil	Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	CEM485	TECHNICAL DRAWING	66				54							
2	CES427	STATICS & DYNAMICS	63	41									80	
3	CEW432	HYDRAULICS AND FLUID MECHANICS LABORATORY				67	91			83				

Figure 5b. Detailed cumulative PO attainment by student

4. PO Intervention

Data of students that require PO interventions are listed under the PO Intervention tab in POSCES. The attainment that does not achieve the threshold of 50% is highlighted in yellow making it easier for the OBE committee to trace the PO's that requires improvement. This data is essential for the faculty to plan for intervention or enhancement programs to further develop the skills needed for the students before they graduate.



Bil	Student ID	Student Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2024668238		72	39		67	52			74			60	
2	2024445796			43		71	76			72			90	
3	2024543406		69	44		76	72			78			50	
4	2024534376		59	48		68	77			67			50	
5	2024697844		69	42		76	77			78			70	
6	2024697924		74	44		76	82			78			40	

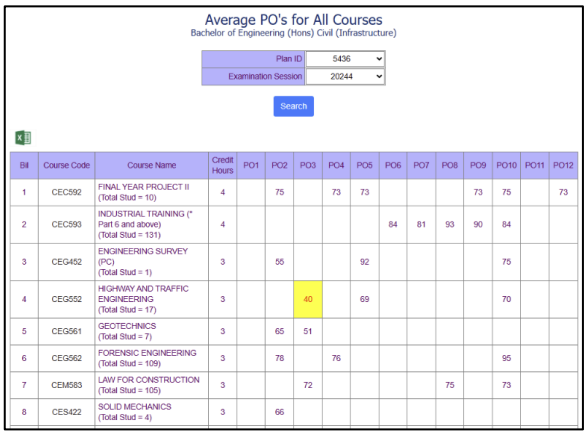
Figure 6. PO Intervention

Accessible for OBE Committee

For the purpose of PO analysis at program level and campus level, these features are made accessible to the OBE commitee including the overall generated report. Details of the features is explained below.

1. Overall Average PO

Figure 7 shows the overall average PO attainment based on selected semesters. This data is very important for the OBE Committee to be able to get an overview of the attainment for all courses offered. This data has to be accessed to strategize for the continual quality improvement of the program as a whole and has to be presented to the faculty management and all the faculty members during CQI day.



Bil	Course Code	Course Name	Credit Hours	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	CEC592	FINAL YEAR PROJECT II (Total Stud = 10)	4		75		73	73				73	75		73
2	CEC593	INDUSTRIAL TRAINING (* Part 6 and above) (Total Stud = 131)	4						84	81	93	90	84		
3	CEG452	ENGINEERING SURVEY (PC) (Total Stud = 1)	3		55			92					75		
4	CEG552	HIGHWAY AND TRAFFIC ENGINEERING (Total Stud = 17)	3			40		69					70		
5	CEG561	GEOTECHNICS (Total Stud = 7)	3		65	51									
6	CEG562	FORENSIC ENGINEERING (Total Stud = 109)	3		78		76						95		
7	CEM583	LAW FOR CONSTRUCTION (Total Stud = 105)	3			72					75		73		
8	CES422	SOLID MECHANICS (Total Stud = 4)	3		66										

Figure 7. Overall Average PO

2. PO Attainment by Exam Session

The PO attainment by exam session or semester is presented in Figure 8. From this tab, monitoring of the PO attainment for the cohort can be carried out to keep track of their progress from their first semester until they graduate.

3. Cumulative PO attainment by intake

For the purpose of reporting at campus level, the program outcomes tab is developed with full analysis of the PO attainment by intake compiled in one page as shown in Figure 9a. A detailed cumulative analysis of the PO attainment is shown together with the analysis of the KPI achievement of each PO. This page is also made available for direct printing for an A4 report format making it convenient for the OBE committee to do the reporting for CQI Day in the faculty and also for the Curriculum Affair Unit (UHEK) as displayed in Figure 9b.

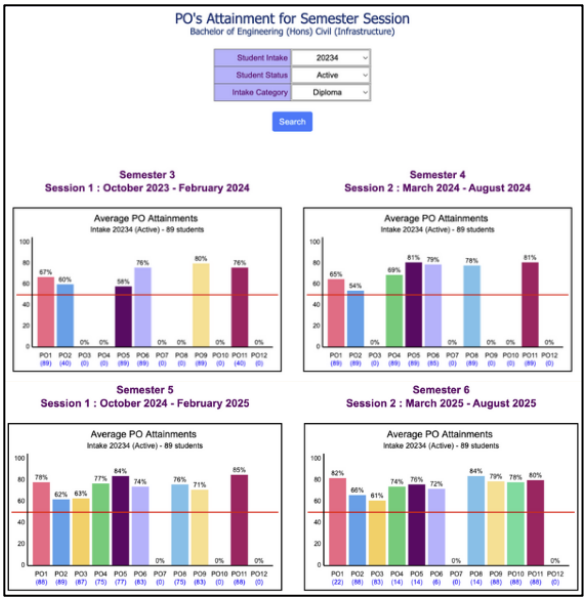


Figure 8. PO attainment by exam session

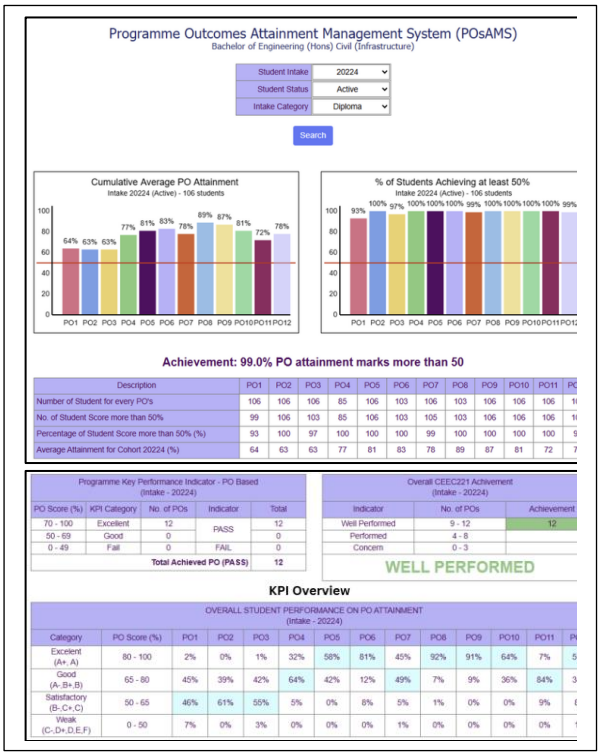


Figure 9a. Summary of cumulative PO attainment by intake attainment report

Figure 9b. Cumulative PO

4. MyReflections Analysis

Another tab in the POSCES is the MyReflections analysis. This presents the reflections data gathered from the students through the faculty every semester. MyReflections is a two-way communication between the students and their Academic Advisors during the first two weeks of the semester. The students can view their PO attainment through the faculty's website that is integrated with POSCES and leave comments or reflections on their attainment. Then, their Academic Advisor will comment and respond to their reflections. Consequently, all the gathered reflections will be gathered in the POSCES system for the reference of the OBE committee.

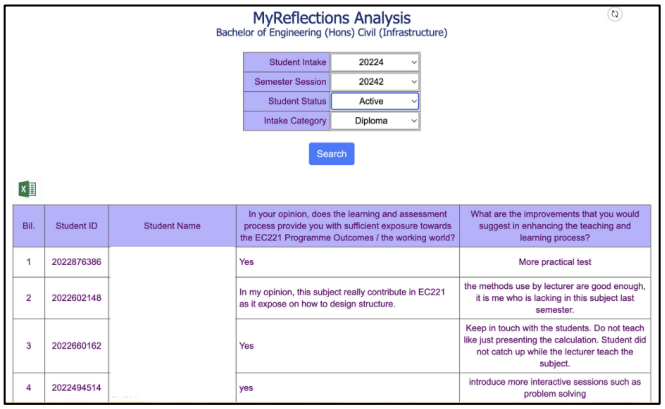


Figure 10. Sample of MyReflections

POSCES User Feedback

The POSCES adoption across multiple campuses and across bachelor and diploma programs further validated its applicability and future potential. A simple survey was carried out to get the user feedback. This POSCES system has been used across all campuses offering the civil engineering diploma and degree program. There are four campuses involved which are UiTM Cawangan Pulau Pinang, UiTM Cawangan Pahang, UiTM Cawangan Johor dan UiTM Cawangan Sarawak.

A total of 40 respondence were involved for this survey focusing on the direct users of the OBE system from across all campuses. The results presented in Table 2 show that most of the respondence agrees that the POSCES was good in helping with the systematic management of the Program Outcomes (POs). In particular, 55% of those who answered said the system was "very effective," while 22.5% said it was "somewhat effective." This shows that more than three-quarters of users thought the system helped them with their academic work, especially with data access, reporting, and CQI documentation. The fact that only a small number of people rated the system as "neutral" (7.5%), "somewhat ineffective" (5%), or "very ineffective" (10%) suggests that the system is mostly working well, but there may still be some areas that need work, such as training for users, develop a user manual and perhaps also making the interface easier to use. The high levels of satisfaction of users are similar to what has been found in other research on OBE information systems, which showed that digital monitoring tools made managing academic data and preparing for CQI documentation much easier (Liew et al., 2021).

Table 2. POSCES towards Systematic management

Category	Percentage (%)
Very effective	55
Somewhat effective	22.5
Very ineffective	10
Neutral	7.5
Somewhat ineffective	5.0

Consequently, in view of how the system facilitates Continual Quality Improvement (CQI) and the OBE monitoring process, the findings are shown in Table 3 and Table 4. The results indicate that a majority of respondents agreed that the POSCES effectively facilitates the CQI process, with 45% selecting “to a great extent” and 40% selecting “to a large extent” and it significantly aligned with the faculty's execution of Outcome-Based Education (OBE) and with 57.5% rating it as "very well aligned" and 32.5% as "well aligned." These results show that the system not only enables continuous improvement processes, but it also ensures that the system contributed to data-driven improvement and quality assurance with the Outcome Based Education academic framework that meet the accreditation requirements under EAC and ETAC.

Table 3. POSCES towards Continual Quality Improvement (CQI)

Category	Percentage (%)
To a great extent	45.0
To a large extent	40.0
To a moderate extent	12.5
To a small extent	2.5
Not at all	0

Table 4. POSCES alignment towards OBE and accreditation requirements

Category	Percentage (%)
Very well aligned	57.5
Well aligned	32.5
Moderately aligned	10.0

Figure 11 shows that most respondents found POSCES easy (55%) or very easy (30%) to use, indicating high satisfaction with their usability. About 15% remained neutral, suggesting minor room for improvement, particularly for new users. The system's straightforward design meets users' needs, allowing quick access to PO data input, analysis, and reporting. These findings highlight POSCES's efficiency, accessibility, and transparency in PO monitoring. Overall, its strong average rating of 4.59 confirms its effectiveness in supporting OBE and CQI implementation in the civil engineering faculty.

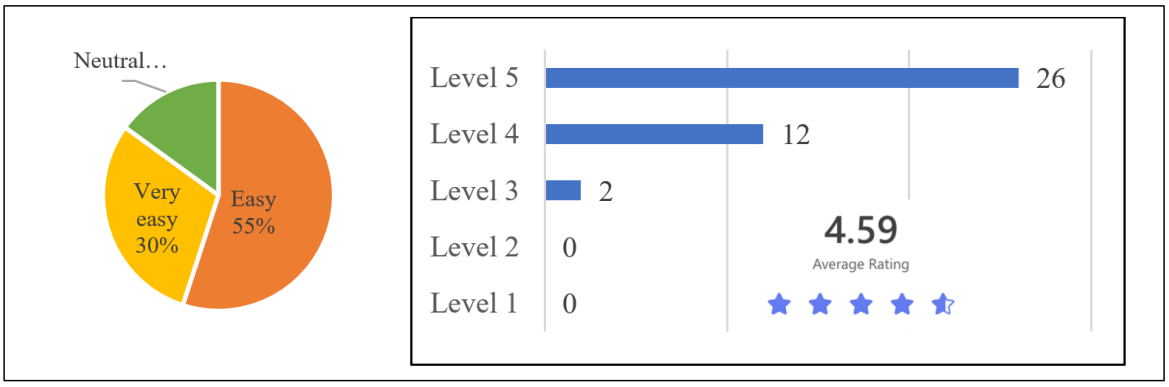


Figure 11. User friendliness and rating of POSCES

CONCLUSION

In conclusion, POSCES has proven to be an effective digital tool for managing Program Outcomes (PO) data and supporting CQI under the OBE framework. Moreover, user feedback confirms high satisfaction with its usability and functionality. Overall, POSCES could assist in strengthening the quality assurance and accreditation compliance of engineering education.

LIMITATION & FURTHER RESEARCH

The limitation of the study included the use of a relatively small database of 40 students, the absence of a double blinded project in which the assessment investigators should be different from the course instructors, the effect of Covid stress on the studied students, and the assumption of zero plagiarism in remote asynchronous delivery. A deep understanding of simulation in uncertainty assessment using lab data would provide a solid foundation to an understanding of the nature of simulation in prospection in daily life and could offer protection against depression induced by the Covid-19 lockdown. Furthermore, the simulation of uncertainty could be an approach to resolve the conflict between the prospection prediction from statistical learning and the encoding of the present into episodic memory, based on the interpretation of the brain scan data of the hippocampus (Sherman, et al.; 2020).

ACKNOWLEDGMENTS

The authors would like to thank the Centre of Civil Engineering Studies, College of Engineering, UiTM Cawangan Pulau Pinang for providing full support for the OBE Unit in developing this POSCES System.

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