Journal of Advanced Research in Applied Sciences and Engineering Technology

Journal homepage:
https://semarakilmu.com.my/journals/index.php/applied_sciences_eng_tech/index
ISSN: 2462-1943

# A Proposed Comprehensive Novel Model (CN-Model): To Drive Continuous Quality Improvement (CQI) on Engineering Programme in Institution of Higher Learning

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**ARTICLE INFO**

***Article history:***
Received 23 March 2023
Received in revised form 3 June 2023
Accepted 30 November 2023
Available online 24 January 2024

***Keywords:***
CQI; teaching and learning; student assessment; student performance; curriculum

**ABSTRACT**

The Continuous Quality Improvement (CQI) model is an evaluative tool for academic performance in teaching and learning (T&L), emphasizing student enablement and continuity. Recognizing the inherent subjectivity in T&L performance assessment, the evaluation process is complex and intricate. In pursuit of an enhanced T&L experience, a novel model was introduced and rigorously tested across four consecutive semesters within the Electrical Engineering Programme at a University. The study encompassed 90 courses spanning from year 1 to year 4, involving 1062 students. Qualitative and quantitative parameters were considered, including student failure rates and strategic plans. The results demonstrated a significant and consistent reduction in the failure rate each semester. This comprehensive model not only contributes to professional development within the T&L Malaysian Qualifications Framework (MQF) Level 6 sector but also exhibits potential applicability in diverse performance evaluation contexts.

## 1. Introduction

Continuous quality improvement (CQI) represents a set of educational growth strategies derived from industrial process enhancement methodologies. The conceptualization of CQI as "a theory of continuous improvement of the processes involved with delivering a product or service that meets or exceeds customer expectations" has been posited in existing literature [1]. However, it is essential to note that this terminology lacks a formal consensus and rigorous testing for durability, rendering it challenging for inclusion in proof syntheses [2].

Enhancing clarity and operationalization of key CQI features is imperative for intervention tracking, cataloguing, and structural review. Recognizing the evolving meanings associated with CQI, particularly within the dynamic realms of business and education, necessitates concerted efforts to establish standardized meanings conducive to its evolution [3]. Scientific precision in terminology is vital for communication and comprehension, exemplified by its historical role in expediting progress in practical and analytical fields [4].

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https://doi.org/10.37934/araset.38.1.4863

Aligned with the Engineering Accreditation Council (EAC) in Malaysia, this study aims to advance education quality assurance by clarifying the current usage of the term Continuous Quality Improvement (CQI). The overarching objective is to "develop processes, tools, and guidelines for the design, behaviour, and documentation of CQI research and assessments, including standardized typologies, descriptions, and measurements of core principles and consensus statements in the education sector." The research introduces a comprehensive CQI model, assesses its accessibility, and applies it to electronically defined quality improvement interventions, shedding light on prevalent CQI features in contemporary literature.

Continuous Quality Improvement (CQI) serves as a potent tool for evaluating the quality of education services provided by educators, revealing both strengths and areas for improvement [5]. Its potential applicability in opportunity or satisfaction investigations suggests that an optimal quality metric should encompass mechanism, configuration, and result elements relevant to the attribute under scrutiny [6]. The argument is made that CQI inherently contains a "process" component (teaching and learning mechanism), a "structure" component (continuity of teaching and learning), and an "outcome" component (enablement or result) [7-8]. This study pioneers the development of a new qualitative and quantitative metric, the CN-Model, which integrates CQI and Teaching and Learning (T&L) measures into a singular "holistic instrument" to comprehensively assess substantive aspects of T&L structure, process, and outcome.

The integration of CQI into educational practices can be realized through ongoing routines and cycles, exemplified by the Plan-Do-Study-Act (PDSA) sequence, also known as the Deming Cycle or Shewhart control chart. This iterative process involves optimizing a commodity or procedure, implementing the transformation, tracking outcomes, and potentially repeating the cycle in a different context [9-12].

In certain Teaching and Learning quality literature, Quality Assurance (QA) is construed as an umbrella term encompassing CQI rather than an alternative [13-16]. Differentiating between the two, QA emphasizes outcomes, while CQI emphasizes processes and results. Debates surrounding the systematic nature of QA versus the aggressive nature of CQI underscore nuanced perspectives on expectations and goal attainment [17-19].

While CQI has gained traction in educational institutions in Canada and the United States, it remains in its early stages within the Teaching and Learning sector. In contrast, select European countries, notably the United Kingdom, are advancing quality transformations in education [20-22]. Emerging interest in Asia signals potential developments, warranting attentive observation of future trends.

### *2.1 Hypotheses*

In response to lingering research inquiries about the augmentation of Teaching and Learning (T&L) quality within higher education institutions, a set of hypotheses was devised. These hypotheses were strategically crafted to address unresolved research questions and contribute to the advancement of T&L quality. To operationalize these hypotheses, a pioneering model, the CN-Model, was conceptualized. This model serves as an intervention mechanism, targeting T&L structure, process, and outcome specifically tailored for the MQF Level 6 sector.

i. "Does the CQI theory align with the underlying principles, values, and convictions integral to the enhancement of teaching and learning (T&L)?"
ii. "Is the application of the CQI technique and practice deemed valid within the context of teaching and learning in the higher education sector?"

iii. "In the absence of fundamental disparities between CQI and T&L enhancement, can the implementation of CQI mechanisms effectively elevate teaching and learning practices, contributing to the attainment of T&L enhancement goals?"
iv. "How might a Continuous Quality Improvement (CQI) model designed for Teaching and Learning (T&L) enhancement manifest if CQI principles were tailored to suit T&L objectives?"
v. "Are there alternative approaches to Continuous Quality Improvement (CQI) that may prove more efficacious for the improvement of teaching and learning (T&L)?"
vi. "Are there any impediments or factors rendering the implementation of Continuous Quality Improvement (CQI) infeasible within the context of teaching and learning?"
vii. "What repercussions, if any, may arise from the failure to enforce Continuous Quality Improvement (CQI) in the realm of teaching and learning?"

## 2. Model Adopted

The essential components of Continuous Quality Improvement (CQI) are categorized into four main pillars: customer-focused, scientific approach, team approach, and challenges [23-28]:

### *2.1 Customer-Focused*

The CQI literature underscores the significance of the client's status, whether external or internal to the system, encompassing individuals such as students, acquaintances, employees, or those from different departments. In the Teaching and Learning (T&L) sector, customers extend beyond service participants to encompass the broader community, funders, other organizations, and individuals within the association, including personnel, managers, and diverse stakeholders. This broad conceptualization integrates the notion of "need" into the customer concept. Achieving consistency in this context occurs when the customer's needs and expectations are effectively met.

### *2.2 Scientific Approach*

Under the umbrella of the CQI empirical method, several components are encompassed, including data interpretation, machine reasoning, benchmarking, and variance analysis. The intrinsic value of data in CQI lies in its capacity to establish a robust foundation for informed decision-making. System thinking, a key tenet, emphasizes the interconnectedness of different elements within a process, highlighting those issues are more likely rooted in the system than in individuals.

In the context of Teaching and Learning (T&L) enhancement, a process methodology aligns with the emphasis on the interdependence of various stimuli. However, a holistic transformation of T&L, if undertaken, should extend beyond organizational boundaries to encompass societal dimensions. Systematically, benchmarking in CQI entails identifying best practices from analogous environments to serve as benchmarks or success objectives.

Integral to CQI is the imperative to reduce variation in practices and outcomes. Nevertheless, the endeavour to eliminate variance in T&L enhancement procedures may prove challenging and, in certain instances, unacceptable for various reasons.

### *2.3 Team Approach*

Central to the concept of Continuous Quality Improvement (CQI) is the premise that teams excel at comprehensively analyzing systems, surpassing individual efforts. The distinctive features of the CQI team approach encompass essential elements such as robust management support, active staff engagement, and the elimination of arbitrary task constraints. By dismantling these limitations, personnel from diverse divisions and hierarchical positions within the organization can collaborate on the same team.

In the Teaching and Learning (T&L) sector, embracing this team-oriented philosophy could result in the dissolution of silos, with individuals from external entities, such as community members, being integrated into these collaborative teams. This inclusivity seeks to transcend traditional organizational boundaries, fostering a dynamic and interdisciplinary approach to T&L improvement.

### *2.3 Challenges*

Whalen [29] delves into a spectrum of challenges organizations face when endeavouring to adopt and implement Continuous Quality Improvement (CQI). These challenges encompass issues ranging from a lack of leadership preparedness and inspiration to financial constraints and uncooperative management within the organizational context. Additionally, hurdles such as environmental changes emerge as significant obstacles during the adoption of the CQI model.

The implementation of the Movement Control Order (MCO) by the Government of Malaysia has markedly transformed the landscape of Teaching and Learning (T&L). The shift to online platforms for all lectures and tutorial sessions has introduced new challenges, particularly regarding network coverage, bandwidth stability, and equipment availability, which are now pivotal factors in the effective delivery and receipt of information. The initially proposed model, designed for face-to-face T&L, necessitates adaptation to confront these additional challenges for seamless T&L [30-36].

## 3. Methodology

Figure 1 illustrates the implementation of the Outcome-Based Education (OBE) model within the Electrical Engineering Programme at the University of Technology (UTS). In Figure 2, the integration of Continuous Quality Improvement (CQI) is depicted within the loop of Programme Outcomes (PO) and Course Outcomes (CO) levels. The inception of the proposed CN-Model took place in the February semester of 2019 and has been actively implemented over four consecutive semesters, continuing until the present date.

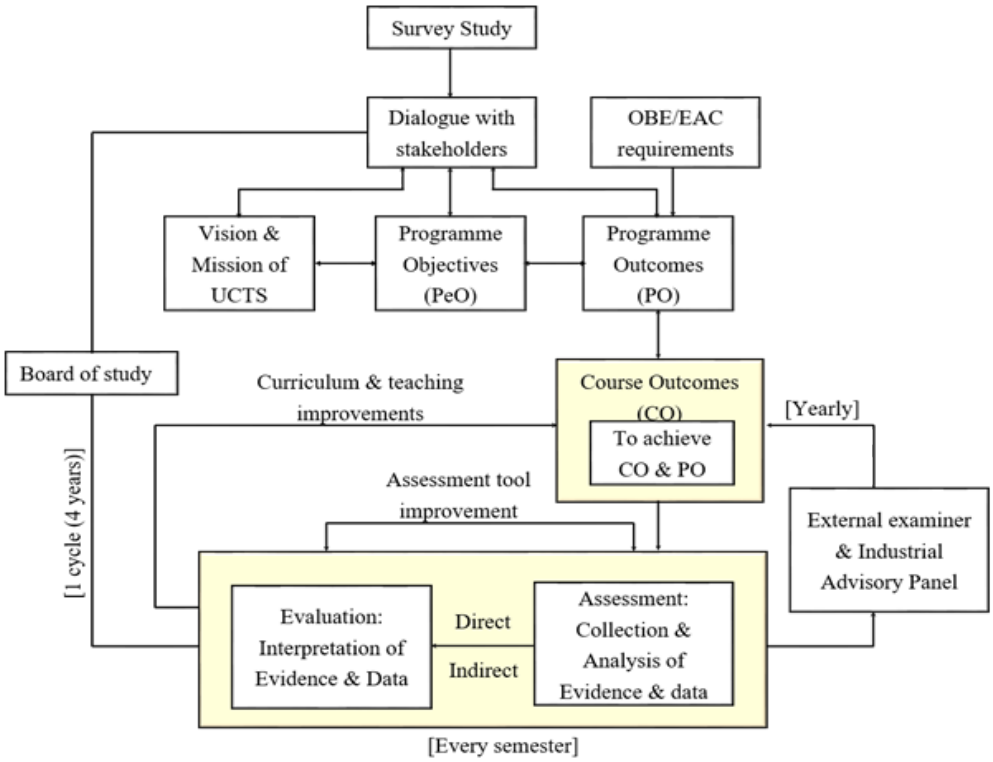


**Fig. 1.** Overview of the Outcome Based Education (OBE) implemented in T&L

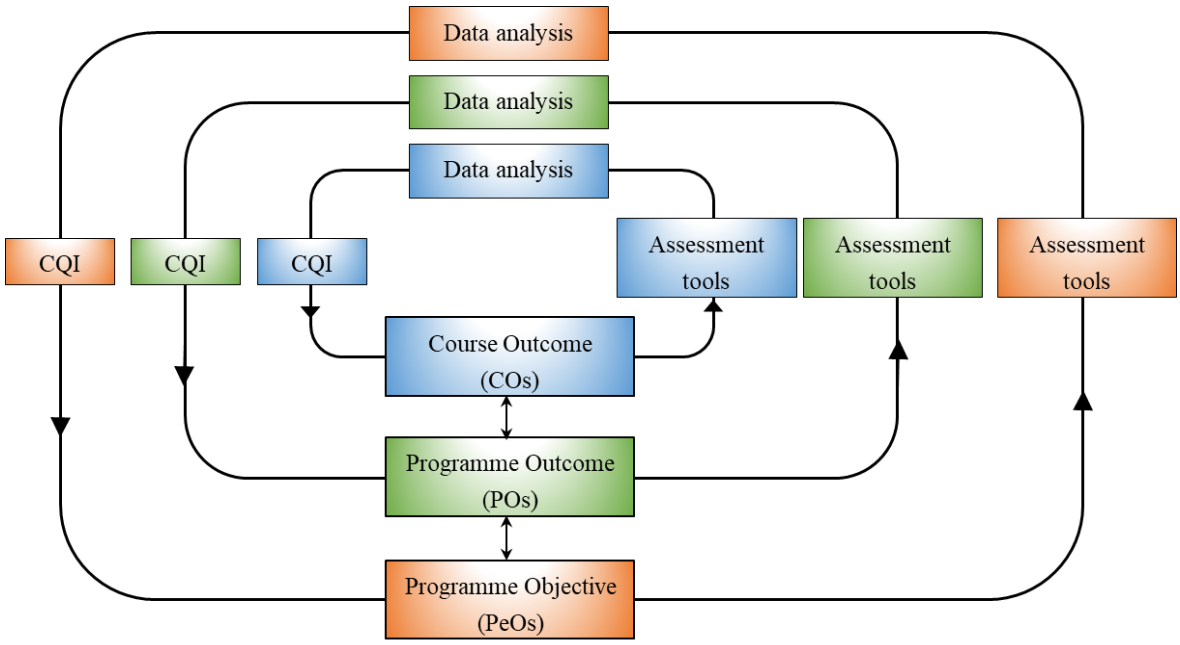


**Fig. 2.** Implementation of CQI to close the loop of the OBE model

Table 1 presents a benchmarking analysis, drawing a comparison between the widely employed general Continuous Quality Improvement (CQI) model in the industry and the proposed model. The adoption of the proposed model is grounded in six crucial aspects: initiative, customer focus, scientific approach, team collaboration, alignment with prevailing culture, and effectiveness. A comprehensive assessment was undertaken, juxtaposing the existing literature on general CQI principles with the distinctive attributes inherent in the proposed model.

**Table 1**
Overview benchmarking of proposed CN-Model with general CQI

| | | CQI in general literature [23-28] | CN-Model applied to T&L enhancement |
|---|---|---|---|
| a | Initiative | Products services | No product service |
| b | Customer-focused | | |
| | 1. People | Individual (internal and external) | Individual (internal and external)<br>Teams, communities, populations |
| | 2. Area of concentration | Satisfaction<br>Occasionally need | Satisfaction<br>Need<br>Active participation of all<br>Campus/Building capacity |
| c | Scientific Approach | | |
| | 1. Data | Strongly dependent on quantitative data | Qualitative (descriptive) and quantitative (statistical) data |
| | 2. System thinking | Internal | Internal and external |
| | 3. Variation among processes and outcomes | Critical to eliminate | Intervention throughout the process |
| d | Team Approach | | |
| | 1. Management support | Central to success | Self-management might be considered |
| | 2. Staff involvement | Empowerment oriented | Empowerment and self-regulation-oriented |
| | 3. Boundary/limit removal | Internal | Internal and external |
| e | Consistency with the prevailing culture | Mixed | Mixed |
| f | Effectiveness | Mixed results | Significant |

The proposed CN-Model was seamlessly integrated into the Outcome-Based Education (OBE) framework, incorporating data collection through various assessment tools such as Progress Tests, assignments, and the Final Exam. The collected data undergoes analysis based on several parameters, notably emphasizing the passing rate.

In Figure 3, the intervention of the CN model is depicted at the course level. Continuous Quality Improvement (CQI) actions unfold twice within a semester, specifically during Progress Test 1 (PT1) and the Final Exam (FE). After PT1 (within weeks 6-8), it becomes mandatory for all course lecturers to propose and implement CQI actions during the latter part of the semester (weeks 8-14). These actions strategically target the course's weakest topic and students exhibiting the lowest performance. The outcomes of these CQI actions are seamlessly integrated into the Final Exam assessment within the same semester. The failure rate serves as a key indicator for evaluating course performance, with the proposed model exclusively honing in on core engineering courses.

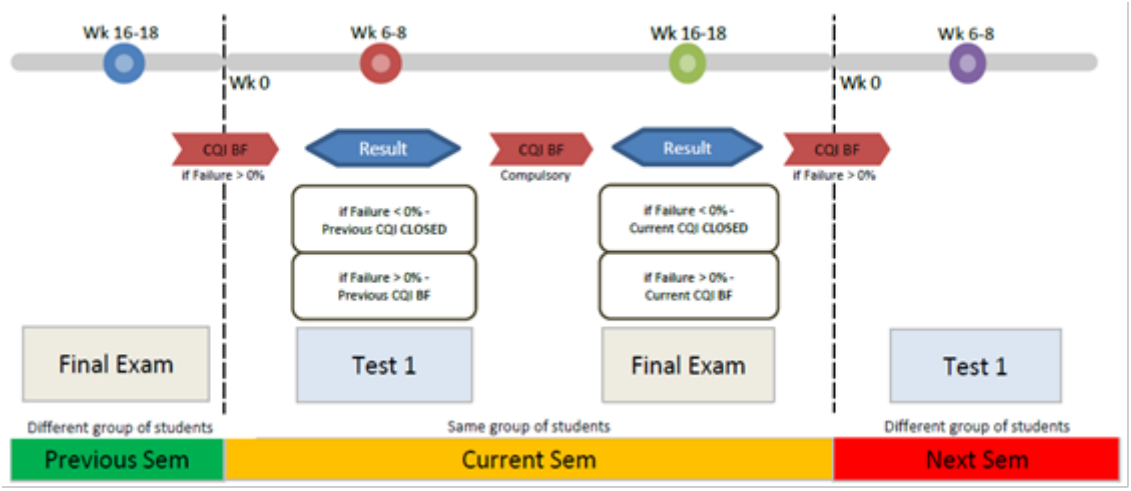


**Fig. 3.** Proposed CN-Model intervention at course level

Following the School Board of Examination (SBX) Meeting for result moderation and official release, the failure rates for all the courses offered are extracted from the OCULUS system, which houses academic data. A comparative analysis of failure rates is then conducted between Progress Test 1 (PT1) and the Final Exam (FE) within the same semester. The analysis is categorized into THREE (3) cases, as outlined in Table 2:

**Table 2**
Conditions for executing CQI actions in three (3) possible cases

| Case | PT1 | | FE | CQI Actions |
|---|---|---|---|---|
| a | - | | No failure | Closed |
| b | Failure rate | > | Failure rate | Bring Forward |
| c | Failure rate | < | Failure rate | Bring Forward |

As outlined in Table 2, if no student experiences failure in the Final Exam (FE), the Continuous Quality Improvement (CQI) for the course will be concluded for the current semester, irrespective of the Progress Test 1 (PT1) results. However, if a student does fail in the FE, regardless of whether the failure rate increased or decreased compared to PT1, CQI actions must be proposed and carried forward to the subsequent semester. The CQI committee of the Programme will diligently monitor and make a record of courses exhibiting an increasing failure rate.

The implementation of bring-forward CQI actions (from the current semester) is scheduled for Weeks 1-7 in the subsequent semester. CQI actions from the current semester are concluded if no failures occur in PT1 (next semester). Nevertheless, new and up-to-date CQI actions are mandatory, irrespective of the PT1 results in the subsequent semester.

## 3. Methodology

Table 3 presents the outcomes over four consecutive semesters following the initiation of the CN-Model in the 2019 (Feb) semester. The evaluation of the proposed model after this period reveals a significant reduction in the failure rate, the number of courses with student failures, and the overall number of student failures. Notably, the passing rate exhibited a noteworthy increase of 8% over the four semesters.

However, a minor decline in the passing rate, amounting to 2%, was observed in the February semester of 2020. This dip can be attributed to the initial enforcement of the Movement Control

Order (MCO) by the Government of Malaysia in response to the COVID-19 pandemic. The University promptly transitioned from physical (face-to-face) Teaching and Learning (T&L) to an online mode, leading to an adjustment period for both students and lecturers. Challenges, particularly in terms of ICT equipment and internet coverage, emerged during information delivery. Additionally, the mode of the Final Exam transitioned to online, accompanied by modifications in the Table of Specification (ToS) to encompass a higher percentage of complex engineering elements in the questions (refer to Figure 4).

**Table 3**
Student performance for four consecutive semesters

| Semester [a] | Number of courses with student fail (Total course offered) | Number of students/sitting fail the course (Total students/sitting) | Failure rate (%) | Passing rate (%) |
|---|---|---|---|---|
| 2019 (Feb) | 12 (18) | 33 (221) | 15 | 85 |
| 2019 (Sept) | 7 (21) | 36 (312) | 12 | 88 |
| 2020 (Feb) | 14 (24) | 37 (272) | 14 | 86 |
| 2020 (Sept) | 8 (27) | 19 (257) | 7 | 93 |

[a] CQI monitoring for FOUR (4) consecutive long semesters (14 weeks per semester) and two (2) semesters per year.

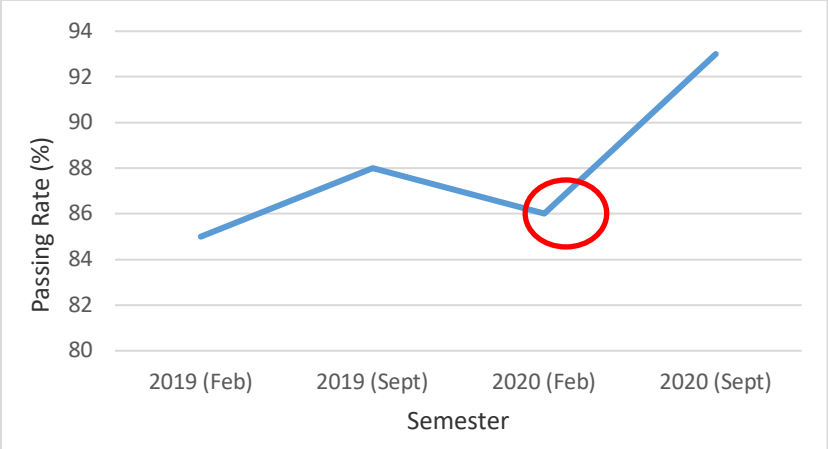


**Fig. 4.** Student passing rate

Figure 5 provides an overview of the total bring-forward and closed Continuous Quality Improvement (CQI) actions over four consecutive semesters. The average percentage of CQI closed actions stands at 56%, signifying the closure of 59 courses out of 106 offered. This indicates a positive impact of the proposed model at the course level.

Upon closer analysis, specific courses such as Signals and Systems and High Voltage Engineering exhibit high bring-forward rates. The likely reason for this trend is associated with the nature of these courses, which demand students to engage in critical thinking and envision various conditions. Concepts such as signal amplification, modulation, and demodulation, coupled with the application of differentiation, integration, algebra, and trigonometry equations, contribute to the complexity of these courses and may explain the observed dissatisfaction and higher rates of bring-forward actions.

Figure 6 and Figure 7 shows the summary of the CQI action report generated every semester to record the CQI actions from the previous, current, and next semesters. This assessment fills in the gaps for:

i. Between previous & current semesters (different batch of students),
ii. The current & current semesters (PT1 and FE) (same batch of students) and
iii. Between the current & next semesters (different batch of students).

The CQI model establishes an interconnected assessment framework that extends beyond the current semester, encompassing both the preceding and subsequent semesters (within four consecutive semesters, contingent on the course offering). This design allows the course lecturer to implement proactive measures for students who did not perform satisfactorily during Progress Test 1 (PT1). The establishment of this linkage is rooted in a combination of quantitative measurements, involving statistical analysis, and qualitative measurements, employing descriptive analysis. This holistic approach ensures a comprehensive and informed intervention strategy that considers both numerical metrics and qualitative insights for continuous improvement over multiple semesters.

## 4. Summary of Principal Findings

The CN-Model emerges as a more precise indicator of Teaching and Learning (T&L) improvement efficiency within standard education organizations. Its utility extends to assessment and revalidation processes, holding the potential for integration into the T&L system as an incentive mechanism for lecturers to consistently deliver comprehensive and high-quality T&L services to their students.

As an exceptional indicator of overall T&L effectiveness, the CN-Model aligns with Cloutier's perspective [37] that quality metrics should encompass components interrelated and derived from aspects reflecting form, method, and result. The CN-Model achieves this by incorporating the Engineering Accreditation Council (EAC) accreditation test, coinciding with all three components of the initial Continuous Quality Improvement (CQI). This augmentation significantly enhances the CN-Model as a metric for assessing instructor T&L enhancement.

Studies, such as those by Cloutier [37] and others [38-40], consistently emphasize students' rating of empathy and humanity as crucial attributes of a “good lecturer.” The expansive concept of empathy embedded in the formulation of the EAC measure encompasses the core competencies required of educators demonstrating 'student-centered' consultation skills. Despite a limited sample size, the CN-Model demonstrates its ability to discern variations between educators, considering both educators' and students' perspectives in the current research. To decisively determine if the CN-Model strikes a robust balance between reliability and practicality as a consistency metric for T&L efficacy, additional data from a broader sample is imperative.

Regarding the CN-Model's potential as a screening method for assessment and revalidation, the initial CQI tended to identify a limited number of low-scoring students demonstrating studying difficulties or a lack of desire to learn, attributed to subpar performance. Low CN-Model scores have been associated with issues related to low confidence in learning and motivation. Students with low CN-Model scores are less likely to experience problems with study–life balance, suggesting potential disengagement from studies, especially during the pandemic. However, causality should be approached cautiously, particularly for correlations with low statistical significance, necessitating further studies to validate these results.

## 5. Closing the Loop for Hypotheses

The CN-Model acts as an outstanding indicator of overall T&L effectiveness, the concluding remarks of the hypotheses are based on the results and findings of the CN-Model:

i. “Does the CQI theory align with the underlying principles, values, and convictions integral to the enhancement of teaching and learning (T&L)?”
**ANS**: “The proposed CN-Model has demonstrated its efficacy in yielding favourable outcomes for Teaching and Learning (T&L) enhancement, successfully garnering approval

from the Engineering Accreditation Commission (EAC) panels for the Outcome-Based Education (OBE) implementation in the Engineering Programme. Ongoing monitoring ensures the model's continuous relevance, with provisions for modifications as necessitated by evolving circumstances."

ii. "Is the application of the CQI technique and practice deemed valid within the context of teaching and learning in the higher education sector?"
**ANS**: "The Continuous Quality Improvement (CQI) technique and practice remain steadfast in Teaching and Learning (T&L) within the higher education sector. Continuous monitoring and ongoing data collection support in-depth analysis for sustained effectiveness."

iii. "In the absence of fundamental disparities between CQI and T&L enhancement, can the implementation of CQI mechanisms effectively elevate teaching and learning practices, contributing to the attainment of T&L enhancement goals?"
**ANS**: "The intervention of the proposed CN-Model underscores the indispensability of an effective CQI model in enhancing the T&L mechanism within higher education, affirming its role in achieving T&L enhancement targets."

iv. "How might a Continuous Quality Improvement (CQI) model designed for Teaching and Learning (T&L) enhancement manifest if CQI principles were tailored to suit T&L objectives?"
**ANS**: "The demonstrated success of the proposed CN-Model illustrates the potential contours of a Teaching and Learning (T&L) enhancement CQI model. Interventions throughout the semester, coupled with inter-semester connections—comprising the previous-current semester, current-current semester, and current-next semester—serve as crucial indicators for closing the loop or initiating necessary actions."

v. "Are there alternative approaches to Continuous Quality Improvement (CQI) that may prove more efficacious for the improvement of teaching and learning (T&L)?"
**ANS**: "While the proposed CN-Model has exhibited superior performance compared to the general CQI model discussed in the literature for Teaching and Learning (T&L) improvement, ongoing data extraction aims to further refine and enhance its effectiveness in the future."

vi. "Are there any impediments or factors rendering the implementation of Continuous Quality Improvement (CQI) infeasible within the context of teaching and learning?"
**ANS**: "The versatility of the proposed CN-Model enables implementation across various conditions and situations, including the challenging circumstances posed by the pandemic. The significant results achieved, particularly when compared with the initial semester of CN-Model implementation, highlight its adaptability and success."

vii. "What repercussions, if any, may arise from the failure to enforce Continuous Quality Improvement (CQI) in the realm of teaching and learning?"
**ANS**: "To date, there have been no adverse impacts or consequences of enforcing Continuous Quality Improvement (CQI). The simplicity, directness, and cost-effectiveness of the proposed CN-Model, even during the pandemic, have contributed to its successful implementation and lack of additional technological requirements."

There is some information that the authors would like to highlight here:

There is no preference for selecting the CQI action on students. The course lecturers are free to opt for the best action for the students. However, there are 19 possible activities that a lecturer may select from to suit their students. The courses involved in this survey are covered with the nature of

the core engineering courses that have progress tests and final examinations. Excluded courses such as Final Year Project, Integrated Design Project, Laboratory, Mata Pelajaran Umum (MPU), and University Compulsory Subjects. According to the PDSA sequence, the plan, do, and study steps were implemented successfully. The action step will be executed by repeating the loop for the coming and following semesters to obtain more feedback and data.

In a nutshell, the proposed CN-Model has shown its role in regulating the performance of the students. The educators are pleased to continue executing the current model to further analyze the student performance and curriculum structure. In the future, more parameters will be covered for analysis to create a better platform for CQI in education

## 6. Implication for Future Research

Further research involving students from diverse groups is essential for both current and future assessments of Teaching and Learning (T&L) efficiency, encompassing the instruments presently employed for conducting accepted "student results." Despite existing disparities, the study successfully demonstrates a clear correlation between students' and courses' Continuous Quality Improvement (CQI) rankings.

It is acknowledged that readers might harbour scepticism about the analysis of CQI approaches in the current literature, given the lack of consensus on the definition of the term "CQI." Reviews may yield inconclusive findings unless the features of CQI are explicitly identified. Therefore, ongoing investigations into CQI features within the literature are imperative to gain more valuable and accurate insights into this pivotal quality assurance strategy. Simultaneously, the more CQI practitioners elucidate the key components of their CQI approaches, the more interpretable and informative their work becomes. Clear articulation of these components enhances the credibility and applicability of CQI studies in the broader educational context.

## Acknowledgement

The authors extend their sincere gratitude and acknowledge the University of Technology Sarawak and the School of Engineering and Technology for their invaluable support and funding that facilitated the completion of this study.

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| | | | S2Y1819 | | S1Y1920 | | S2Y1920 | | S1Y2021 | | S2Y2021 | | | Total | | Percentage | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No | Code | Course | Closed | Bring Forward | Closed | Bring Forward | Closed | Bring Forward | Closed | Bring Forward | Closed | Bring Forward | | Closed | Bring Forward | Closed | Bring Forward |
| 1 | | | | 1 | | 1 | | 1 | 1 | | | | | 2 | 3 | 40% | 60% |
| 2 | | | | 1 | | 1 | | 1 | 1 | | | | | 2 | 3 | 40% | 60% |
| 4 | | | | 1 | | 1 | | 1 | 1 | | | | | 1 | 3 | 25% | 75% |
| 6 | | | | | | | 1 | | | 1 | | | | 1 | 1 | 50% | 50% |
| 8 | | | | 1 | 1 | | | 1 | 1 | | | | | 2 | 2 | 50% | 50% |
| 9 | | | 1 | | 1 | | | 1 | 1 | | | | | 4 | 1 | 80% | 20% |
| 11 | | | | | | | | | | 1 | | | | 0 | 1 | 0% | 100% |
| 15 | | | | | | 1 | | 1 | | 1 | | | | 0 | 3 | 0% | 100% |
| 16 | | | | | 1 | | 1 | | 1 | | | | | 3 | 1 | 75% | 25% |
| 17 | | | | | | 1 | | 1 | 1 | | | | | 1 | 3 | 25% | 75% |
| 21 | | | | 1 | 1 | | 1 | | 1 | | | | | 4 | 1 | 80% | 20% |
| 22 | | | | 1 | 1 | | | 1 | 1 | | | | | 3 | 2 | 60% | 40% |
| 23 | | | | 1 | | | | | 1 | | | | | 1 | 1 | 50% | 50% |
| 24 | | | | 1 | 1 | | | 1 | 1 | | | | | 2 | 3 | 40% | 60% |
| 28 | | | | 1 | | | | 1 | | 1 | | | | 1 | 3 | 25% | 75% |
| 29 | | | | 1 | 1 | | 1 | | | 1 | | | | 3 | 2 | 60% | 40% |
| 30 | | | | | 1 | | 1 | | 1 | | | | | 3 | 1 | 75% | 25% |
| 33 | | | 1 | | 1 | | 1 | | 1 | | | | | 5 | 0 | 100% | 0% |
| 34 | | | | 1 | | | | 1 | | 1 | | | | 0 | 3 | 0% | 100% |
| 36 | | | | | | 1 | | | 1 | | | | | 2 | 1 | 67% | 33% |
| 37 | | | | 1 | 1 | | | 1 | | 1 | | | | 1 | 3 | 25% | 75% |
| 39 | | | | | 1 | | | | 1 | | | | | 2 | 1 | 67% | 33% |
| 42 | | | 1 | | | | 1 | | | | | | | 2 | 0 | 100% | 0% |
| 43 | | | | | | | 1 | | 1 | | | | | 2 | 0 | 100% | 0% |
| 44 | | | 1 | | 1 | | 1 | | | 1 | | | | 4 | 1 | 80% | 20% |
| 46 | | | 1 | | 1 | | 1 | | 1 | | | | | 4 | 0 | 100% | 0% |
| 48 | | | 1 | | 1 | | | 1 | 1 | | | | | 3 | 1 | 75% | 25% |
| 49 | | | | | | 1 | | 1 | 1 | | | | | 1 | 3 | 25% | 75% |
| **Total** | | **0** | 6 | 12 | 14 | 7 | 10 | 14 | 19 | 8 | 0 | 0 | | 59 | 47 | 56% | 44% |
| Bring Forward rate | | FE | | 67% | | 33% | | 58% | | 30% | | #DIV/0! | | | | | |
| Failure rate | | Test 1 \| FE | 19% | 15% | 8% | 12% | 4% | 14% | 8% | 7% | | | | | | | |

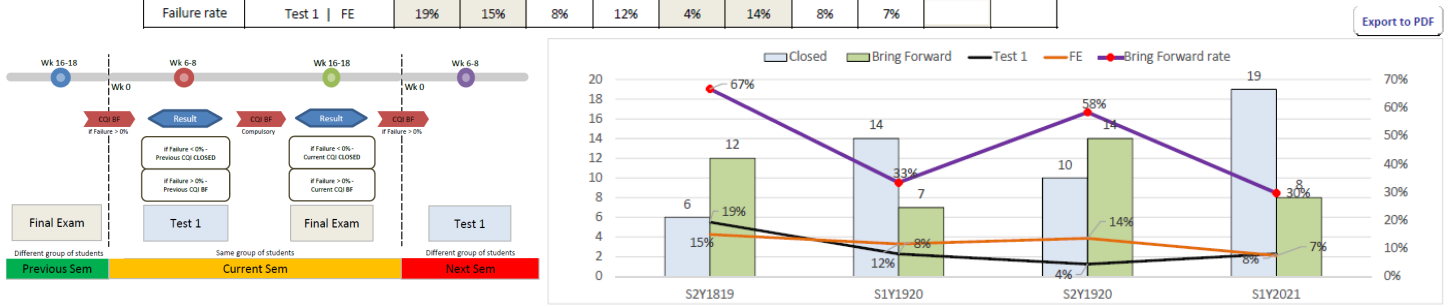
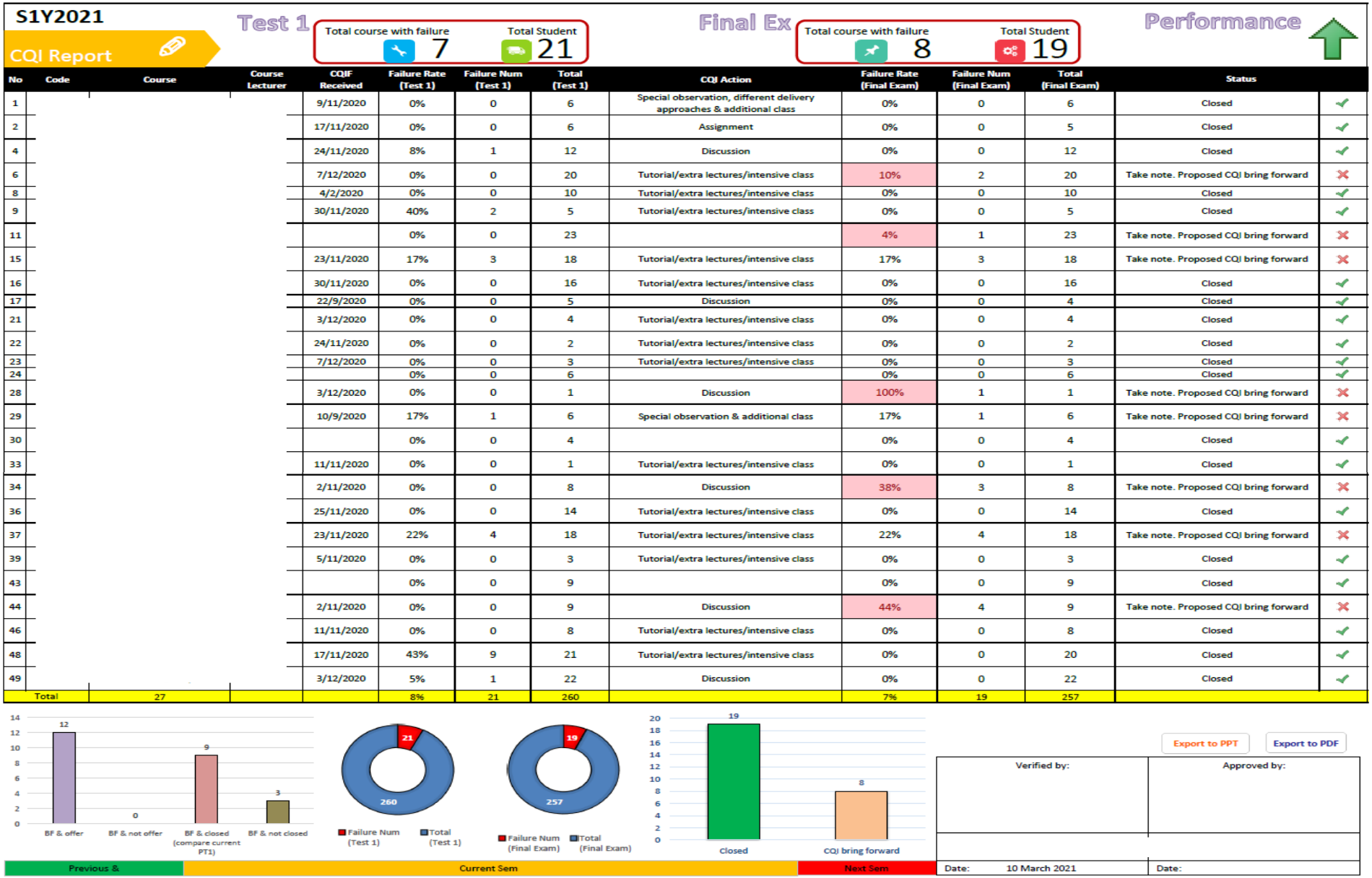



**Fig. 5.** An overview of the bring forward and closed CQI actions for four consecutive semesters



S1Y2021

CQI Report

Test 1 — Total course with failure: 7 — Total Student: 21

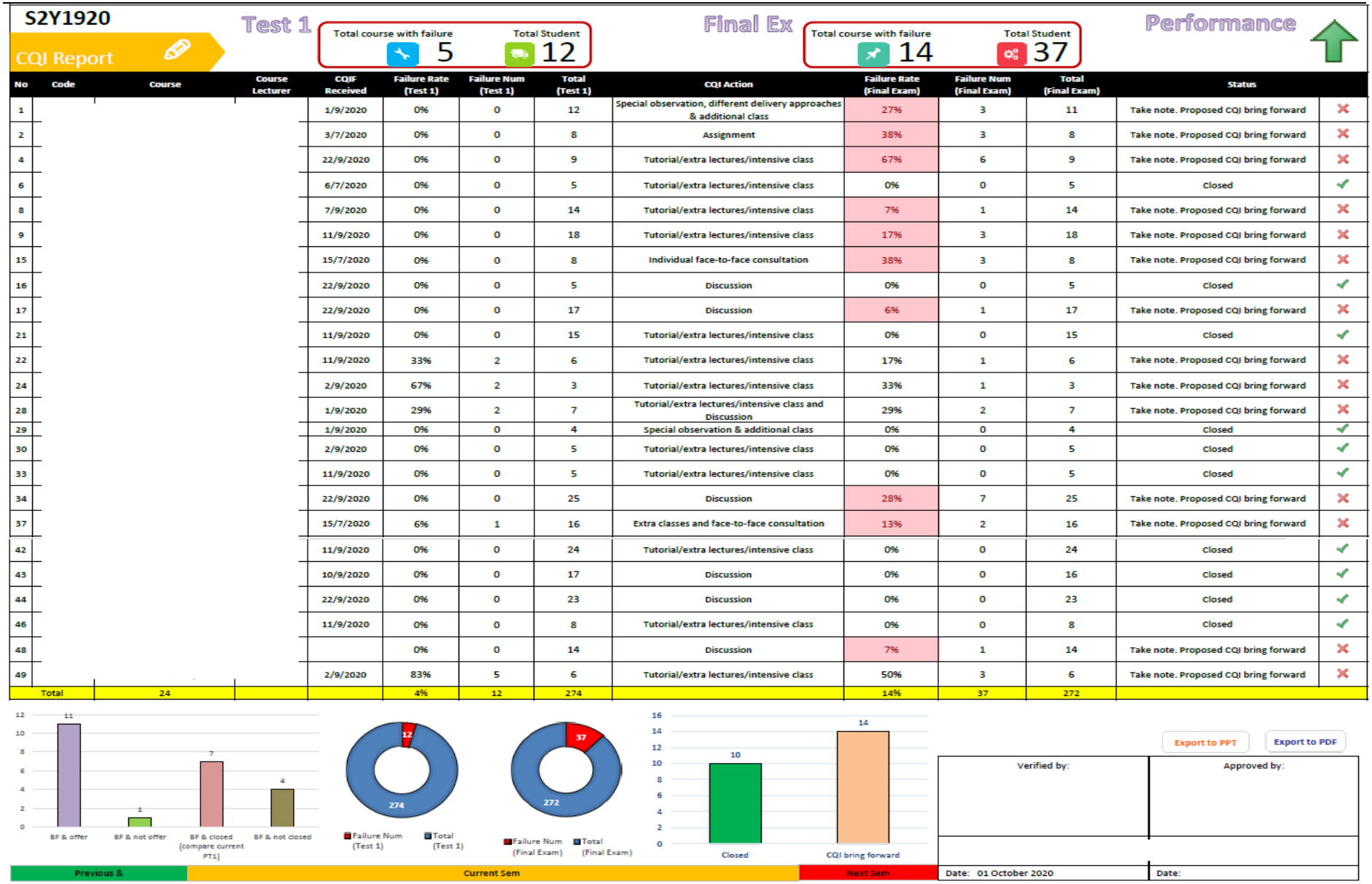
Final Ex — Total course with failure: 8 — Total Student: 19

Performance

| No | Code | Course | Course Lecturer | CQIF Received | Failure Rate (Test 1) | Failure Num (Test 1) | Total (Test 1) | CQI Action | Failure Rate (Final Exam) | Failure Num (Final Exam) | Total (Final Exam) | Status | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | 9/11/2020 | 0% | 0 | 6 | Special observation, different delivery approaches & additional class | 0% | 0 | 6 | Closed | ✓ |
| 2 | | | | 17/11/2020 | 0% | 0 | 6 | Assignment | 0% | 0 | 5 | Closed | ✓ |
| 4 | | | | 24/11/2020 | 8% | 1 | 12 | Discussion | 0% | 0 | 12 | Closed | ✓ |
| 6 | | | | 7/12/2020 | 0% | 0 | 20 | Tutorial/extra lectures/intensive class | 10% | 2 | 20 | Take note. Proposed CQI bring forward | ✗ |
| 8 | | | | 4/2/2020 | 0% | 0 | 10 | Tutorial/extra lectures/intensive class | 0% | 0 | 10 | Closed | ✓ |
| 9 | | | | 30/11/2020 | 40% | 2 | 5 | Tutorial/extra lectures/intensive class | 0% | 0 | 5 | Closed | ✓ |
| 11 | | | | | 0% | 0 | 23 | | 4% | 1 | 23 | Take note. Proposed CQI bring forward | ✗ |
| 15 | | | | 23/11/2020 | 17% | 3 | 18 | Tutorial/extra lectures/intensive class | 17% | 3 | 18 | Take note. Proposed CQI bring forward | ✗ |
| 16 | | | | 30/11/2020 | 0% | 0 | 16 | Tutorial/extra lectures/intensive class | 0% | 0 | 16 | Closed | ✓ |
| 17 | | | | 22/9/2020 | 0% | 0 | 5 | Discussion | 0% | 0 | 4 | Closed | ✓ |
| 21 | | | | 3/12/2020 | 0% | 0 | 4 | Tutorial/extra lectures/intensive class | 0% | 0 | 4 | Closed | ✓ |
| 22 | | | | 24/11/2020 | 0% | 0 | 2 | Tutorial/extra lectures/intensive class | 0% | 0 | 2 | Closed | ✓ |
| 23 | | | | 7/12/2020 | 0% | 0 | 3 | Tutorial/extra lectures/intensive class | 0% | 0 | 3 | Closed | ✓ |
| 24 | | | | | 0% | 0 | 6 | | 0% | 0 | 6 | Closed | ✓ |
| 28 | | | | 3/12/2020 | 0% | 0 | 1 | Discussion | 100% | 1 | 1 | Take note. Proposed CQI bring forward | ✗ |
| 29 | | | | 10/9/2020 | 17% | 1 | 6 | Special observation & additional class | 17% | 1 | 6 | Take note. Proposed CQI bring forward | ✗ |
| 30 | | | | | 0% | 0 | 4 | | 0% | 0 | 4 | Closed | ✓ |
| 33 | | | | 11/11/2020 | 0% | 0 | 1 | Tutorial/extra lectures/intensive class | 0% | 0 | 1 | Closed | ✓ |
| 34 | | | | 2/11/2020 | 0% | 0 | 8 | Discussion | 38% | 3 | 8 | Take note. Proposed CQI bring forward | ✗ |
| 36 | | | | 25/11/2020 | 0% | 0 | 14 | Tutorial/extra lectures/intensive class | 0% | 0 | 14 | Closed | ✓ |
| 37 | | | | 23/11/2020 | 22% | 4 | 18 | Tutorial/extra lectures/intensive class | 22% | 4 | 18 | Take note. Proposed CQI bring forward | ✗ |
| 39 | | | | 5/11/2020 | 0% | 0 | 3 | Tutorial/extra lectures/intensive class | 0% | 0 | 3 | Closed | ✓ |
| 43 | | | | | 0% | 0 | 9 | | 0% | 0 | 9 | Closed | ✓ |
| 44 | | | | 2/11/2020 | 0% | 0 | 9 | Discussion | 44% | 4 | 9 | Take note. Proposed CQI bring forward | ✗ |
| 46 | | | | 11/11/2020 | 0% | 0 | 8 | Tutorial/extra lectures/intensive class | 0% | 0 | 8 | Closed | ✓ |
| 48 | | | | 17/11/2020 | 43% | 9 | 21 | Tutorial/extra lectures/intensive class | 0% | 0 | 20 | Closed | ✓ |
| 49 | | | | 3/12/2020 | 5% | 1 | 22 | Discussion | 0% | 0 | 22 | Closed | ✓ |
| Total | | 27 | | | 8% | 21 | 260 | | 7% | 19 | 257 | | |



**Fig. 6.** The CN-Model statistical and descriptive results for the September semester year 2020



**S2Y1920**

CQI Report

**Test 1** — Total course with failure: 5 — Total Student: 12

**Final Ex** — Total course with failure: 14 — Total Student: 37

**Performance**

| No | Code | Course | Course Lecturer | CQIF Received | Failure Rate (Test 1) | Failure Num (Test 1) | Total (Test 1) | CQI Action | Failure Rate (Final Exam) | Failure Num (Final Exam) | Total (Final Exam) | Status | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | 1/9/2020 | 0% | 0 | 12 | Special observation, different delivery approaches & additional class | 27% | 3 | 11 | Take note. Proposed CQI bring forward | ✗ |
| 2 | | | | 3/7/2020 | 0% | 0 | 8 | Assignment | 38% | 3 | 8 | Take note. Proposed CQI bring forward | ✗ |
| 4 | | | | 22/9/2020 | 0% | 0 | 9 | Tutorial/extra lectures/intensive class | 67% | 6 | 9 | Take note. Proposed CQI bring forward | ✗ |
| 6 | | | | 6/7/2020 | 0% | 0 | 5 | Tutorial/extra lectures/intensive class | 0% | 0 | 5 | Closed | ✓ |
| 8 | | | | 7/9/2020 | 0% | 0 | 14 | Tutorial/extra lectures/intensive class | 7% | 1 | 14 | Take note. Proposed CQI bring forward | ✗ |
| 9 | | | | 11/9/2020 | 0% | 0 | 18 | Tutorial/extra lectures/intensive class | 17% | 3 | 18 | Take note. Proposed CQI bring forward | ✗ |
| 15 | | | | 15/7/2020 | 0% | 0 | 8 | Individual face-to-face consultation | 38% | 3 | 8 | Take note. Proposed CQI bring forward | ✗ |
| 16 | | | | 22/9/2020 | 0% | 0 | 5 | Discussion | 0% | 0 | 5 | Closed | ✓ |
| 17 | | | | 22/9/2020 | 0% | 0 | 17 | Discussion | 6% | 1 | 17 | Take note. Proposed CQI bring forward | ✗ |
| 21 | | | | 11/9/2020 | 0% | 0 | 15 | Tutorial/extra lectures/intensive class | 0% | 0 | 15 | Closed | ✓ |
| 22 | | | | 11/9/2020 | 33% | 2 | 6 | Tutorial/extra lectures/intensive class | 17% | 1 | 6 | Take note. Proposed CQI bring forward | ✗ |
| 24 | | | | 2/9/2020 | 67% | 2 | 3 | Tutorial/extra lectures/intensive class | 33% | 1 | 3 | Take note. Proposed CQI bring forward | ✗ |
| 28 | | | | 1/9/2020 | 29% | 2 | 7 | Tutorial/extra lectures/intensive class and Discussion | 29% | 2 | 7 | Take note. Proposed CQI bring forward | ✗ |
| 29 | | | | 1/9/2020 | 0% | 0 | 4 | Special observation & additional class | 0% | 0 | 4 | Closed | ✓ |
| 30 | | | | 2/9/2020 | 0% | 0 | 5 | Tutorial/extra lectures/intensive class | 0% | 0 | 5 | Closed | ✓ |
| 33 | | | | 11/9/2020 | 0% | 0 | 5 | Tutorial/extra lectures/intensive class | 0% | 0 | 5 | Closed | ✓ |
| 34 | | | | 22/9/2020 | 0% | 0 | 25 | Discussion | 28% | 7 | 25 | Take note. Proposed CQI bring forward | ✗ |
| 37 | | | | 15/7/2020 | 6% | 1 | 16 | Extra classes and face-to-face consultation | 13% | 2 | 16 | Take note. Proposed CQI bring forward | ✗ |
| 42 | | | | 11/9/2020 | 0% | 0 | 24 | Tutorial/extra lectures/intensive class | 0% | 0 | 24 | Closed | ✓ |
| 43 | | | | 10/9/2020 | 0% | 0 | 17 | Discussion | 0% | 0 | 16 | Closed | ✓ |
| 44 | | | | 22/9/2020 | 0% | 0 | 23 | Discussion | 0% | 0 | 23 | Closed | ✓ |
| 46 | | | | 11/9/2020 | 0% | 0 | 8 | Tutorial/extra lectures/intensive class | 0% | 0 | 8 | Closed | ✓ |
| 48 | | | | | 0% | 0 | 14 | Discussion | 7% | 1 | 14 | Take note. Proposed CQI bring forward | ✗ |
| 49 | | | | 2/9/2020 | 83% | 5 | 6 | Tutorial/extra lectures/intensive class | 50% | 3 | 6 | Take note. Proposed CQI bring forward | ✗ |
| | Total | 24 | | | 4% | 12 | 274 | | 14% | 37 | 272 | | |



**Fig. 7.** The CN-Model statistical and descriptive results for the February semester year 2020