

Continuous Quality Improvement (CQI) Mechanisms Effectiveness of Closing-The-Loop (CTL) Processes on Subsequent Course Outcomes Attainment

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ABSTRACT

Outcome Based Education (OBE) is embedded within Continuous Quality Improvement (CQI), which keeps academic programmes relevant, effective, and aligned with institutional and accreditation standards. Closing-the-Loop (CTL) mechanisms are central to this process, ensuring that improvement actions are actually implemented and that the results of those actions are captured and evaluated for subsequent Programme Learning Outcome (PLO) attainment. Many institutions, however, struggle to move beyond documenting CQI intentions toward demonstrating that interventions produce measurable, sustained improvement, particularly where evidence remains scattered across course reports, CQI logs, moderation records, and committee minutes. This study investigates the effectiveness of CTL mechanisms in enhancing PLO attainment within a higher education programme, focusing on how well-structured, evidence-based closing-the-loop processes translate CQI actions into demonstrable outcome gains. The study draws on Course Achievement Analysis Reports from selected academic courses, observing PLO score trends across baseline, post-intervention, and follow-up cycles. Evidence was triangulated across Course Achievement Analysis Reports which include CLO-PLO attainment and CQI documentation. The results show that well-structured CTL processes make a significant contribution to PLO attainment, help address persistent achievement gaps, and strengthen the linkages between curriculum delivery, assessment design, and learning support. Verification of Effectiveness reinforced academic accountability by requiring lecturers to substantiate claimed improvements with evidence rather than intention, while stakeholder engagement and programme-level governance structures, such as dedicated CQI committees and standardised CTL templates, further enhanced the traceability and sustainability of improvement actions. The study provides practical guidance on how academic institutions can strengthen OBE performance by improving CQI governance, formalising Verification of Effectiveness, and embedding Closing-the-Loop as a routine part of academic and programme-review processes rather than an ad hoc accreditation exercise.

Keywords: continuous quality improvement, closing the loop, outcome-based education, program outcomes, higher education

INTRODUCTION

Outcome Based Education is a paradigm shift from a content-based approach to curriculum delivery to an evidence-based approach, in which the effectiveness of a programme is judged by what the graduate can demonstrate at the end of the course of studies in terms of knowledge, skills and values. In this context, academic programmes should establish measurable Programme Learning Outcomes (PLOs) and link these PLOs to Course Learning Outcomes (CLOs), offer suitable learning opportunities, and provide suitable assessment evidence to measure to what degree the intended graduate competences have been realised. OBE needs not only to be formally defined in terms of learning outcomes, but it also requires a close relationship between curriculum design, teaching and learning activities, assessment practices, outcome attainment analysis and systematic educational improvement (Luangrangsee & Ratsameemonthon, 2024). This expectation is especially relevant in engineering and technical education as graduate competency is not only the knowledge of the discipline, but also

the ability to analyze a problem, design a solution, investigate a situation, communicate, work in a team, adhere to ethical responsibilities of an engineer, be aware of sustainability, and engage in lifelong learning (Pappas & Kander, 2020).

OBE implementation is hence, a key aspect of Continuous Quality Improvement (CQI). CQI is the systematic application of assessment results and evidence from stakeholders to identify gaps in the education system, determine the causes of these gaps, subsequently plan interventions based on the identified causes, and plan for further delivery of the curriculum to address gaps. At the programme level, CQI should ensure that data on PLO attainment is gathered not just for reportable purposes of accreditation, but they should be employed actively to enhance student learning and graduate competence. This is because the mere presence of learning outcomes, assessment matrices and attainment reports does not necessarily mean that an institution has an effective culture of improvement (Smith et al., 2015). The evidence chain is a crucial element of an academically mature OBE system that shows how identified gaps are addressed with corrective actions and then followed by educational outcomes. The evidence chain is the most important part of an academically mature OBE system, demonstrating the connection between identified gaps, corrective actions, and subsequent educational outcomes.

While OBE has become popular, institutions often struggle with transforming the outcomes of assessments into ongoing improvement (Stitt-Bergh et al., 2018). A challenge is the lack of centralization of evidence in course files, assessment reports, CQI records, moderation documentation, stakeholder feedback and minutes from academic committees. It is challenging to track the impact of these sources when they are not kept separately, as a weakness in an evaluation cycle may have affected teaching in the next cycle, and/or student performance, which can make it difficult to determine how the weakness in the initial cycle influenced the student performance in the subsequent cycle (Wardhani & Laksono, 2026). Other common gaps are generic CQI statements; recommendations repeated semester to semester; no root cause analysis; unclear accountability for CQI; and lack of measurable improvement targets. In such a case, CQI can turn into a procedure of documenting instead of enhancing the educational effectiveness (Akdemir et al., 2020).

Another difficult issue occurs when institutions equate the proposal or implementation of an action with evidence of completion of the improvement process. For instance, a course report might suggest more tutorials, modified questions on the assessment, increased application of practical activities or changes to resources. These actions could be appropriate, but are not evidence that the attainment gap has been closed. If there is no evidence of change before and after the intervention, the institution will not know if the action is effective, ineffective, or if no change occurred. If change is not demonstrated before and after the action, the institution will have no evidence that the action is effective, ineffective, or unrelated to the observed change (McDuff et al., 2018). To close the loop, this verification requirement is the basis for that process.

Closing the Loop (CTL) is defined as a systematic process of determining if a CQI intervention addressed the previously identified gap in education. Relates evidence of one assessment cycle to planning, implementation, evaluation in a later cycle. Typically, the CTL process starts with defining a CLO or PO attainment gap and moves on to an analysis of the likely causes. A targeted intervention is then developed, designed into the following teaching plan, enacted, and assessed with similar post-action evidence. Findings are subject to an appropriate academic governance review prior to the question of whether the intervention is to be institutionalised, adapted or repeated. As a result, CTL's CQI is not only a transparent process of recommendations, but also an iterative and assessment-based feedback process. (Hu & Tang, 2025)

The conceptual framework of CTL aligns with Deming model Plan–Do–Check–Act (Alderman, 2022), which is a model of continuous improvement through planned intervention, implementation, evaluation, and standardisation or further revision. In the context of higher education, the “plan” phase sets the desired outcomes, educational approaches, assessment techniques, performance metrics and CQI activities. The “do” phase is when the curriculum is implemented and student performance evidence gathered. The “check” stage involves analysing CLO and PLO attainment and determining if the target was met as a result of the intervention. The “act” stage codifies a successful practice or modification of a non-effective intervention. Therefore, CTL should not be viewed as a single report or meeting, but it is a process that is ongoing over the course of at least two assessment cycles (McNaught & Chun, 2023).

A second theoretical perspective is offered regarding the possible impact of CQI interventions on outcome

achievement, namely, constructive alignment. Biggs (1996) argues that the success of education ultimately relies on the alignment of the desired learning outcomes, learning activities and assessment tasks (Lawrence, 2023). So there can be various misalignments that can lead to an attainment gap. The cognitive level of the task(s) students are required to perform may be higher or lower than the cognitive level of the content in the

CLO. Likewise, if the Student Learning Time is not sufficient, the amount of formative practice is insufficient, or the rubric of the assessment is inappropriate, or the feedback is limited, then the student is unable to demonstrate the intended competency. Effective CQI must therefore go beyond reporting attainment percentages and explore the structural and pedagogical conditions that lead to attainment.

Such diagnosis should be based on several lines of evidence. CLO and PLO attainment determine if the threshold was met, and assessment-item analysis pinpoints questions/tasks that were poorly performed. Specific problem formulation, technical analysis, design justification, tool application, communication, and teamwork deficiencies can be identified through rubric-level analysis. Moderation records support evidence of the validity and challenge of assessment. Feedback from students will give information about whether instruction is clear, workload, learning resources and learning barriers, while the reflection from the lecturer will indicate whether there are constraints or deviations from the teaching plan that has been approved. Evidence of student achievement comes directly from samples of student work, and comparison to past cohorts, suggests whether or not changes are a sustained trend or isolated fluctuations. Aggregate attainment results are insufficient to inform the selection of an improvement intervention and triangulating these sources creates a more credible basis for the choice (Damaj et al., 2017).

Quality of the feedback given during the learning process is also a factor in CQI and CTL. For students to gain understanding of expected standards, assess their own performance and work out what they need to do to close the gap between their current and expected achievement, feedback should do all of this (Nicol & Macfarlane-Dick, 2006). Therefore, an intervention that includes formative assessment should not only be judged by whether or not they did more exercises. Evidence for its effectiveness should be explored by means of student engagement, feedback use, rubric-level student performance, and subsequent attainment of CLOs. This is intended to enhance the causal argument linking the intervention that was undertaken to the education outcomes that were observed.

The importance of CQI and CTL is further supported by the Code of Practice for Programme Accreditation by Malaysian Qualifications Agency (MQA) which stipulates that programmes must demonstrate systematic monitoring, review and continual quality improvement (Grapragasem et al., 2014). The student performance, stakeholder feedback, curriculum evaluation, academic governance, and documented improvement are all integral components of COPPA, which views programme monitoring as an evidence-based process. (Malaysian Qualifications Agency (Hanh et al., 2020). The national expectations for engineering programmes are supplemented by the requirements of the Engineering Accreditation Council in relation to the implementation of OBE in engineering programmes and continual improvement. The Malaysian engineering-accreditation system is embedded in the framework of the expectations of the Washington Accord, which stipulates that an accredited programme is expected to produce graduates whose attributes are "substantially equivalent" to the internationally recognised engineering-education standards (Tanjong et al., 2020).

CTL is evidence of institutional quality assurance maturity in this accreditation context. A developing system could be used to determine outcomes and to gather attainment evidence, and a more established system can be used to show how evidence is used for decision making, actions are integrated into subsequent delivery and effectiveness is measured over time. However, the progress in attainment should not be regarded as automatic as a result of a CQI action. The findings can also be affected by the differences between cohorts, the difficulty of the assessment, teaching staff, the type of delivery and entry characteristics of students. Therefore, a careful CTL analysis must consider the similarities and differences in assessment instruments, attainment targets, cohort characteristics and contextual conditions before conclusions about the effectiveness of the intervention can be drawn.

This study aims to explore the relationship between the CTL processes and the resulting measurable subsequent improvement in the attainment of a set of desired outcomes (PLOs) in an undergraduate technical programme, given the context discussed above. It highlights the link between identified attainment gaps, documented CQI

actions, evidence of implementation and post-intervention PLO attainment. The study aims to identify whether the change actions have taken place as planned and whether any educational outcomes have been achieved by the use of evidence from the previous and current academic cycles, course reports, CQI documentation and the minutes of the academic committee. The study contributes to CTL by providing a

conceptualization that does not see CTL as an administrative destination but as an evidence-based governance process that links assessment, pedagogical intervention, institutional learning, and accountability for accreditation. It does this by offering a framework for differentiating between CQI actions that are simply proposed and CQI actions that are evaluated, implemented and made a part of what works in education. (Alderman, 2022)

LITERATURE REVIEW

The literature highlights the role of CQI in educational quality reform, in fostering the use of evidence-based practices and curriculum improvement (Ihsan & Khalifa, 2011; Temponi, 2005). Some of the basic things about CQI are that it is an ongoing process (Elassy, 2015). It is done periodically, there is a measurement and re-evaluation (Ihsan & Khalifa, 2011). Focuses on continuous small-scale change rather than big scale change. Quality is judged in terms of the needs and expectation of their internal customers (staff, departments) or external customers (customers, industry, students) (Hogg & Hogg, 1995). Feedback is gathered on an on-going basis and used to make improvements (Hogg & Hogg, 1995). CQI is about process improvement, rather than fault finding. Poor outcomes are seen as the result of poor processes (Kibira et al., 2016). Workflows can be standardized and optimized to minimize variations and errors. It is based on evidence and measurable data, rather than assumptions, and employs key performance indicators (KPIs), metrics, audits and trend analysis (Oakland, 2014). Data provides insights into gaps, progress and validates improvement. The PDCA cycle is a systematic approach to continuous improvement that allows organisations to plan changes, test them, evaluate the outcomes and standardise what works (Deming, 1986). The whole organization must be involved in CQI. Involving employees enhances problem identification, problem ownership and the implementation of quality initiatives (Oakland, 2014). CQI focuses on preventing defects and errors by identifying the root causes of them rather than fixing them after the fact, thus decreasing waste and increasing efficiency (Juran et al., 1999). Improvements made are recorded and standardized to maintain consistency, repeatability and sustainability of quality practices (Quality Management Systems. Requirements, 2015). Deming (1986) emphasized the need for strong leadership to create a quality culture, to ensure provision of resources and to support continuous improvement initiatives. CQI fosters learning within organizations, with reflection, benchmarking and adaptation to emerging internal and external needs (Oakland, 2014).

Program Outcomes Attainment

Assessment instrument quality, course–PLO mapping accuracy, and teaching strategy effectiveness and student readiness are strong factors affecting program learning outcome (PLO) attainment in outcome-based education. Valid and reliable assessment is a central focus of the recent research and development of trustworthy PLO data that would guide improvement actions (Ibrahim et al., 2025; Mahalingam, 2025). Likewise, by linking learning activities with intended outcomes, the mapping of curriculum and course–PLO can help identify the gaps in attainment and guide interventions (Anandh et al., 2025; Kadappa et al., 2022). Pedagogical approaches and students' preparedness also shape PLO achievement, as pedagogical redesign and pedagogical support mechanisms have been found to positively impact attainment when properly applied (Alias et al., 2026; Baharudin, 2026). Although continuous quality improvement (CQI) frameworks are common, the literature consistently reveals effective closing-the-loop (CTL) processes that demonstrate the impact of interventions across assessment cycles are essential for sustainable improvements in PLO attainment (Ratim et al., 2024), (Köse, 2025). Most of the existing studies, however, depend on descriptive or single cycle evidence, and relative few have attempted to measure the impact of CTL on the subsequent trends of PLO attainment, and quantify that effect over time, thus highlighting the need for further research (Akdemir et al., 2020).

Outcome-Based Education (OBE) Framework.

As shown in Figure 1, the basic activities in the Outcome Based Education (OBE) are divided into three sections: Outcome, teaching and learning, and assessment. Three analyses are carried out: Course Learning Outcome

(CLO) analysis, Programme Learning Outcome (PLO) analysis, and Programme Educational Objective (PEO) analysis. This study is based on the implementation of Closing the Loop (CTL) at the PLO analysis level where the improvement actions are based on the results of the course assessment and evaluation

report prepared by the course lecturer.

There are three levels of CTL as illustrated in Figure 1. The effectiveness of individual courses is assessed by means of CLO and PLO analyses. For PLO analysis further analysis is carried out to look at the overall achievement of the programme with a cohort of students in a particular academic year. From the analysis results, the achievement of every PLO that is linked to the respective courses can be identified and then recommendations for improvement are proposed based on the level of PLO achievement. This means that if a PLO does not achieve the targeted attainment levels then CTL actions can be taken.

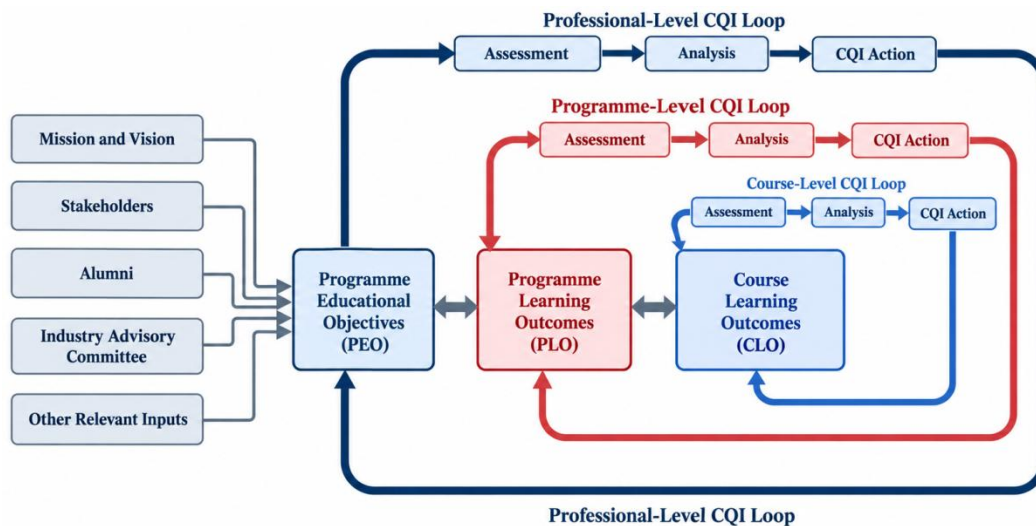


Figure 1: OBE academic structure and main processes

Figure 2 shows the systematic process whereby assessment evidence for the course is summarised to create Programme Learning Outcome (PLO) attainment evidence for the programme. Although each course is described in its own course, they are all courses that contribute towards the respective PLOs during a specific semester. In line with this, the method employed is consistent with Outcome Based Education (OBE) that evaluates student achievement through specified and clear learning outcomes and backed by documented evidence (Yang, 2024).

A Course Learning Outcome (CLO) Attainment Report for each contributing course is prepared in the process. CLO attainment is measured through students' performance in the mapped assessment components such as examinations, assignments, laboratory activities, projects, presentations and other direct measures. The connections and linkages between the CLOs, teaching activities, and assessment instruments and questions should be clearly established in order to ensure constructive alignment (Mahzari et al., 2023). Indirect evidence like student feedback, survey data on courses and reflections from the lecturer may support, but should not supplant, evidence of student performance. (Alyasin et al., 2023)

The verified attainment results are then translated into corresponding contributions to the PO based on the programme's approved CLO – PLO mapping matrix following CLO assessment. Systematic CLO–PLO or CLO–PLO alignment is crucial as it allows institutions to determine how the individual assessment activities and courses are interrelated to fulfil the overall programme outcomes (Derouich, 2025). These courses then generate a PLO Attainment Report which outlines the calculated PLO values, the sources of the assessment, the relationship between each CLO and PLO, the performance targets, the identified attainment gaps and recommended actions for improvement.

The Course reports should be moderated and validated before they are aggregated at programme level. This verification can involve any of the following: confirmation of attainment calculations, completeness of evidence for assessment, suitability of the mapping of CLO – PLO, consistency of performance levels, comparability of

results across courses. This validation helps to minimise threats of measurement inconsistencies and to increase the validity of programme-level interpretations (O’Connell et al., 2015).

Programme-level validated PLO attainment results follow from the results in the individual courses. This aggregation in many-to-one ratio prevents the interpretation of programme performance being based on a single course and offers a more accurate assessment of achievement across the curriculum. The aggregation

process must be based on a definite and consistent calculation method, which can be based on the course contribution, the strength of the mapping of CLOs and PLOs, course assessment contribution, course credit value or the number of students assessed (Abdeljaber & Ahmad, 2017). The weighting method used should be chosen in advance of examining the results, to minimise any analytical bias and enhance the methodological reproducibility of the results.

The aggregated results are consolidated in the Programme PLO Assessment Results Database, a centralised database to hold evidence. Systematic electronic handling of assessment information enables data retrieval, comparing trends across academic terms, identifying weaknesses in outcomes, compiling evidence for accreditation and tracking remedial actions from term to term (Buzzetto-More & Alade, 2006). The final attainment percentages should be recorded in the database, along with the information relating to the course, cohort, semester, assessment instrument, mapping, weighting, target, and moderation.

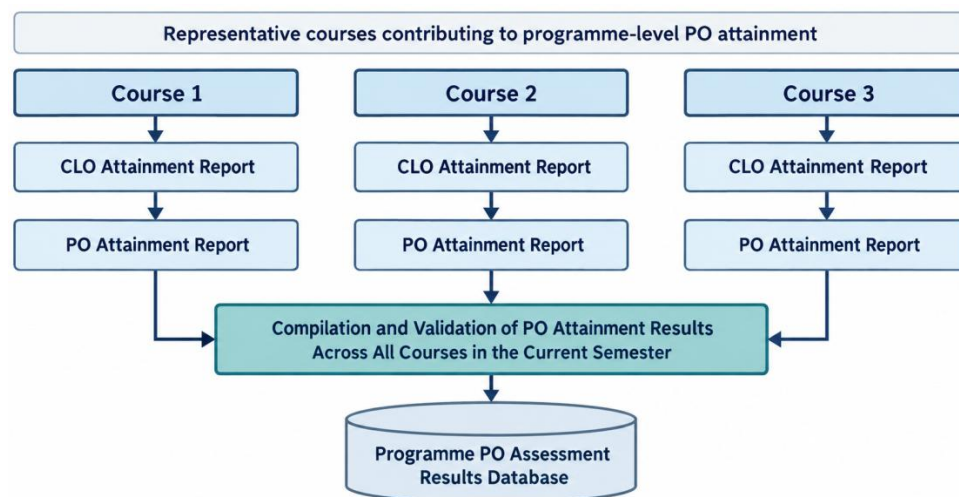


Figure 2: Detail processes in OBE implementation.

This database is used as the basis to derive direct and indirect attainment values and these values are combined and used to look at the overall effectiveness of the academic programme (Pradhan, 2021). The table shows that each Programme Learning Outcome (PLO) attainment is the arithmetic mean of the scores of attainments from all courses mapped to that PLO. Courses listed with a “–” are not included as they do not support the respective PLO.

CQI in Higher Education

CQI empowers systematic assessment of teaching and learning which connects assessment results to actionable improvements through systematic quality assurance processes. In outcome-based education systems, CQI involves various tools, including the Plan–Do–Check–Act (PDCA) cycle, curriculum mapping, rubric calibration, and stakeholder engagement, which contribute to evidence-based decision-making, harmonization of learning outcomes, reliability in assessment, and curriculum relevance (Ahmad et al., 2023; Jönsson & Svingby, 2007).

Closing-the-Loop (CTL)

Continuous Quality Improvement (CQI) offers the overall structure to look for gaps and make improvement plans, but Closing-the-Loop (CTL) is unique as it assesses the effects of any actions taken to improve the learning

outcomes. However, while CTL is about planning and implementation, it also makes an attempt to explicitly determine if corrective actions have resulted in measurable and sustainable improvement, especially in Outcome-Based Education (OBE) settings (Ratim et al., 2024),(Köse, 2025). Recent literature highlights that while many institutions have CQI intent, there is a lack of closing the loop because of the absence of validation of outcomes, inadequate documentation, or failure to follow through across assessment cycles (Smith et al., 2015). Effective CTL helps tackle this challenge by incorporating verification and evidence-based validation in the improvement process.

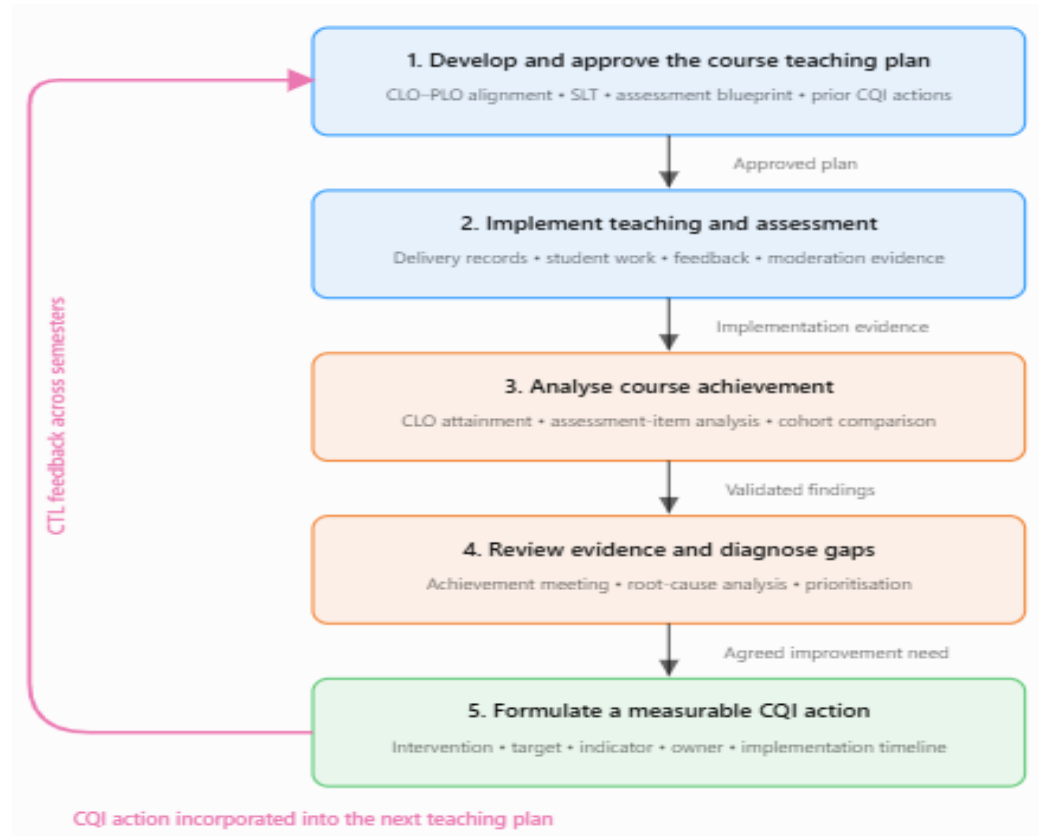


Figure 3: Framework for the Closing-the-Loop cycle in course evaluation.

The suggested framework is an evidence-based process that builds on the original three-stage flow, and involves planning, implementation, analysis of achievement, collegial review, intervention design, and effectiveness verification. This expansion is required as the original flow is correct in recognising the major transition from a teaching plan to an achievement report and then to a CQI action, however, it does not explicitly detail how evidence is gathered, how the cause of a performance gap is identified and how the effectiveness of the CQI action is verified. This combination of diagnostic and verification stages can help guarantee that decisions on curriculum modifications and pedagogical changes are based on data, not anecdotal evidence (Liew et al., 2021).

The new framework separates Continuous Quality Improvement (CQI) from Closing the Loop (CTL). While CTL is demonstrated through evidence of improvement after the intervention, CQI is an ongoing process that seeks to uncover and correct educational gaps. The implementation of an action, therefore, does not "automatically" form a loop. Instead, true closure requires a visible feedback process, with further cycles of assessment confirming the effectiveness of the changes in practice (Ahmad & Qahmash, 2020).

The Development and Approval of Teaching Plan for Courses

The process starts with the development and approval of the course teaching plan prior to the semester. The plan identifies the intended alignment of Course Learning Outcomes (CLOs), Programme Learning Outcomes (PLOs), teaching and learning activities, Student Learning Time (SLT), assessment and past CQI actions. This initial phase uses information from previous performance reviews, to ensure that new pedagogical approaches effectively target student achievement deficits identified in previous observations (Liew et al., 2021). This is the expected level for the entire quality cycle. The teaching plan should clearly define the teaching learning activities

that will be used to develop the CLOs, the PLOs and the graduate attributes that will be supported by the students' learning of the CLOs. It should also identify the assessment evidence to be gathered, outline the CQI actions that have been embedded from the previous semester and outline measurable indicators of the effectiveness of those actions.

This is a constructive alignment where intended outcomes, instructional activities and assessment are carefully aligned (Pereira et al., 2024). The CLO–PLO mapping in engineering education allows for establishing a bridge to the graduate attributes set forth by the International Engineering Alliance and adopted in Malaysia by

the Engineering Accreditation Council (EAC) (Basir et al., 2019). It is important to note that the teaching plan should not simply restate a CQI recommendation that was made in the previous course report. It should make it very clear where the action is tied to—such as a specific teaching week, formative assessment, a practical activity, a rubric criterion or other learning tools (McCallum & Milner, 2020).

The Embedding of Teaching and Assessment Strategies

The approved teaching plan is then followed throughout the semester. Evidence should be gathered to provide evidence that the planned activities were delivered at this stage. Examples of relevant evidence include the following: attendance record, instructional materials, assessment questions, moderation forms, marked student work, rubrics, formative feedback, deviations in actual delivery, lecturer reflections. It is assumed in the initial diagram and is therefore represented as a separate stage as there may be a discrepancy between planned curriculum and implemented curriculum (Praetorius & Charalambous, 2023). If the planned activities are not implemented and/or significant changes are made without documentation, then an apparently well-aligned teaching plan will not support CQI.

The planned teaching and learning should be recorded on the implementation record as either completed or deferred to another week. It should be used to compare the actual allocation of Student Learning Time (SLT) against the planned allocation to provide a clear idea of whether there are significant deviations of student workload. It is also important to note and explain any adjustments to assessment dates, submission timelines, weightings, and delivery of products. Furthermore, the record must show if the students had adequate access to the necessary facilities, equipment, software and learning resources. Include information about formative feedback given to students as it explained how learning gaps were addressed prior to summative assessment. Online learning platforms may also be used to measure student engagement via attendance, participation, task completion, consultation, or the activity on the learning platform (Ahmadi et al., 2023; Plessis et al., 2021). Lastly, problems in implementing a course should be recorded and the impact of the problems on learning and remediation efforts should be recorded. This information can be used in aggregate to compare the planned and implemented curriculum and to offer credible evidence in support of future CQI and CTL decisions. These records are crucial to understanding achievement data. The causes of a weak CLO result can be the result itself, the instructional strategy, lack of learning opportunities, unsuitable evaluation, lack of previous knowledge, or incomplete implementation.

Course-Achievement Analysis Report

The Course Achievement Analysis Report is a document that transforms student performance data into evidence of the achievement of CLOs after assessment. This analysis should not just be based on average marks. It should study the achievement for CLOs, performance on individual assessment items, rubric dimensions, distributions of achievement levels, failure patterns, and, if appropriate, comparisons with earlier cohorts.

This is important for accreditation, since Course-level assessment evidence supports Programme-level judgements on Attainment at programme level. It is important, however, that a course result is not being used as an indication of an overall graduate attribute if the curriculum mapping is not showing how the overall graduate attribute is being developed and assessed in a series of courses (Spencer et al., 2011). Comparing across time is particularly beneficial. An attainment percentage only tells us about the attainment of one cohort and not whether an intervention has led to an enduring improvement. CQI can be evaluated more defensibly between successive cycles of delivery.

Review and Diagnosis of Any Gaps in Evidence

A collegial validation and diagnostic step are the course achievement meeting. It should not be used to sign off on the attainment report. Participants should also review if evidence was valid and if the assessment was properly linked with the topics, and if it was not and why.

The updated diagram will then insert the concept of root-cause analysis between achievement reporting and CQI action. The revised diagram will then place the concept of root-cause analysis in between achievement reporting and CQI action. If this stage is missed, the improvement actions can be based on assumptions, not on facts. For instance, if a student is not doing well in a course, this should not automatically mean that they need more hours of lectures. The real reason may be expressed as a vague assessment question, poor formative practice, too many assessments in a too short of a time, poor prerequisite knowledge, or an assessment that does not sufficiently measure the intended outcome as stated in the rubric.

At this stage the evidence that will be considered will be used to establish whether the intended course and programme outcomes have been met, and may include CLO and PLO attainment. For each assessment item, an analysis of student responses can help determine which questions or tasks were challenging, and for each competency, a rubric-level performance level can give more specific detail about the weaknesses in that competency, e.g., problem analysis, design, communication, teamwork, or engineering tools. The results of the internal or external moderation should also be checked to ensure that the assessment is valid, appropriate, consistent and meets the academic rigour (Subheesh & Sethy, 2020).

Student feedback may be used to gain insight into how clear instruction is, available resources for learning, appropriateness of learning activities, and difficulties students have encountered throughout the course. The student's reflection should also be supported by the lecturer's reflection on his/her effectiveness in teaching, active participation of students, limitations in carrying out the lecture, and deviation from the teaching plan. The distribution of assessment workload should also be checked to ensure that workload is not excessive or that submissions are not scheduled to coincide or that there is not an excessive amount of formative versus summative assessments. Samples of pupils' work can then be checked to ensure that the attainment outcomes are of a high quality and accurate. Lastly, comparison with other cohorts can help to identify trends and assess if improvements achieved as a result of previous CQI interventions are durable. Together, these sources can help make a more accurate diagnosis of learning gaps, and they can provide support for evidence-based CQI and CTL decisions. This triangulation increases the validity of the diagnosis as no single data source is enough to explain comprehensively educational performance (Zizka et al., 2020).

Establishment of A Measurable Action to Improve The CQI

After determining the gap and likely cause of the gap, the meeting should develop a measurable CQI action for the next delivery cycle. There should be five elements to a valid action. This format identifies the changes that will be made, the individuals responsible for making the changes, and when and how the changes will be measured to determine success. Feedback is a crucial intervention as it enables the student to compare their performance at the present moment with the required standard and know what action steps they need to take to bridge the gap between them (Brooks et al., 2019).

Verification of Effectiveness

The major improvement of the new framework is the explicit effectiveness-verification decision. Post-action evidence should be compared to the baseline in the previous delivery cycle during this next delivery cycle. Assessment should be used to see if the CQI intervention was followed up to the agreed plan. This is not just about confirming the activity—it involves more. Implementation fidelity can be evaluated through comparing the intervention delivered with the intervention as planned, such as who was responsible, who was involved, what was taught, what resources were used, how it was assessed, and how long it lasted and when it was delivered. Evidence can be in the form of updated teaching plans, teaching materials, attendance records, records of the learning-management-system, assessment rubrics, student work, lecturer reflections, and records of the course committee. This comparison is critical because if an intervention is only partially implemented, then it can't be fairly compared to its original performance goal.

This evaluation should then take place to assess if the set target indicator was reached. A target should be specific and measurable, such as improving attainment of a specific Course Learning Outcome (CLO) from 55% to at least 65%, narrowing the spread of students' attainment to fall below a specific rubric threshold or raise attainment in a specific criterion in an assessment (Shirk, 2020). There should be a baseline data point before the intervention that can be compared to the post intervention data to confirm that the intervention had an impact. Consideration of achievement as well as distribution of student achievement and attainment at the threshold level, and changes in lower performing groups, should be included where possible. This way, an improvement by a few students with high achievement scores will not be read as an achievement improvement in the whole group.

Getting to the number goal does not prove that the intervention led to the improvement. The assessment should critically analyse if the observed change can be reasonably attributed to the action implemented. Variations in cohort characteristics, how difficult the assessment is, who is teaching them, how the teaching occurs, how this is assessed, what knowledge they bring in prior to assessment, and what resources are available for learning can also have an impact upon attainment. Thus, conclusions should be drawn by using triangulation of several evidence sources such as the attainment of CLO and Programme Learning Outcome (PLO), students' work samples, rubric-level performance, students' feedback, moderation results and lecturer's reflection. Assessment is meaningful when institutions change how they gather data to show how evidence-based practice decisions impact student learning (Stitt-Bergh et al., 2018). However, caution should be used when making causal inferences in evaluations that do not utilize an experimental or controlled research design.

Unintended consequences of the intervention should be identified in the evaluation. Adding more activities can, for instance, increase student workload, despite improved adherence to one CLO, decrease the adherence to other CLOs, or increase students' dependence on the lecturer's guidance. Likewise, if a change is made to an assessment, the attainment may rise due to the clarity of the question – but the change may also inadvertently be lowering the level of cognitive demand. An intervention must be assessed on the basis of the positive impact it is designed to have and also on the basis of its impact on curriculum balance, student workload, assessment validity, assessment equity and student autonomy of learning. Constructive alignment calls for improvement strategies that ensure consistency between intended learning outcomes and learning activities and assessment requirements, instead of enhancing attainment by lowering the level of learning (Boud & Falchikov, 2006).

After this assessment, the academic committee responsible should decide whether or not this intervention shall be continued, adapted, or discontinued. It must be based on a documented evidence rather than on a personal perception or a single attainment percentage. There are two main options that can be taken.

Close and Standardise: Effective Action

If the evidence shows that the intervention was carried out as intended and reached the intended target with no unacceptable unintended consequences, then the action can be seen as effective. The intervention can then be shared with regular instruction, documented in the curriculum, or in the assessment process or department guidelines. This process can include a revision of the following teaching plan, learning materials, assessment blueprint, rubric or standard operating procedure (Puzziferro & Shelton, 2019).

The choice to standardise the intervention should be noted in the Course Evaluation Report and confirmed by the Course committee / academic committee minutes. The documentation should include documentation of the original gap, baseline results, action taken, post-intervention results, supporting evidence, and formal decision. This documentation offers an audit trail demonstrating that the institution has moved from the identification of a problem toward improving it based on evidence.

But a closed loop does not mean that the intervention will not be reviewed ever again. Standardisation refers to the fact that the practice has proven it has enough impact to be part of delivery practice. It would be good to continue monitoring it in future cohorts to see if the improvement is maintained. According to improvement philosophy, quality should be kept up by ongoing evaluation, not just a "one-time corrective action" (Otto & Mandorli, 2024).

Failure to Act Effectively or To Find Out If Anything Has Happened: Change Directions and Repeat

Intervention should not be considered "complete" simply because it was provided if the target indicator is not met. This evaluation should identify if the intervention was poorly designed, was not fully implemented, was based on an incorrect root cause diagnosis, was an unrealistic target, had an insensitive measurement, or if there were cohort differences. This difference is crucial as an intervention can be the right thing at the right time, but not be implemented correctly. On the other hand, an intervention could be carried out properly, but be unsuccessful due to its failure to target the root cause of the attainment gap. (Carroll et al., 2007)

If the evidence is inconclusive the intervention can be modified and implemented in a different cycle. This updated action plan needs to elaborate on the changes that are being made and explain why, who will be responsible, when they will be implemented, and the new or existing success measure. Other evidence may also be needed, including student focus-group data, rubric analyses which are more detailed, prerequisite testing, or moderation by external providers. The process should then proceed through another implementation, evidence gathering, analysis and academic review cycle. (Anderson et al., 2024; Smith et al., 2015)

Withdrawal should be considered if there is evidence of ineffectiveness, impracticality, inequity, excessive resources or impact on other learning areas. The end of an unsuccessful action should not be seen as a failure of CQI. (Stirman et al., 2012) It is rather a decision taken in an evidence-based, institutional manner, not to promote ineffective practices in the curriculum. At this decision point, the difference between genuine Closing the Loop (CTL) and administrative reporting comes in. A CQI statement records a commitment to enhance and CTL requires evidence of the intervention, evaluation, and a formal decision. In this regard, the pursuit of learning in the institution does not necessarily result in a recommendation, but rather in proven educational effectiveness and institutional learning. (Anderson et al., 2024; Smith et al., 2015) This evidence-based approach aligns with the monitoring, review and continuous improvement requirements of the Malaysian Qualifications Agency and the engineering accreditation systems (Yong & Iderus, 2024).

Accreditation Significance

The framework offers a clear pathway for programme accreditation, using course level evidence. The IEA Graduate Attributes and Professional Competencies Framework identifies the attributes and competencies that an engineering graduate should be expected to possess, and the Washington Accord sets out expectations that signatory accreditation systems would demonstrate that the graduate preparation is similar and of sufficient quality (Ressler & Lenox, 2016). The expectations are translated into programme accreditation requirements in Malaysia that include implementation of OBE, assessment of the outcomes, and continuous quality improvement (Tanjong et al., 2020).

The teaching plan includes evidence of intended alignment, while the achievement report includes evidence of student actions. Records of the meeting include collegial evaluations; the following teaching plan is used to determine if the agreed action was implemented. Lastly, the outcomes of post-intervention assessments and committee decisions determine if CTL has occurred. This systematic documentation guarantees that programs can provide clear evidence of a closed loop mechanism to evaluators outside the program (Sarker et al., 2022).

CQI AS CTL TOOLS IN STUDENT ACHIEVEMENT MONITORING

More than one academic and quality assurance document were used to obtain data and to assess if Positive Results in Programme Learning Outcome (PLO) attainment emerged as a result of Continuous Quality Improvement (CQI) actions and of Closing-the-Loop (CTL) processes. The use of quantitative findings and documentary and stakeholder evidence helped to add triangulation and minimise reliance on a single source of measurement. This is in line with the requirements for systematic assessment, evaluation and continuous programme improvement (Hussain et al., 2021).

The main longitudinal data were from attainment records in PLO for three consecutive school cycles. The first cycle was the baseline performance prior to the implementation of selected CQI actions, the second was the initial post-intervention performance and the third was to measure whether or not the improvement remained. In the records there was attainment percentages and targets and student numbers for each PLO. Analysis identified

outcomes, which when repeated, met the targets, were not meeting the targets and were enhancing and improving as a result of an intervention. Results were disaggregated at programme and cohort level, wherever this was possible, as the aggregated results could mask weaknesses at programme level (Kitto et al., 2018).

Some course-level evidence was presented for the courses relating to the PLO results in Course Learning Outcome (CLO) attainment reports and in analyses of examinations. Reports contained statements of CLOs, CLO–PLO mapping, assessment instruments, achievement targets, and student results and suggested student improvement actions. Assessment for the evidence was from examination, assignments, lab exercises, projects and presentation. The analysis was done based on the percentage of students reaching each CLO, distribution of performance, difficult assessment items, and the alignment of the CLO and the teaching activities and assessment tasks. This assessment helped identify whether low PLO attainment was due to student-learning difficulties, the design of assessments themselves, the teaching standards and/or if mapping CLO to PLO was inaccurate, (Derouich, 2025) emphasizes the need for assessment practices to be aligned with learning outcomes and for regular review.

The CQI action logs captured the performance gap identified, supporting evidence, proposed intervention, responsible personnel, period of implementation and expected improvement. Assessment reports were created using the related CTL and Verification-of-Effectiveness (VoE) reports to determine if each intervention was implemented and then assessed. Supporting evidence was seen in terms of enhanced CLO or PLO outcomes, reduced numbers of underperforming students, enhanced assessment performance and moderation outcomes. Actions were categorized as effective, partially effective, ineffective or pending verification.

Minutes from programme committees and OBE moderation sessions and department meetings were evidence of governance, approval and follow-up. They recorded discussions on attainment gaps, discussions around assessment moderation, responsibility allocation and CQI action approval. Feedback from lecturers gave explanations about contextual issues: Student preparedness, Teaching, Assessment workload, Resource limits. Independent third-party input from external examiners and industrial evaluators was received on the relevance of the curriculum and assessment standards and competencies for graduates.

Last, detailed CLO analysis was provided in course evaluation reports and results in contributing courses were aggregated in PLO evaluation reports. A cohort analysis to determine if improvement was maintained across cohorts was conducted using PLO. Strong support for a CQI action was indicated by the consistency of improvements in PLO attainment with CLO results, implementation records, VoE findings, meeting decisions and stakeholder feedback (Shariff & Isa, 2025). Any evidence that conflicts with the preceding evidence was kept in the next assessment cycle for further investigation.

Table 1: Example of PLO Achievement for Courses in Particular Semester

Course Code	Course Name	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
Course Code 1	CADD	100	-	100	-	100	-	-	-	100	-	-	-
Course Code 2	Programming	10	-	32	-	98	-	-	-	-	-	98	-
Course Code 3	Workshop	85	6	-	100	100	100	-	-	-	100	-	-
Course Code 4	Statics	63	-	-	-	-	-	-	-	-	-	-	-
		64.5	6	33	25	99.3	100	0	0	100	100	98	0

Table 1 shows that there are low levels of attainment in PLO2, PLO3 and PLO4 for Bachelor Degree in Manufacturing Engineering of year 1, which means there are areas of need for the curriculum to be reviewed or pedagogical changes to be made (Shariff & Isa, 2025). To overcome these gaps, faculty needs to implement structured CQI interventions, for example, additional exercises targeted at learning outcomes or revised approaches to delivery, specifically aligned to identified learning outcomes (Chowdhury et al., 2023). These interventions should be documented formally by means of Instructor Course Assessment Reports, so that the subsequent performance trends can be monitored rigorously by the curriculum committee (Qadir et al., 2020).

Moreover, when indirect assessment methods are used, including surveys of graduating students and faculty to get other stakeholders' views on the impact of these changes, they offer a more complete set of stakeholder perspectives that can confirm that the changes are actually removing the core of the weakness (Alkhatib, 2021).

PROGRAMME : XXXX								
COURSE : XXXXXXXX								
SESSION : 1-2024/2025								
COHORT : 2020/2021								
NO.	MATRIC NO.	NAME	LO01	LO01 %	LO02	LO02 %	LO03	LO03 %
1	XXXXXXXXXX	STUDENT NAME 1	16.0	80.00%	16.7	83.50%	47.9	79.83%
2	XXXXXXXXXX	STUDENT NAME 2	4.0	20.00%	17.0	85.00%	47.9	79.83%
NUMBER AND PERCENTAGE OF STUDENTS ACHIEVE LO			1	50.00	2	100.00	2	100.00

Figure 4: Example of Students CLO (LO) Achievement Mapping for Particular Course

PROGRAMME : XXXX								
COURSES : XXXXXXXX								
SESSION : 1-2024/2025								
COHORT : 2020/2021								
NO.	MATRIC NO.	NAME	PO02	PO02 %	PO03	PO03 %	PO05	PO05 %
1	XXXXXXXXXX	STUDENT NAME 1	32.7	81.75%	23.9	79.67%	24.0	80.00%
2	XXXXXXXXXX	STUDENT NAME 2	21.0	52.50%	23.9	79.67%	24.0	80.00%
NUMBER AND PERCENTAGE OF STUDENTS ACHIEVE PO			2	100.00	2	100.00	2	100.00

Figure 5: Example of Students PLO (PO) Achievement Mapping for Particular Course

SUBJECT IMPROVEMENT REPORTS			
COURSE : XXXX			
SUBJECT : XXXXXXXXXXXX XXXXXX			
SUBJECT CODE : XXXXXXXX			
SESSION : 1-2024/2025			
LECTURER : XXXXXXXXXXXX			
SUBJECT	SESSION	SUGGESTION OF IMPROVEMENT (CURRENT SESSION)	ACTION TAKEN (NEXT SESSION)
XXXXXXXX	1-2024/2025	SAMPLE.	SAMPLE

Figure 6: Course Improvement Report (CQI Form)

Figure 4 and 5 show the granular relationship between the assessment instruments and the attainment of the outcomes, which is one of the key ways of mapping students' achievement to the performance levels in the outcomes (Marsafawy et al., 2022; Sikander et al., 2017). This data represents a Bachelor in Manufacturing Engineering programme students taken Intelligent System Course which is an elective course. These tables provide a clear roadmap for the introduction, reinforcement and demonstration of each learning outcome, which enables a more comprehensive constructive alignment between curricula and student achievement (Kushari & Septiadi, 2022). The pedagogical refinements are documented systematically as described in figure 6, connecting the identified gaps in the curriculum, aligned with the mapping process, with the evidence-based intervention strategies (Al-Masoud et al., 2020). While consistently linking the course-level assessments to program-level goals ensures that curriculum mapping continues to be a dynamic, participatory process that entails the engagement of all faculty (Mackh, 2023).

Finally, Course Achievement Analysis Reports were analysed which relate achievement at course level to achievement at programme level. The review included the CLO achievement, CLO–PLO mapping, assessment tools, examination outcomes, the recommended CQI actions, and verification of CQI actions. These reports were triangulated with statistical findings, themes from interviews, and CTL maturity scores to gain a complete picture of the effectiveness of CTL.

DISCUSSION

The results show that aggregate-level program indicators may indicate attainment of successful outcomes, but granular analysis shows course-level variations in individual courses (Khan, 2019). The differences highlight the need to carry out curriculum mapping to identify and address possible redundancy or gaps in the sequence of scaffolded graduate capabilities development (Hoare et al., 2024).

Verification of Effectiveness (VoE) Strengthened Accountability

The Verification of Effectiveness (VoE) was designed to reinforce academic accountability, by making lecturers demonstrate that the CQI actions they had undertaken brought about the desired improvement (Pulkkinen et al., 2019). The activities involved in the verification process encompassed the review of representative samples of student work, the recalculation of assessment and attainment scores, the examination of revised assessment and/or rubrics and the observation of teaching or laboratory activities. The following steps allowed us to differentiate between completed activities and truly effective interventions. When attainment targets were not met, lecturers needed to explain why attainment gaps remained and to suggest further measures to address this. This evidence-based process made it easier to be transparent, to clarify the responsibilities of the staff and to make it known that there is a connection from the weaknesses that are found, the action plan for improvement, and the student performance that is seen as a result of the improvement actions that have been taken (Rahminawati & Supriyadi, 2023).

Stakeholder Engagement and Curriculum Synergy

The relevance of CQI interventions was enhanced through involvement with industry advisory panels and external examiners, which added to the scope of the data used to inform CQI decisions beyond the attainment data. Information was provided by industry representatives, regarding current technology, professional practices, workplace skills and emerging needs. Curriculum content, assessment standards, student work and the alignment of the CLO–PLO were reviewed independently by external examiners. They made recommendations to revise the course content, practical activities, assessment rubrics, and industry-based projects. This consultation also assisted in uncovering differences between academic performance and expectations of the workplace. Incorporating stakeholder input into the achievement of the PLO provided a degree of synergy in the curriculum by keeping the teaching and assessment of the graduate competencies aligned. Improvements in projects and assessment showed increased students' readiness for work and a greater match with employers' expectations. Including stakeholders in a systematic way is crucial to improve the employability of graduates and to keep the curriculum relevant in the constantly evolving job market (Attree, 2025).

Governance and OBE Maturity

The programme-level governance was enhanced by the creation of dedicated committees on the CQI, standardisation of the Closing-the-Loop (CTL) template, and monitoring by semester. CQI committees facilitated the process of checking attainment of CLOs and PLOs, set responsibilities, agreed on actions for improvement and tracked their implementation. Documented identified attainment gaps, root causes, interventions proposed, people responsible, intervention timeframes and Verification-of-Effectiveness evidence were standardised using templates. The monitoring by semester allowed for actions to be carried forward and reviewed based on evidence from subsequent cohorts of students. These structures enhanced the traceability, minimized the "decision making by accident" and avoided relying on individual lecturers to conduct CQI activities. OBE governance needs to be more mature and have documented processes, shared responsibility, systematic evaluation and continuous use of attainment evidence for decision-making (Rais et al., 2021). As a result, the enhanced governance mechanisms enhanced institutional accountability and helped to drive incremental, consistent and sustainable progress in PLO attainment across academic cycles.

CONCLUSION

The study shows that the effectiveness of the CTL mechanisms has a significant impact on the attainment of the subsequent PLO. CTL helps ensure that CQI actions are both data-informed and impactful and meet accreditation requirements. Enhancing the CTL cycle promotes the constant improvement of curriculum design, teaching

methods, assessment methods and academic governance.

Implications for Higher Education Institutions

Higher education institutions should not see Closing-the-Loop as an ad hoc accreditation exercise, but as part of the annual academic and programme-review processes. Each CQI action needs to have a measurable goal, a person to take the responsibility for it, a timeline, and supporting evidence. Actions should be regularly reviewed and Verification of Effectiveness should be required prior to formal closure of a CQI item. This will help to differentiate implementation from demonstrated improvements. Capacity building workshop on OBE implementation, CLO–PLO mapping, rubric development, assessment design and assessment moderation should be held at institutions to keep the academic staff consistent and uniform in designing assessments and moderating them. Digital dashboards can help facilitate this by showing trends in POs, attainment gaps, and intervention status and cohort comparisons (Lamis & Pisuená, 2026). But, dashboards are not a substitute for academic assessment; rather, they are meant to be used in conjunction with it. The practices can enhance evidence-based decision-making, accountability and sustained programme improvement (Nash et al., 2020),(Samuel & Farrer, 2025).

FUTURE RESEARCH

Future studies should explore the impact digitalisation of the Closing-the-Loop (CTL) processes has on academic governance, decision making timeliness, documentation accuracy and staff accountability. Research might compare the digital CTL system with the traditional CTL system to see if automated workflows and dashboards will positively affect the timely implementation and verification of CQI actions. Comparative studies of the engineering and information technology and business programmes are also required as these may generate different approaches to CTL as a result of their learning outcomes, assessment practices, and expectations for accreditation. Due to the lack of comparative evidence reported for international OBE practice, multi-institutional longitudinal studies should be carried out to check if Programme Outcome attainment is sustained and transferable to other institutional settings. Additional research could incorporate the use of artificial intelligence and predictive analytics to pinpoint those POs who are likely to underachieve at the end of an assessment cycle. The use of explainable models and human supervision is recommended in such systems due to concerns about the accuracy of predictions, privacy of data, and algorithmic bias. With the support of AI, performance prediction has shown promise in facilitating timely academic interventions through the use of learning analytics (Khan et al., 2021; Ouyang et al., 2023).

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