Analysis of Graduate Attributes and Continual Improvement Criteria Findings from 2016 to 2024

July 7, 2025

Questions concerning the content of this report should be directed to:
Roselyne Lampron
Accreditation Program Advisor
Engineers Canada
roselyne.lampron@engineerscanada.ca
613.232.2474 Ext. 222

Table of Contents

Introduction

This document contains the summaries derived from findings related to each criterion of the Graduate Attributes (GA) and Continual Improvement (CI) process, based on decision letters from 2016 to 2024.

Working group

At their June 2022 meeting, CEAB members discussed their interest in studying trends in compliance with GA and CI data to identify opportunities to offer additional training and support to accredited programs. Since 2024, this initiative has been included in the Policies and Procedures (P&P) Committee's workplan. To conduct this study, a working group comprising Pemberton Cyrus (lead), Ray Gosine, and Julius Pataky was created. Roselyne Lampron provided accreditation secretariat support for much of the analysis.

The working group (WG) agreed on the following methodology and scope of work:

- Review the June decision summary reports (quantitative data) and the feedback provided in the decision letters (qualitative data).
- Gather the Concerns (C), Weaknesses (W), and Deficiencies (D) findings for 2016-2023, excluding the June 2021 COVID year. In particular, 2021 was excluded because decisions were only made for new programs, where a full GA/CI assessment was not done, all visits were virtual, and assessments were significantly affected by pandemic restrictions.
- Identify trends in compliance to determine the scope of the qualitative data analysis.
- Compare the quantitative findings to the qualitative information communicated to the Higher Education Institutions (HEIs) in the decision letters.
- Identify where the HEIs are falling short of satisfying specific criteria and confirm if these are largely related to the GA/CI criteria.
- Demonstrate the experience of moving to outcome-based GA as an indicator of the challenge of transitioning to an accreditation system relying only on outcome-based assessments.
- Develop tools and measures that the CEAB can use to:
    - Demonstrate the effectiveness of adopting GA/CI criteria to the Engineers Canada Board and the regulators.
    - Inform the larger community, specifically the Engineering Deans Canada (EDC) and the Canadian Federation of Engineering Students (CFES), about the identified trends.
    - Communicate evidentiary feedback on the status of satisfying the GA/CI requirement.
    - Develop recommendations to assist HEIs in satisfying these criteria (e.g.: potential changes to criteria, improved communication to HEIs, other assistance to HEIs, etc.).

History

GAs were first introduced in 2008 and were to be fully implemented by 2014, following a transition period. During this period, programs were expected to provide evidence to demonstrate compliance with the criteria and received constructive feedback from the CEAB; however, no summative findings were made. Beginning in June 2015, accreditation decisions were made based on Graduate Attributes and Continuous Improvement criteria.

Purpose

The present analysis of GA/CI findings from 2016 to 2024 has the following objectives:

- Show the overall level of GA/CI compliance of engineering programs.
- Highlight the readiness of engineering programs for outcome assessment.

Quantitative summary of overall results

Preliminary analysis and the data source

The initial analysis that guided the WG toward a qualitative analysis was based on 2016-2023 data (see Figure 1). At the time, 2024 decision data was not yet available. As illustrated in the graph below, it was identified that from 2016 to 2023, criteria 3.1 (Graduate Attributes) and 3.2 (Continual Improvement) accounted for 47% to 72% of issues each year compared to all other criteria, especially in the "Deficiencies" category of findings. This was sufficient evidence to show that a GA/CI analysis was necessary.

The subsequent analysis was conducted using the complete dataset from 2016 to 2024, excluding the results for 2021. In 2021, due to the pandemic, only a small number of new programs were considered, and they were not subjected to a full GA/CI assessment. This data reflects all criteria findings for all programs visited at all HEIs as recorded in the decision letters.

The sample data for this study was as follows:

- 430 program assessments
- 8 GA/CI criteria
- 8 years of decision letters

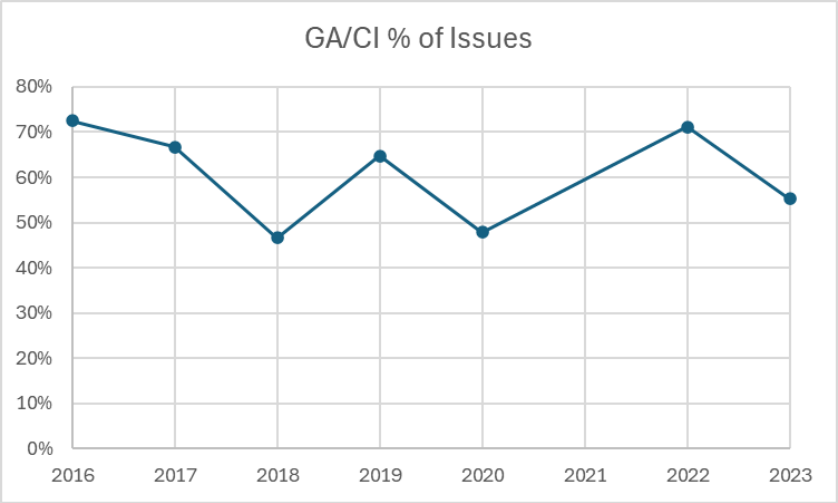


Figure 1: Percentages of GA/CI findings from 2016 to 2023 (excluding 2021) compared to all other accreditation criteria

Program level analysis

The graph in Figure 2 illustrates the findings detailed in the decision letters, highlighting the relative proportions of compliance versus non-compliance with Graduate Attributes and Continual Improvement (GA/CI) criteria.

It is important to note that some observations were aggregated at the visiting team level to avoid penalizing an HEI multiple times for issues common to more than one criterion. As a result, the graphs may underrepresent the actual situation.

When reading the graphs, consider the following definitions:

- **Concern**: Criterion satisfied; potential exists for non-satisfaction in near future.
- **Weakness**: Criterion satisfied; insufficient strength of compliance to assure quality of program will be maintained.
- **Deficiency**: Criterion not satisfied.

Summary findings for programs

Some example conclusions from this program-level analysis are:

- Approximately two thirds of programs have no compliance issues with the GA/CI criteria.
- **3.1.2 Curriculum Maps** has the highest level of compliance.
- **3.2.2 Stakeholder Engagement** appears to be a point of difficulty for the programs.
- **3.2.3 Improvement Actions**, while handled well by most programs, has the highest number of deficiencies.

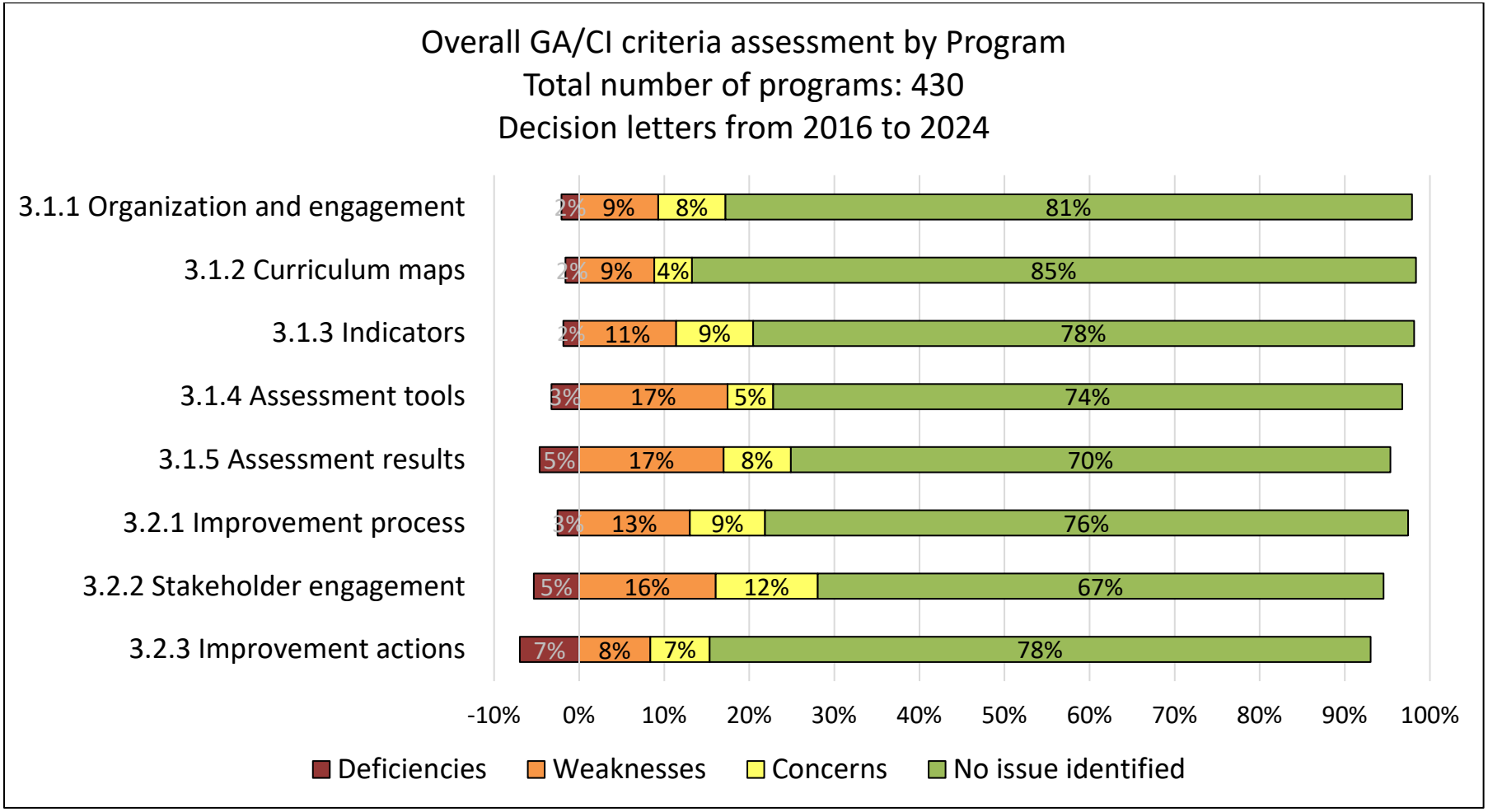


Figure 2: Overall GA/CI Assessment by Program 2016-2024

HEI level analysis

The graph in Figure 3 illustrates the overall GA/CI compliance at the HEI level. A HEI analysis was conducted because many institutions manage GA/CI systems at the institution level. Thus, compliance issues often show up across programs.

When reading the graph, it is important to note that an HEI may have multiple programs and that programs can fall into any of the three compliance levels (C/W/D) for each criterion. Therefore, the same HEI can be represented in each of the 3 compliance levels for the same criterion. For each GA/CI criterion, the percentages represent the number of HEIs per compliance level (C/W/D) divided by the total number of HEIs (44). The results shown in Figure 3 can be interpreted as follows:

For example, for criterion **3.1.1 Organization and engagement**, for all institutions visited during the study period (2016 to 2024):

- 43% of the HEIs had **no** program with identified issues for the criterion.
- 34% of the HEIs had **at least one program** with a "concern" finding. That is, the criterion is satisfied; potential exists for non-satisfaction in near future.
- 32% of the HEIs had **at least one program** with a "weakness" finding. That is, the criterion is satisfied; insufficient strength of compliance to assure quality of program will be maintained.
- 7% of the HEIs had **at least one program** with a "deficiency" finding. That is, the criterion is not satisfied.

Summary findings for HEIs

Some example conclusions from this HEI-level analysis are:

- When looked at from the HEI perspective, we can see that overall, less than 50% of institutions were completely free from GA/CI issues.
- 3.1.1 Organization and engagement, 3.1.2 Curriculum maps and 3.1.3 Indicators had the highest levels of compliance, with 43% of institutions having no issues.
- 3.2.3 Improvement actions had the greatest proportion of non-compliance at 30%.

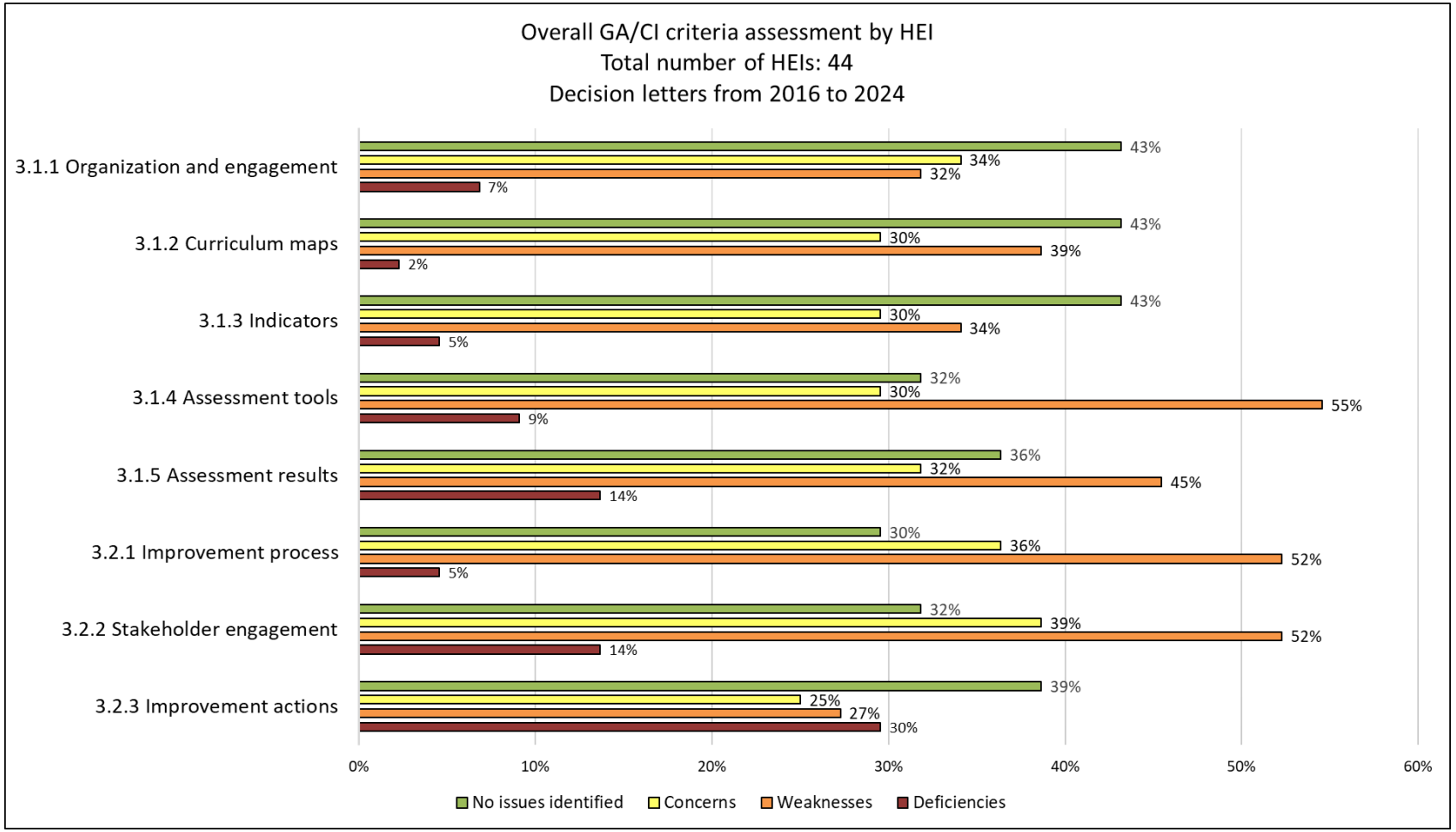


Figure 3: Overall compliance by HEI 2016-2024

Summary findings by criterion

In order to determine the source of non-compliance, a qualitative analysis of the text of decision letters from 2016 to 2024 was performed. The process followed was:

1. Initial summaries of the findings were generated by Microsoft 365 Copilot. These Copilot summaries may have limitations. Specifically:
   - Some summaries may combine multiple program evaluations.
   - In some cases, a summary line may reflect only one program evaluation rather than representing the broader dataset.

As a result, these summaries are not representative of the frequency of findings.

2. The Engineers Canada staff conducted a spot-check validity test of the initial summaries and refined the content as needed.
3. The WG reviewed summaries to combine similar findings and create neutral language that would not identify specific programs or suggest issues that are more or less widespread than the data supports.

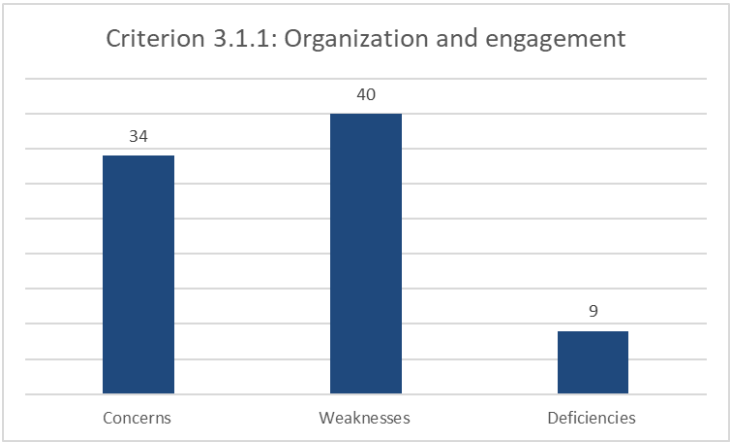
In the following sections, in addition to the qualitative summaries, two quantitative summary graphs are given for each criterion:

1. A summary of total concerns, weaknesses and deficiencies for the criterion in the period 2016-2024.
2. A time series showing how concerns, weaknesses, deficiencies and “no issues” changed over the study period 2016-2024. This is based on data by program and excludes the pandemic year 2021. For these graphs, a simple linear fit is shown for “no issues” and for deficiencies – this illustrates whether there has been an overall improvement in compliance over the years.

Criterion 3.1.1: Organization and engagement

There must be demonstration that an organization structure is in place to assure the sustainable development and measurement of graduate attributes. There must be demonstrated engagement in the processes by faculty members and engineering leadership.

Quantitative findings



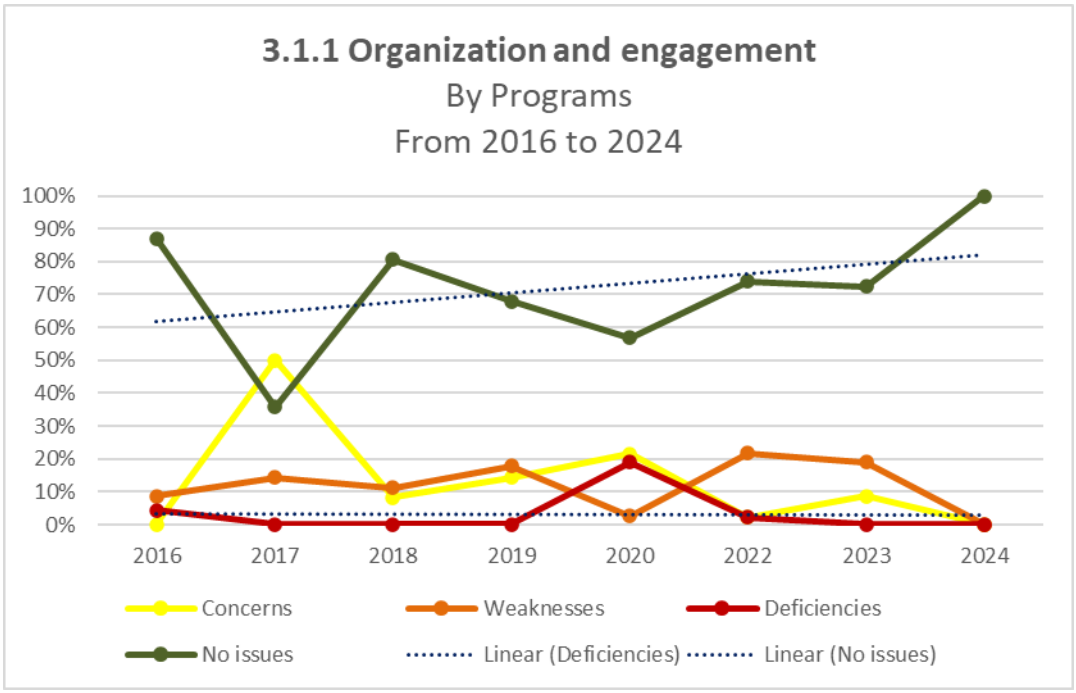


Figure 4: Performance on 3.1.1 Organization and Engagement 2016-2024

Organization and engagement is improving over time, with full compliance increasing and deficiencies dropping. Non-compliance remains very low.

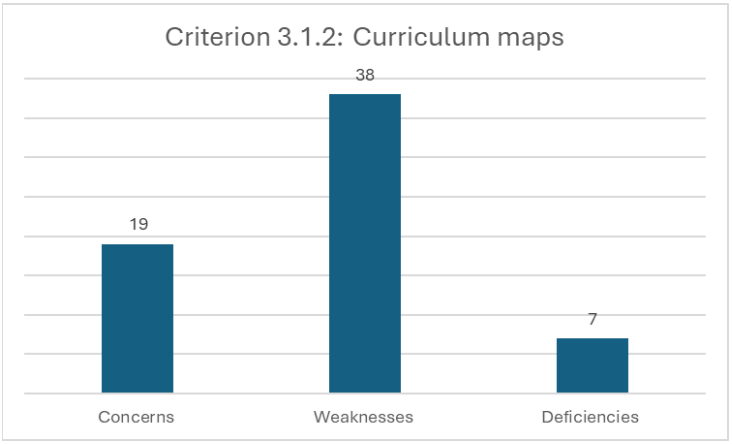
Qualitative summary

- **Leadership and faculty engagement:** Even if Faculty leadership can be committed and engaged in the GA process, this commitment does not always extend to individual faculty members. Not all faculty members are fully aware of the GA/CI processes, some struggle to identify which GAs are to be taught in their courses and how GA indicators or assessments are associated with their courses. This is especially true as it relates to the coordination of common curriculum GA data collection.
- **Implementation including data collection and analysis**: Inconsistencies have been observed in how GAs are integrated and assessed across different courses and programs, leading to gaps in the curriculum maps. While the process of collecting and analyzing GA data is often managed by a few individuals, which is likely not sustainable and does not facilitate broad faculty engagement. Furthermore, the lack of integration of other department processes, such as bridging programs and transfer credits, can lead to gaps in GA information and reduce the ability to draw meaningful conclusions.
- **Documentation and evidence:** Insufficient documentation and evidence of engagement in the GA process are common issues, with gaps in course information sheets and data tables and demonstration of veracity of the GA/CI process.

Criterion 3.1.2: Curriculum maps

There must be documented curriculum maps showing the relationship between learning activities for each of the attributes and semesters in which these take place. A comprehensive, sustainable assessment plan for all attributes must be clearly indicated by the map.

Quantitative findings



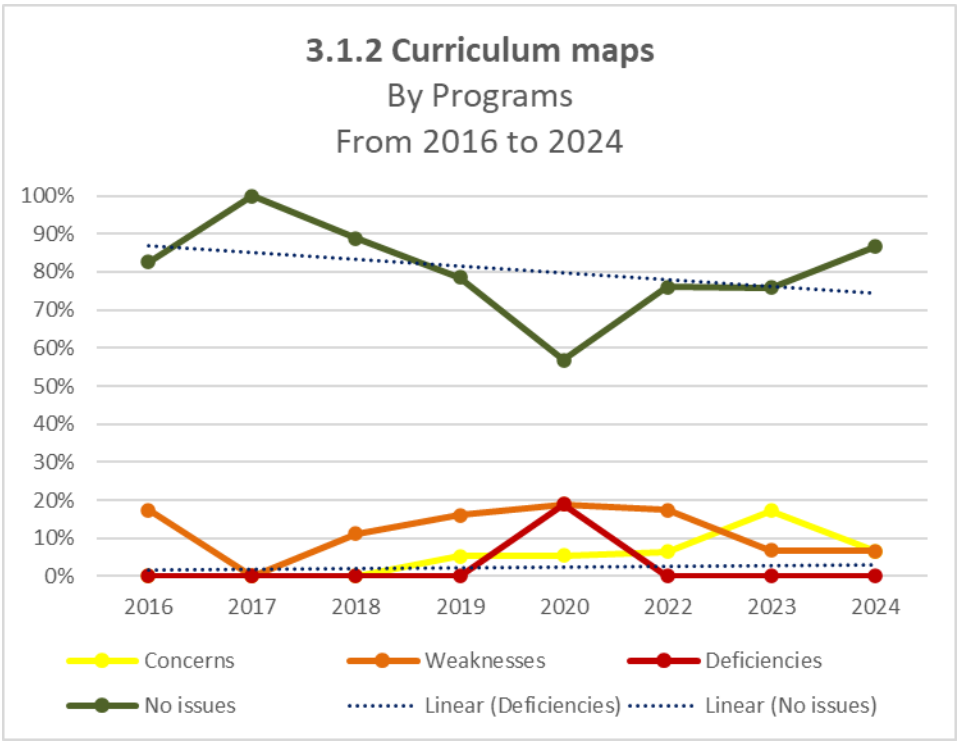


Figure 5: Performance on 3.1.2 Curriculum Maps 2016-2024

There is a tendency for the quality of curriculum maps to drop over the years, although deficiencies do not significantly increase, and about 90% of programs do a good job of compliance. Where there are issues, the data suggests that there is weakness of compliance.

Qualitative summary

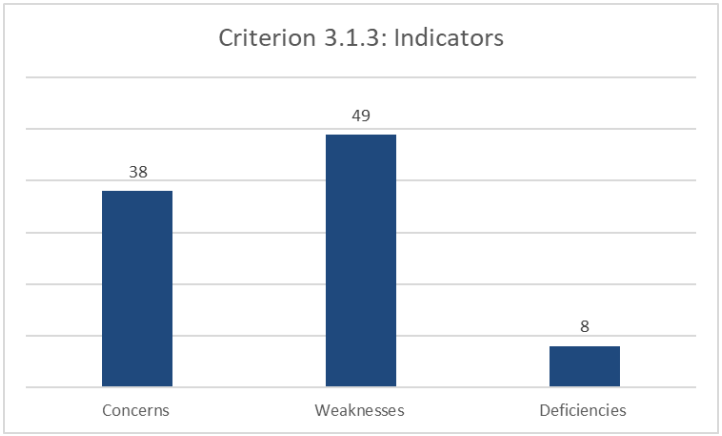
- **Cohesiveness of design**: Linkages between learning activities and GAs, particularly for Professionalism, Impact of Engineering on Society and the Environment, Ethics and Equity, and Lifelong Learning, are not always readily apparent. Sparse linkages are also observed for Individual and Teamwork, Communication, and Professionalism, and are frequently concentrated in the last term of the program. Some GAs are not being assessed at the "applied level" or the "intermediate level". Many learning activities are not clearly defined, leading to unclear mapping of learning outcomes to GAs. A lack of balance in the Rating/Level (I/D/A) assessed, was observed, with fewer evaluations at the "Introductory" level, particularly for GAs 8-12.

- **Quality of design**: Curriculum maps are sometimes inaccurate, with gaps in the student development pathway, especially in years 1 and 2. Inconsistencies were observed in various table entries, with courses designated for assessment not always being depicted in the GA results. An insufficient number of courses used to assess some GAs was observed, particularly for GAs 1, 9, and 10. Inconsistencies exist between course plans and the curriculum map, making it difficult for students to know the actual GAs covered or the level met. Reliability of data obtained through mapping and assessment may be impacted when relying heavily on elective courses with small or no sample sizes. Some feeder institutions did not provide their curriculum maps or showed discrepancies in the level and distribution of coverage of GA compared to the home HEI.

Criterion 3.1.3: Indicators

For each attribute, there must be a set of measurable, documented indicators that describe what students must achieve in order to be considered competent in the corresponding attribute.

Quantitative findings



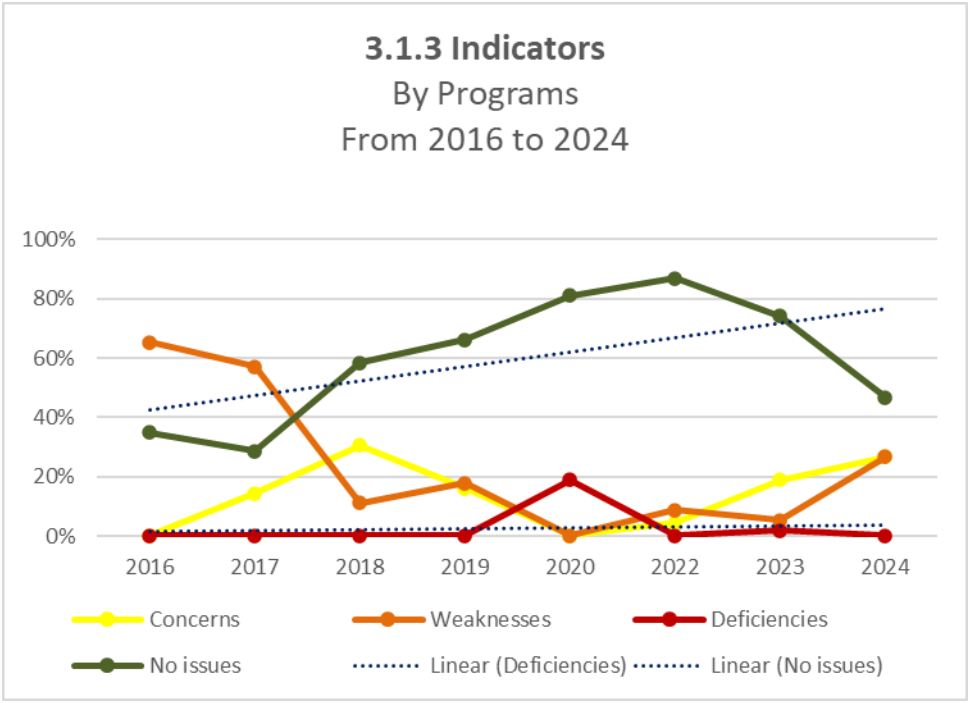


Figure 6: Performance on 3.1.3 Indicators 2016-2024

There is an overall tendency for indicator quality to increase, although there was a sharp downturn in the last year. Deficiencies remain low.

Qualitative summary

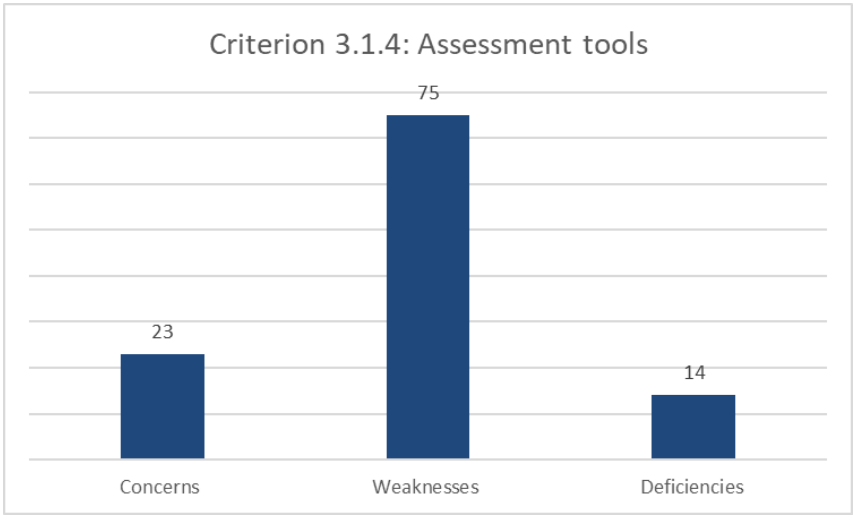
- **Design of indicators:** Using learning outcomes as a proxy for indicators raises challenges, as they are not specific enough and do not span all elements of the GA. Some indicators selected are general in nature and do not provide a clear indication of what is being measured, potentially compromising their effectiveness. There is often a misalignment of corresponding indicators with some GAs, making it difficult to ensure a sustainable data collection program for these GAs. Indicators for some GAs do not reflect the CEAB definitions, and their large number may be difficult to sustain, affecting the connection between desired outcomes and course content. There is sometimes no specific indicator that explicitly measures equity in GA 10 (Ethics and Equity), and the existing indicators are broad and not easily measurable.

- **Application of indicators:** Some engineering courses claim Engineering Design Accreditation Units but do not assess the Design GA, and vice-versa, indicating a lack of understanding among faculty members. It was noted that only a few GAs have been assessed for all their indicators, and several have not been assessed at the applied level. The high number of indicators can create overlap and noise, affecting data reliability and making it difficult to ensure a sustainable data collection process, with limited discussion on the uniqueness of indicators. Accurate measurement of indicators can be uncertain, as several are measured with a single sample point, and very few indicators are sampled for some GAs.

Criterion 3.1.4: Assessment tools

There must be documented assessment tools that are appropriate to the attribute and used as the basis for obtaining data on student learning with respect to all twelve attributes over a cycle of six years or less.

Quantitative findings



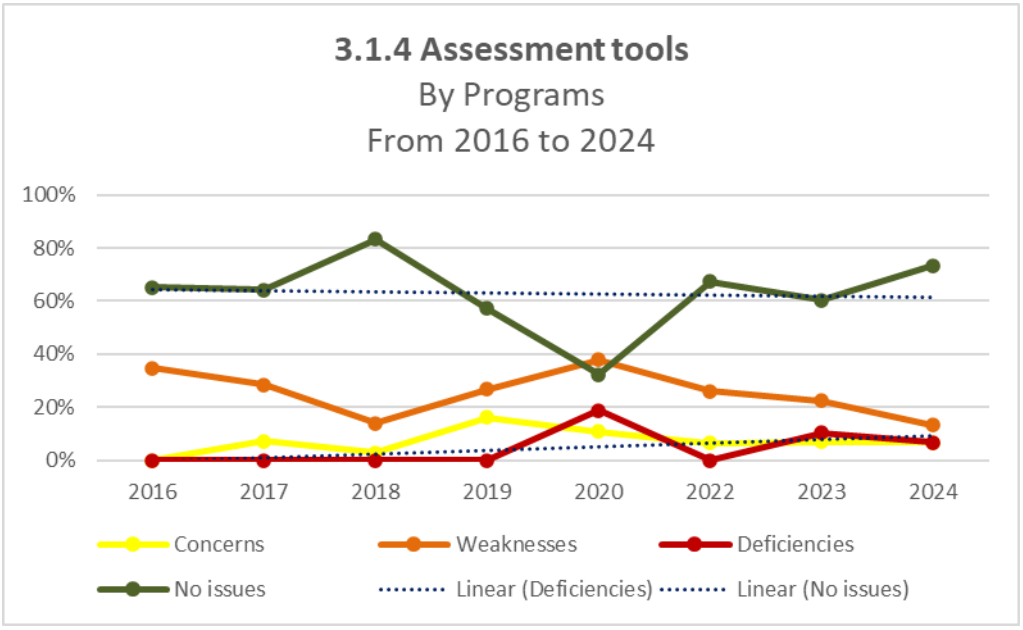


Figure 7: Performance on 3.1.4 Assessment Tools 2016-2024

In assessment tools, programs with no issues remain flat at just over 60%, but there is a trend toward increases in deficiencies.

Qualitative summary

- **Inappropriate or insufficient assessment tools:** The selection of assessment tools is found to be either insufficient or inappropriate for their intended purpose, reducing their effectiveness in measuring the GAs. Some assessment tools are either too broad or too narrow, which impacts their ability to measure specific GAs accurately. There is a need for better alignment and implementation of assessment tools to effectively measure learning outcomes. An over-reliance on course grades has been observed, and exam marks for data collection purposes, which may not provide a meaningful measure of student performance on specific GAs. Some attributes rely on a limited number of tools that do not comprehensively cover the GA.

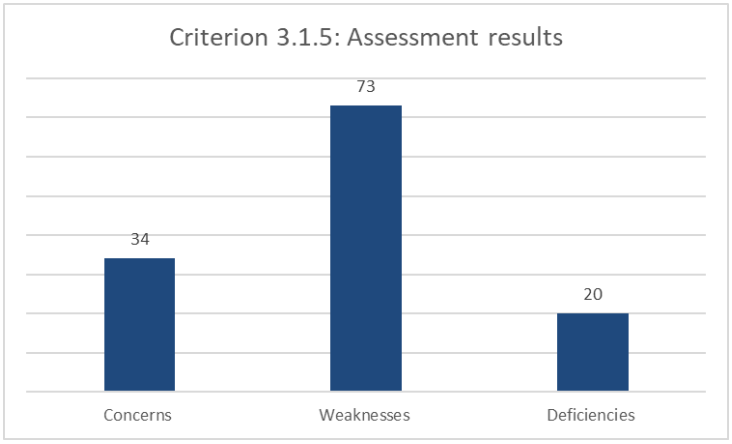
- **Inadequate documentation:** It was observed that the rationale behind the selection of assessment tools can be inadequately documented, making it difficult to understand the choices made, and leading to questions about their validity and reliability.

- **Challenges in data coordination:** There are challenges in coordinating and interpreting data across different courses and programs, making it difficult to assess student progress accurately. There is an opportunity to extend the use of assessment tools to include external feedback mechanisms, which could enhance the assessment process.

Criterion 3.1.5: Assessment results

At least one set of assessment results must be obtained for all twelve attributes over a period of six years or less. The results should provide clear evidence that graduates of a program possess the above list of attributes.

Quantitative findings



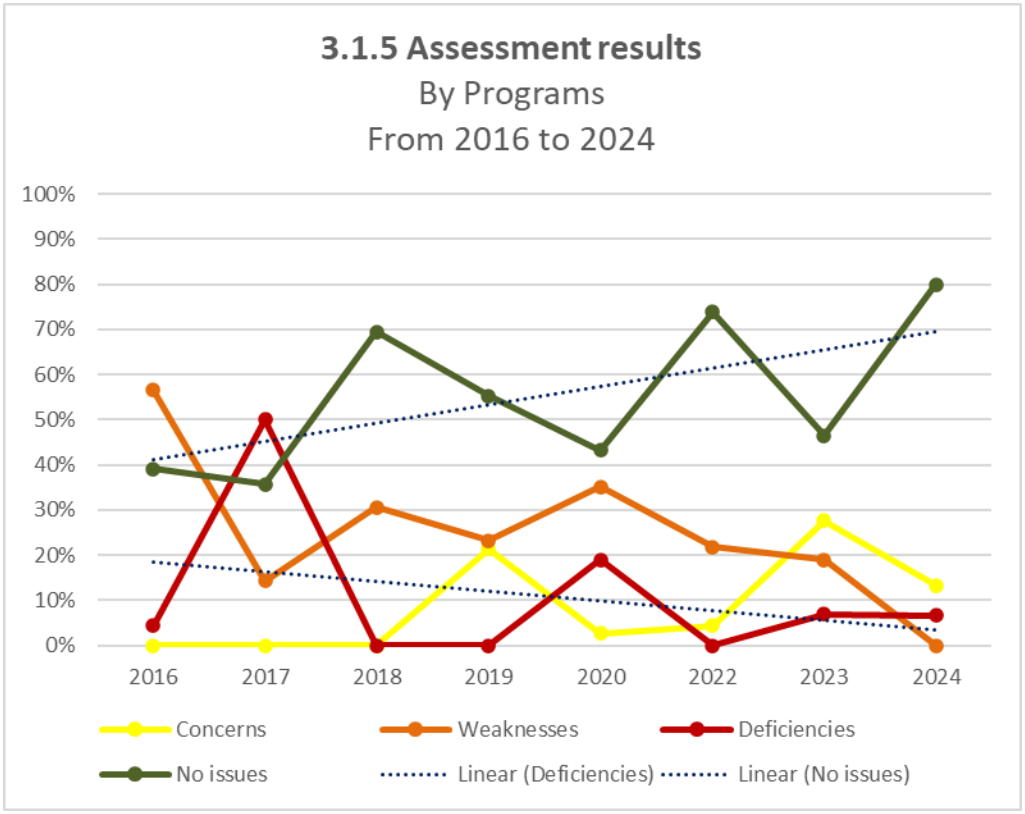


Figure 8: Performance on 3.1.5 assessment results 2016-2024

Compliance in assessment results is improving, with deficiencies declining. The variance indicated by the jagged graphs shows that this is an area that needs more study and training.

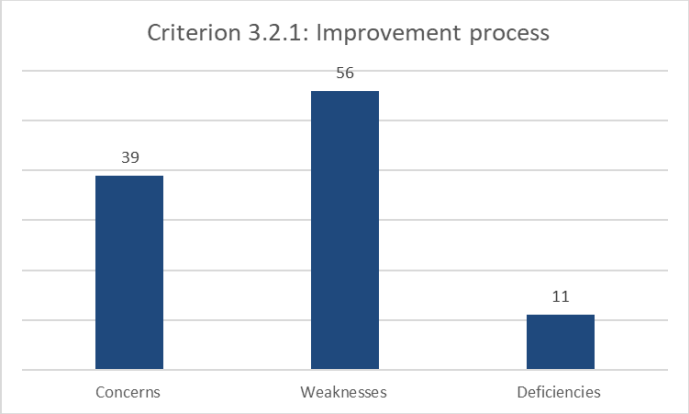
Qualitative summary

- **Inadequate data collection**: A lack of comprehensive data collection for GAs has been observed, as some have only been assessed once or with minimal sampling over the last six years. Missing assessment results for some GAs were noted, with the overall review appearing to be unsustainable and possibly unreliable. The assessment methods used are often insufficient, with issues such as small sample sizes, grade binning, and reliance on a limited set of courses making it difficult to demonstrate that graduates possess the attributes. Additional assessments are required before making any decisions regarding changes to the program. It was noted that there was insufficient evidence to demonstrate that graduates possess the required attributes; specifically, the results presented do not provide a clear indication of whether the program's graduates meet the expected standards.
- **Triggers and presentation issues**: Triggers for remedial actions are not always clear or strictly followed, and poor presentation of charts makes it challenging to interpret the results. Assessment results presented on a course-by-course basis rather than at the indicator or graduate attribute level can lead to a lack of evidence about the students' overall performance.
- **Revised data collection**: The HEI has revised its data collection methods over the last six years, consequently the current system presents very little in terms of assessment results.

Criterion 3.2.1: Improvement process

There must be processes in place that demonstrate that program outcomes are being assessed in the context of the graduate attributes, and that the results are validated, analyzed and applied to the further development of the program.

Quantitative findings



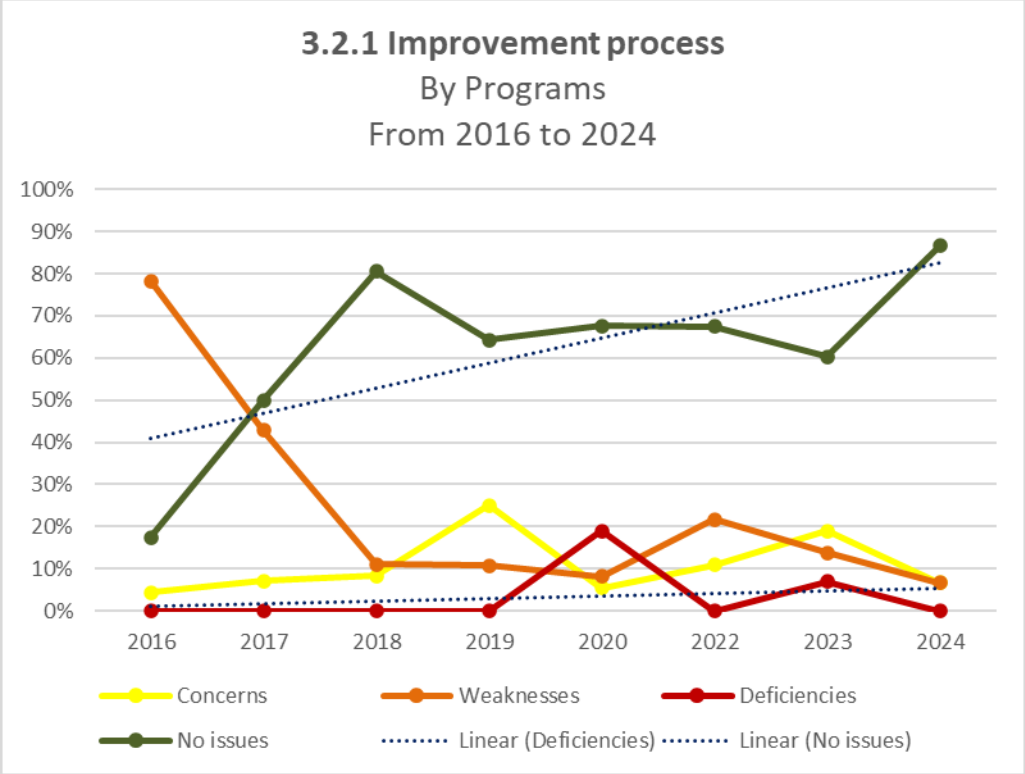


Figure 9: Performance on 3.2.1 Improvement Process 2016-2024

After a weak start in 2016, the improvement processes in place have steadily increased in compliance. Although the programs without issues have now exceeded 80%, there is still some work to do to eliminate the last few compliance issues.

Qualitative summary

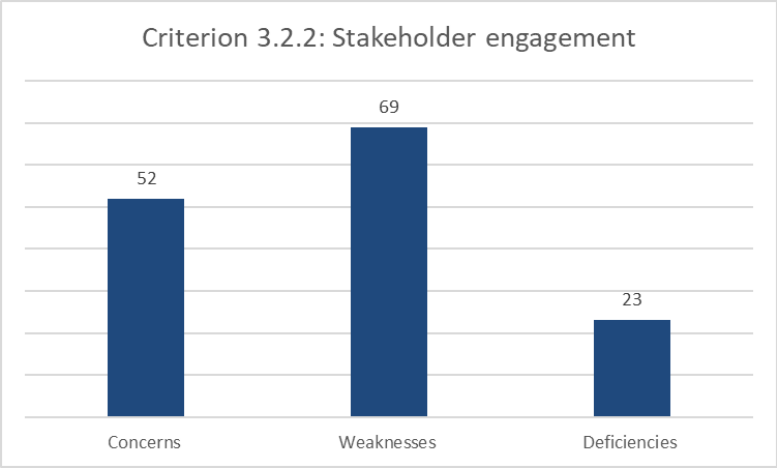
- **General process issues**: There is considerable variability with respect to the implementation of improvement processes, with some processes being limited or not fully operational. It was noted that full-time faculty members are not fully involved in interpreting assessment results, and the process for documenting recommendations and follow-ups is sometimes unclear. Improvements are often made in an ad-hoc manner without a formal process. It is sometimes observed that the responsibility for data assessment and review rests with one or a very small number of individuals, which could limit department- or faculty-wide understanding and perspectives in decision-making.

- **Data interpretation and assessment results:** There is limited evidence that assessment data is effectively analyzed and utilized in the continual improvement process. In some cases, there have been no defined processes to link assessment results to improvement actions.

Criterion 3.2.2: Stakeholder engagement

There must be demonstrated engagement and involvement of stakeholders, both internal and external to the program in the continual improvement process.

Quantitative findings



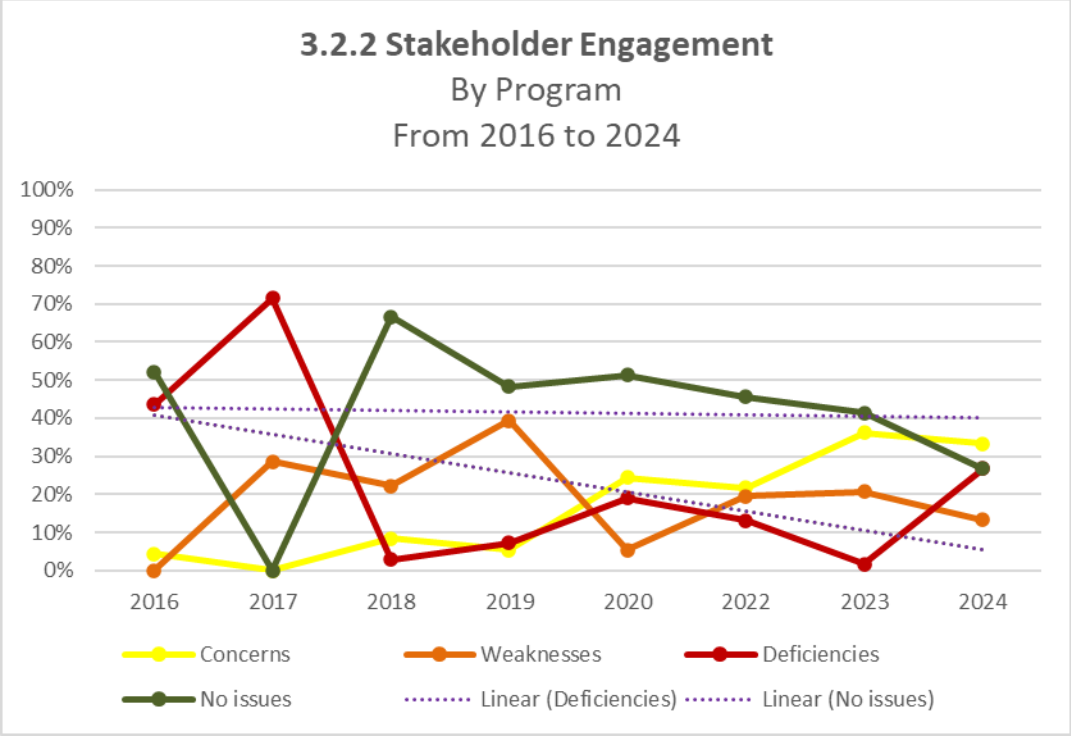


Figure 10: Performance on 3.2.2 stakeholder engagement 2016-2024

Stakeholder engagement has not improved since the beginning of the study period, with about 40% of programs having no compliance issues. There is also great variance in the results. This area needs significant work to improve compliance, possibly through developing a standard method of

stakeholder engagement. It could also be the case that it is very difficult to engage stakeholders, leading to lower compliance.

Qualitative summary

- **Overall engagement process issues:** Stakeholder engagement is generally not well documented and coordinated engagement plans are often not evident. Consequently, there appears to be a lack of significant engagement of internal and external stakeholders in the CI processes.

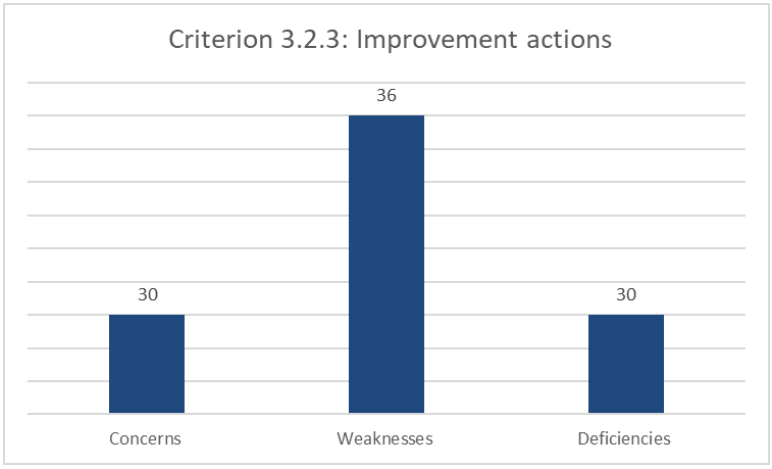
- **Internal engagement issues:** Both faculty and students are aware of the GA/CI process, but students are not always engaged in how the GAs are used in the CI process – this may be due to poor communication. Faculty members have difficulty matching assessment tools to indicators and lack consistent information about GA performance, leading to low-quality data and limited engagement.

- **External engagement issues:** The primary external stakeholders tend to be industrial advisory boards to programs, departments or faculties. These exist for many programs but not all. The degree to which these boards are familiar with and meaningfully engaged in GA/CI processes varies considerably, and the roles of these boards in GA/CI are often not documented. Regular engagement of alumni, graduate employers, and co-op employers in GA/CI processes does not appear to be the norm.

Criterion 3.2.3: Improvement actions

There must be demonstration that the continual improvement process has led to consideration of specific actions corresponding to identifiable improvements to the program and/or its assessment process. This criterion does not apply to the evaluation of new programs.

Quantitative findings



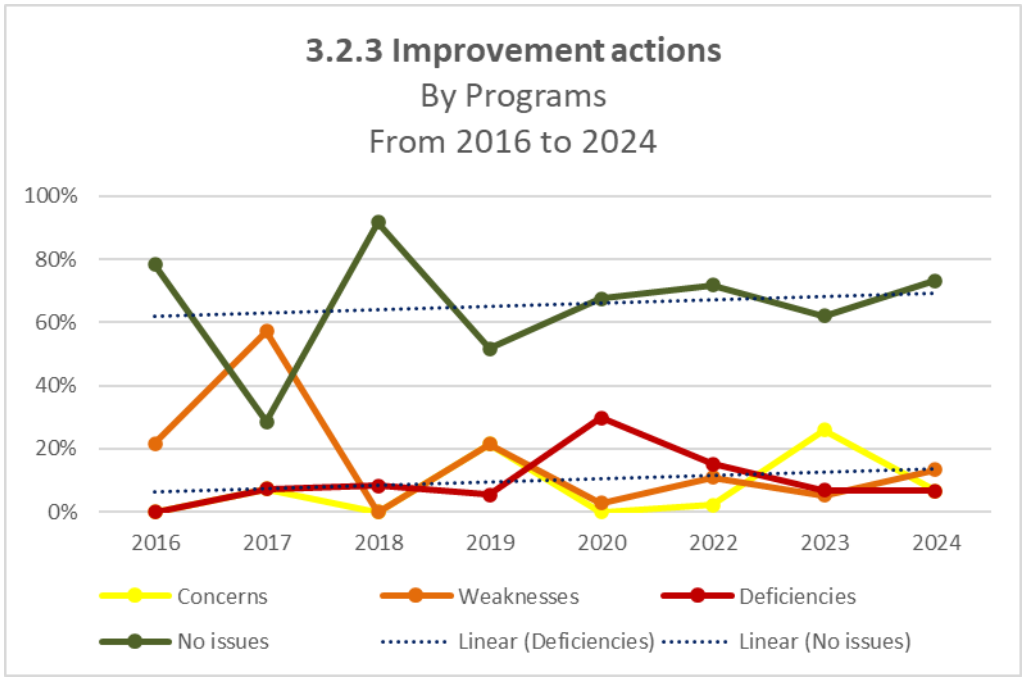


Figure 11: Performance on 3.2.3 improvement actions 2016-2024

Improvement actions are getting better over time, with lower variance, and a steady improvement in programs with no issues, now over 70%. Although deficiencies have increased above 10%, the reduction in variance means that overall, programs are beginning to master this area.

Qualitative summary

- **Program changes and GA/CI processes**: While programs tend to have improvement processes, there is limited evidence that GA data is systematically considered to support improvement actions. In some cases, program improvement processes appear to be done in an ad hoc fashion without a clear rationale, timeline, documentation or accountability.

- **Data confidence issues:** Data unreliability and insufficient indicators for certain attributes prevent effective program improvement. Improvement actions are not tied to GA results, leading to a lack of confidence in the assessment results for program improvement. Due to recent changes in data collection processes, it is premature to see substantive improvement actions, requiring additional data collection and analysis.

Conclusions and recommendations

When looking at each GA/CI criterion, some results are evident:

- Improvement actions have the highest level of non-compliance, but the performance is improving over time, with variance decreasing even as deficiencies slightly increase.
- Curriculum maps and indicators are well done overall, with only 2% deficiencies, and 85% and 78% respectively without any issues; however, there is largely an issue of weakness of compliance among the remainder. This points to a need for careful training of those responsible for curriculum mapping and indicator design.
- Figure 3 shows that institutions have a challenge in implementing GA/CI, with 43% or less mastering each criterion institution-wide. HEIs can close this gap by implementing institution-level training of those who implement GA/CI.
- Largely quantitative indicators such as curriculum mapping in 3.1.2 are generally well handled by programs (this should be the case with engineering). The more qualitative criteria such as improvement actions 3.2.3 poses an assessment challenge for program faculty who are very familiar with quantitative criteria, but usually not so much with qualitative analysis.
- The time series by program are interesting when looking at the graphs for “no issues”. The variance observed is because programs are reviewed on average every 3 to 6 years; the variance therefore represents differences in programs and also in visiting teams. Program personnel change between visits, and the visiting team is never identical.
- When looking at graphs for 3.1.3 and 3.2.2, we can see the potential for programs to devolve over time if the six-year visit cycle is not maintained.

Several key conclusions can be drawn from this analysis:

- In accreditation, the current GA/CI process is designed to assess program-level results and show that the program as a whole will produce graduates who meet the graduate attributes. Since the results are aggregated by program, student-level information may be lost, and GA/CI does not guarantee that each student meets the graduate attribute requirements. This guarantee is embedded in the input assessment done through accreditation units (AUs) and the minimum path. When GA/CI, AUs and the minimum path are combined, every student is guaranteed to meet the graduate attributes.
- To date, the majority of issues with accreditation criteria are in GA/CI (Figure 1) – this suggests that if AUs and the minimum path are removed from consideration, programs will be at greater risk of performing worse on accreditation, since compliance with input criteria is better than with GA/CI as currently formulated.
- Significant work is needed to transform the GA/CI process into one that assesses at a student level, thus guaranteeing graduate attribute compliance of every graduating student.

Recommendations

1. Develop training programs for HEI personnel in the areas of:
    - 3.1.4 Assessment tools
    - 3.1.5 Assessment results
    - 3.2.2 Stakeholder engagement
    - 3.2.3 Improvement actions
2. All other areas can benefit from training once the priority areas in Recommendation 1 have been covered.
3. Identify criteria with high variance in results over time and target these for improvements in criterion definitions and training of both HEI personnel and CEAB visiting teams. In particular, target:
    - 3.1.4 Assessment tools
    - 3.1.5 Assessment results
    - 3.2.2 Stakeholder engagement
4. Identify criteria where there is a declining trend in perfect compliance (i.e., no issues), and target these for investigation. In particular, target:
    - 3.1.2 Curriculum maps
    - 3.1.4 Assessment tools
    - 3.2.2 Stakeholder engagement
5. Identify criteria where there is a significant increasing trend in deficiencies and target these for investigation. In particular, target:
    - 3.1.2 Curriculum maps
    - 3.1.4 Assessment tools
    - 3.2.1 Improvement process
    - 3.2.3 Improvement actions
6. Use the results of this study to improve the visitor training slides, particularly by using the summary of typical issues that arise for each GA criterion.
7. Share the report with:
    - Engineers Canada Board
    - Engineering Deans Canada
    - Canadian Engineering Education Association conferences
    - GACIP summits
8. Although it is not a criterion that the GA/CI system not be dependent on one person, highlight the issues that arise when a critical individual leaves the institution, and encourage HEIs to work on effective succession plans.
9. Implement training for HEI personnel responsible for GA/CI, especially to provide strategies for addressing the most prevalent issues and to reinforce the “big picture” of GA/CI as a means of curriculum improvement, rather than just an accreditation task. Reinforce the difference between assessment of students by “course passing” vs “meeting graduate attributes”.
10. Revise the criteria and interpretive statement on GA/CI, given the new knowledge from this study. It is possible that non-compliance is related to misinterpretation of the GA/CI criteria.

Future studies

1. Do a study to determine whether, over time, there has been increasing rigor in the assessment of GA/CI, and whether this has led to changes in the issues identified.
2. Update the study of GA/CI criteria annually to observe any emerging trends.
3. Study how individual programs perform on GA/CI over time; this must be done carefully to avoid revealing sensitive data.
4. Collect data on programs that use automated GA/CI systems vs those that do it manually and determine if this has any effect on the GA/CI issues observed.