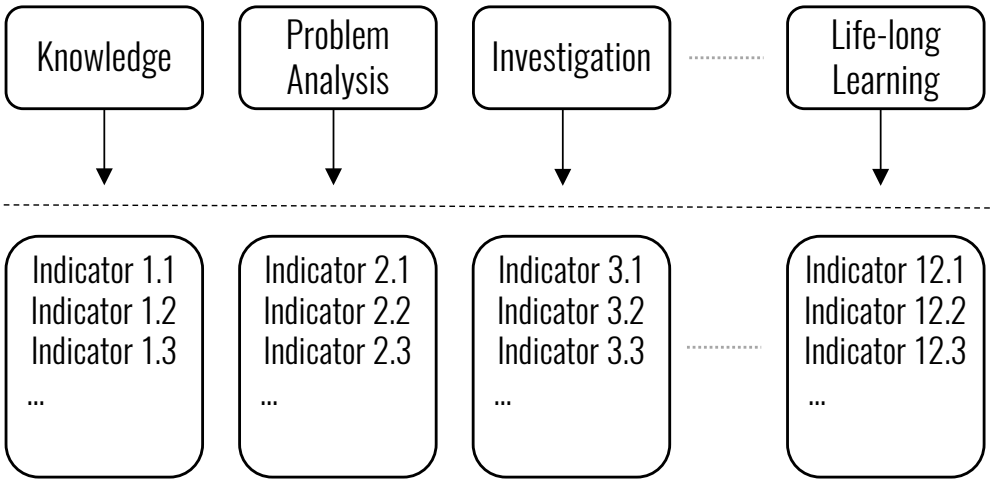
Graduate Attribute Assessment Summary



Assessment tools: ways of measuring students' work against the indicators.
Examples:

- Local written exam
- Standardized exam
- Oral exam
- Performance appraisal
- Oral interviews
- Oral presentation
- Written report
- Focus groups
- Simulation
- Surveys/questionnaires

Outcomes (graduate attributes)

...used to create specific and measurable...

Indicators

...which are measured by...

Assessment tools

...which are often graded using...

Rubrics

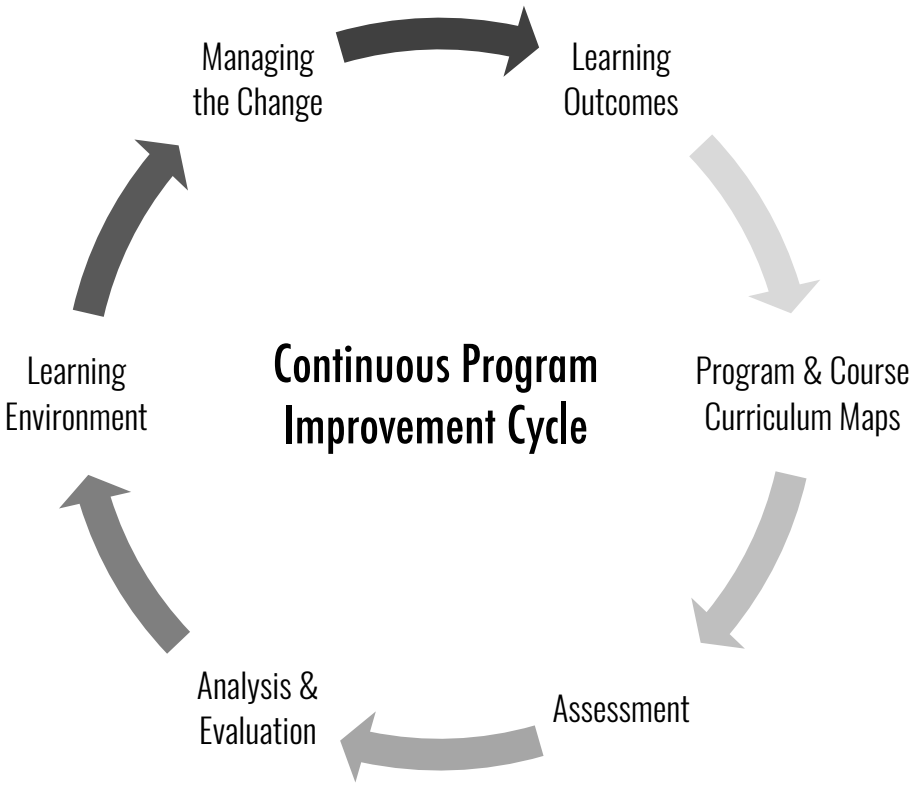
Example of a rubric targeted at a design report

Scales / Dimensions	Not demonstrated	Marginal	Meets expectations	Exceeds expectations
Dimension 1: Course learning outcomes #1, possibly linked to an indicator	Descriptor: e.g. Information sources not critically evaluated for...	Descriptor: e.g. Information from reliable sources but not explicitly evaluated	Description: e.g. Range of information sources used and critically evaluated for...	Descriptor: e.g. Comprehensive analysis of...
Dimension 2:	Descriptor...	Descriptor...	Descriptor...	Descriptor...
Dimension 3:	Descriptor...	Descriptor...	Descriptor...	Descriptor...

Glossary

Name	Description	Also known as
Graduate attribute	Generic characteristics, specified by the CEAB, expected to be exhibited by graduates of Canadian engineering schools.	Program level objective Program outcomes Student outcomes (ABET)
Indicator	Descriptors of what students must do to be considered competent in the attribute; the measurable and pre-determined standards used to evaluate learning.	Assessment criteria Performance criteria Competency outcome
Course learning outcome	A description of what students should be able to know or do at the end of a course.	
Assessment tools	The means by which data on student learning is collected (e.g. report, presentation, design project, examination etc.)	Assessment measures Assessment methods
Assessment	Proceses that identify, collect, and prepare data to evaluate the achievement of graduate attributes.	
Evaluation	Interpreting/analyzing data gathered through the assessment process	

Sample Graduate Attribute Assessment Process Flow



Connaissances en génie / Knowledge Base

Exemple 1:
QR 01.1 Décrire le sens physique des fonctions, des dérivées et des intégrales.
GA 01.1 Describe the physical meaning of functions, derivatives and integrals.

Exemple 2:
QR 01.4 Identifier et appliquer les notions fondamentales de la discipline qui gouvernent un processus ou un système pour résoudre un problème.
GA 01.4 Identify and apply the basic notions of the discipline that govern a process or system, to solve a problem.

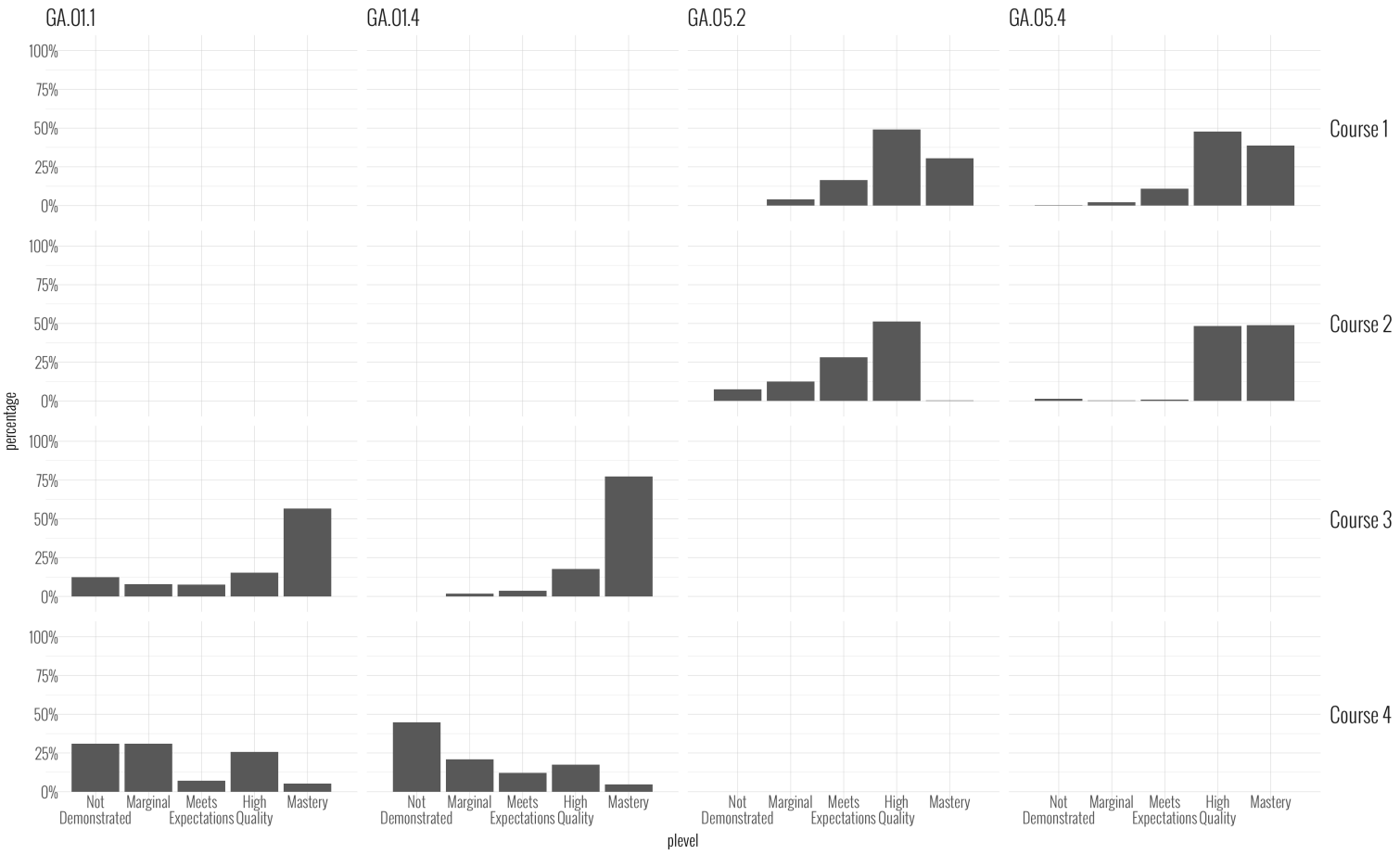
Utilisation d'outils d'ingénierie / Use of Engineering Tools

Exemple 1:
QR 05.2 Utiliser les techniques et outils appropriés pour résoudre un problème.
GA 05.2 Use the appropriate techniques and tools to solve a problem.

Exemple 2:
QR 05.4 Évaluer la justesse des résultats obtenus par divers techniques ou outils.
GA 05.4 Evaluate the accuracy of the results obtained by various techniques or tools.

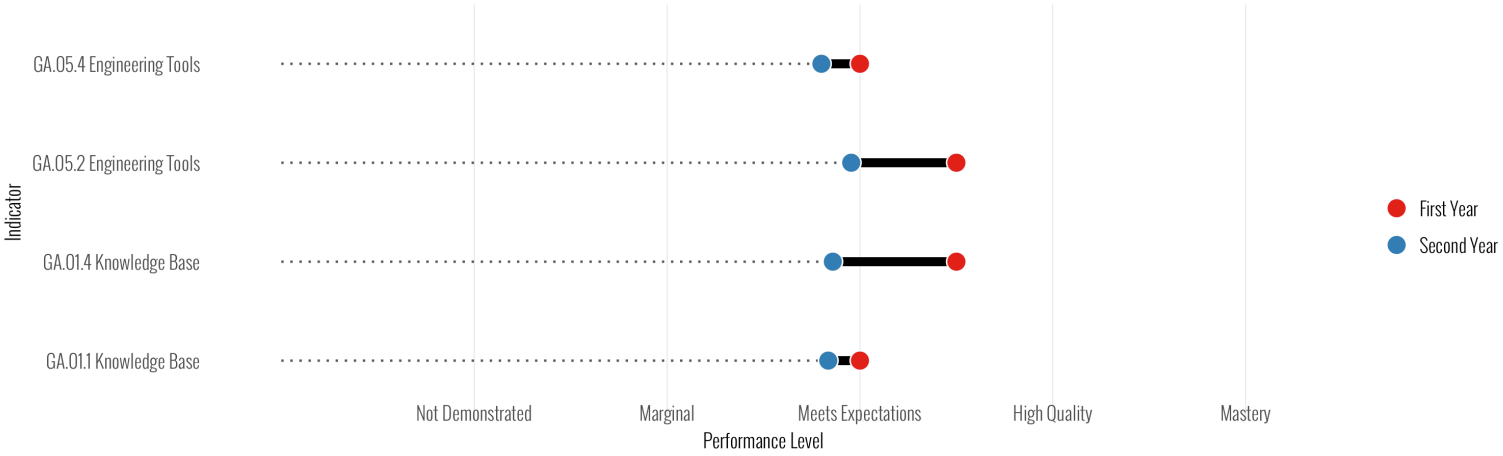
Graduate Attribute Results for Knowledge Base (GA.01) and Engineering Tools (GA.05) attributes

Results are presented as bar chart representing the percentage of students attaining each performance level. These results are drawn from a single assessment from each course. (Course 1 = Final Lab Project Report, Course 2 = Final Exam, Course 3 = Concept Inventory, Course 4 = Final Exam)



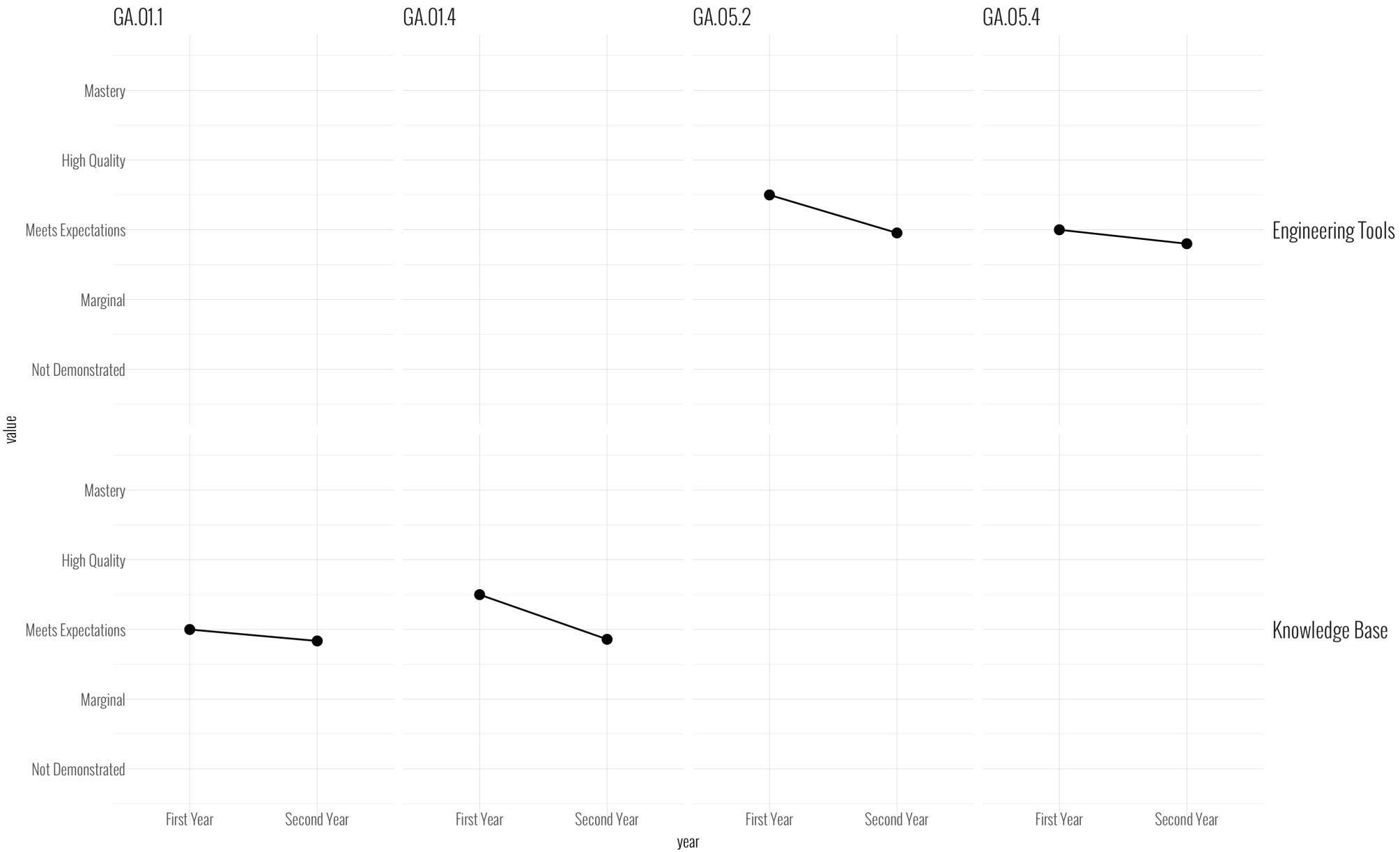
Graduate Attribute Results for Knowledge Base (GA.01) and Engineering Tools (GA.05) attributes

Results are presented as dumbell chart representing the aggregate performance of students in courses between first and second year. Results were aggregated by indicator. GA.01 is comprised of courses 3 & 4 and GA.05 is comprised of data from Course 1 & 2



Graduate Attribute Results for Knowledge Base (GA.01) and Engineering Tools (GA.05) attributes

Results are presented as line chart representing the aggregate performance of students in courses. Results were aggregated by indicator. GA.01 is comprised of courses 3 & 4 and GA.05 is comprised of data from Course 1 & 2



3.1	Graduate Attributes:	Accreditation Criteria and Procedures Description	Rating	Assessment Category Descriptors Quantitative definitions: - almost all (at least 10) - many (at least six) - some (at least two)
	Organization and engagement	There must be demonstration that an organizational structure is in place to assure the sustainable development and measurement of graduate attributes. There must be demonstrated engagement in the process by faculty members and engineering leadership.	**A**	Strong organizational structure in place to assure sustainable development, measurement and review of GAs **AND** clear evidence of engagement by faculty and leadership.
			M	Weak organizational structure in place to assure sustainable development, measurement and review of GAs **AND/OR** limited evidence of engagement by some faculty and/or leadership.
			U	No effective organizational structure in place to assure sustainable development and measurement of GAs **AND/OR** no evidence of engagement by most faculty and/or leadership.
	Curriculum Maps	There must be documented curriculum maps showing the relationship between learning activities for each of the attributes and the semesters in which these take place.	**A**	Sufficient number of learning activities/courses (at least three per attribute) mapped with respect to GAs and program semesters
			M	Inufficient number of learning activities (less than three per attribute) mapped with respect to GAs and program semesters for some GAs
			U	Entries for at least one GA are missing from the curriculum map **AND/OR** only a single assessment point measured for some GAs.
	Indicators	For each attribute, there must be a set of measureable, documented indicators that describe what students must achieve in order to be considered competent in the corresponding attribute.	**A**	Corresponding indicators are well-alligned for almost all GAs **AND** indicators span all important GA components for almost all GAs (see note 1) **AND** indicators are consistent with expectations for an engineering graduate for almost all GAs (see note 2) **AND** number of indicators consistent with assuring a sustainable data collection program for almost all GAs.
			M	Misalignment of corresponding indicators with some GAs **AND/OR** indicators corresponding to at least one important GA component for some GAs **AND/OR** indicators are inconsistent with expectations for an engineering graduate for some GAs **AND/OR** number of indicators inconsistent with assuring a sustainable data collection program for some GAs.
			U	Misalignment of corresponding indicators with many GAs **AND/OR** indicators corresponding to at least one important GA component for many GAs **AND/OR** indicators are inconsistent with expectations for an engineering graduate for many GAs **AND/OR** number of indicators inconsistent with assuring a sustainable data collection program for many GAs.
	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 cyle of six years or less.	**A**	Selection of sufficient and appropriate tools for all GAs **AND** rationale for selection of assessment tools for all GAs is documented **AND** expected achievement levels are appropriate to the stage of the program for all GAs
			M	Selection of insufficient or inappropriate assessment tools for some GAs **AND/OR** rationale for selection of tools for some GAs is inadequately documented **AND/OR** expected achievement levels are inappropriate to the stage of the program for some GAs.
			U	Selection of insufficient or inappropriate assessment tools for many GAs **AND/OR** rationale for selection of tools for many GAs is inadequately documented **AND/OR** expected achievement levels are inappropriate to the stage of the program for many GAs.
	Assessment results	At least one set of assessment results must be obtained for all twelve attributes over a cycle of six years or less. The results should provide clear evidence that the graduates of a program possess the attributes or that remedial action is in progress.	**A**	Assessment results compiled and documented for almost all GAs over a cycle of six years or less **AND** results are able to demonstrate appropriate levels of achievement for almost all GAs.
			M	Assessment results not compiled and documented for several GAs over a cycle of six years or less **AND/OR** results insufficiently demonstrate appropriate levels of achievement for some GAs.
			U	Assessment results not compiled and documented for most GAs over a cycle of six years or less **AND/OR** results insufficiently demonstrate appropriate levels of achievement for many GAs.

Note 1: "GA component" – a component of the attribute description in section 3 of the "Accreditation Criteria and Procedures" (e.g. mathematics is a component of the knowledge base description)

Note 2: "Performance Levels" – a scale of descriptors of the performance corresponding to an individual indicator. Performance levels for a coherent group of indicators corresponding to individuals are aggregated to measure graduate attribute achievement levels.

3.2	Continual Improvement:	Accreditation Criteria and Procedures Description	Rating	Assessment Category Descriptors
	Improvement process	There must be processes in place that demonstrate that program outcomes are being assessed in the context of graduate attributes, and that the results are validated, analysed and applied to further development of the program.	**A**	Process (committees, annual cycle, authority, reporting) is in place **AND** process is adequately documented
			M	Process for continual improvement has some inadequate components **AND/OR** process documentation is limited
			U	Process for continual improvement is not in place **AND/OR** process is not adequately documented
	Stakeholder engagement	There must be demonstrated engagement of stakeholders both internal and external to the program in the continual improvement process.	**A**	Stakeholders broadly selected (e.g. internal:students, program faculty, engineering faculty; external: non-engineering faculty, alumni, engineering professionals, other professionals, employers, learned societies, etc.)
			M	Stakeholders narrowly selected (some internal and some representation) **AND/OR** stakeholder roles in the improvement process is inadequately demonstrated.
			U	Stakeholders insufficiently selected (e.g. only program faculty) **AND/OR** stakeholders are not specified
	Improvement actions	There must be a demonstration that the continual improvement process has led to consideration of specific actions corresponding to identifiable improvements in the program and/or its assessment process. ***This criterion does not apply to new programs.***	**A**	One or more program-level/process change action(s) implemented **AND** timelines and accountability for changes documented
			M	Program-level/process change action(s) implementation in progress **AND/OR** timelines and accountability for changes not yet assigned **AND/OR** rationale for decisions not to act yet to be developed.
			U	No program-level/process change actions implemented **AND/OR** no timelines and accountability for changes assigned **AND/OR** no rationale for decisions developed .

Questionnaire for Evaluation of an Engineering Program - Exhibit 1

Sample response by:

University of Canada

Name of Higher Education Institution

Handwavium Engineering

Program name

Date

1. Graduate Attributes

Introduction & Background

The schools approach to Graduate Attribute Assessment and Continuous Program Improvement (GACPI) builds upon the considerable history of curriculum renewal, program improvement, educational innovation and engineering education research at the school. In the 1990's the school began initiatives, to promote industry relationships and build essential engineering skills in graduates. This initiative lead to the introduction of new courses including HAND100, a two term team/project-based first year course which now incorporates many of the 12 GAs.

Some year later the school began began developing a process for GA assessment by forming working groups from all programs to establish measurable and meaningful GA Indicators, appropriate to first year, middle years, and at graduation. There have been many pilot processes to measure these attributes across the programs, and information has been collected. Currently, we are in the beginning steps of analyzing the data for the purposes of program improvement.

Organization and engagement:
Under this heading discuss the organizational structure for the measurement of graduate attributes. Discuss the roles and engagement of faculty members and engineering leadership in this structure.

Figure 1 shows the current organizational structure for the Schools GACPI development and monitoring process. Most of this process is directed top-down, with the faculty setting the standards for all programs to follow. The GACPI process in program is run by a representative communicating and working with faculty members to assign indicators to specific courses according to curriculum maps developed by each programs. Assessment is conducted by faculty members across the programs in all years, in order to see the development of students during their time at the school. Instructors are encouraged to provide their feedback on the assessment results to the program representative, and suggest changes or improvements to develop more reliable approaches to assessing students.

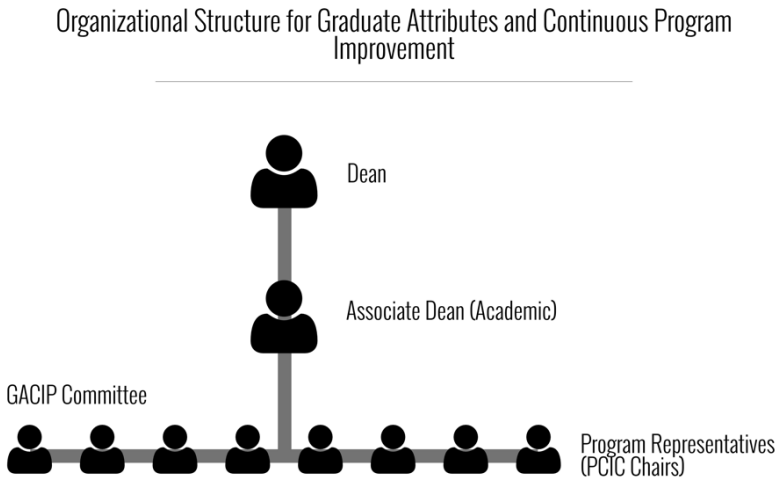


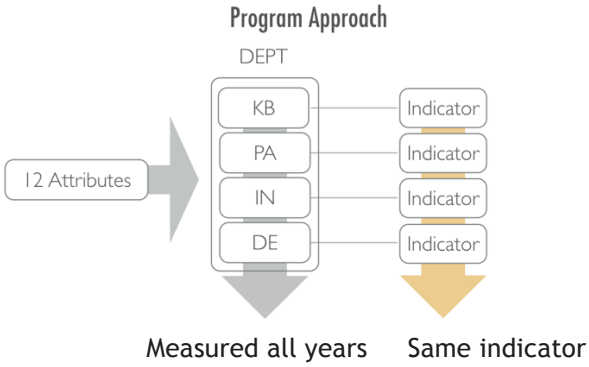
Figure 1

Graduate attribute # 3 Investigation

Canadian Engineering Accreditation Board definition:
An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions.

Indicators:

The Indicator structure in Handwavium Engineering is integrated longitudinally through the program with a single indicator being used first and fourth, illustrated below.

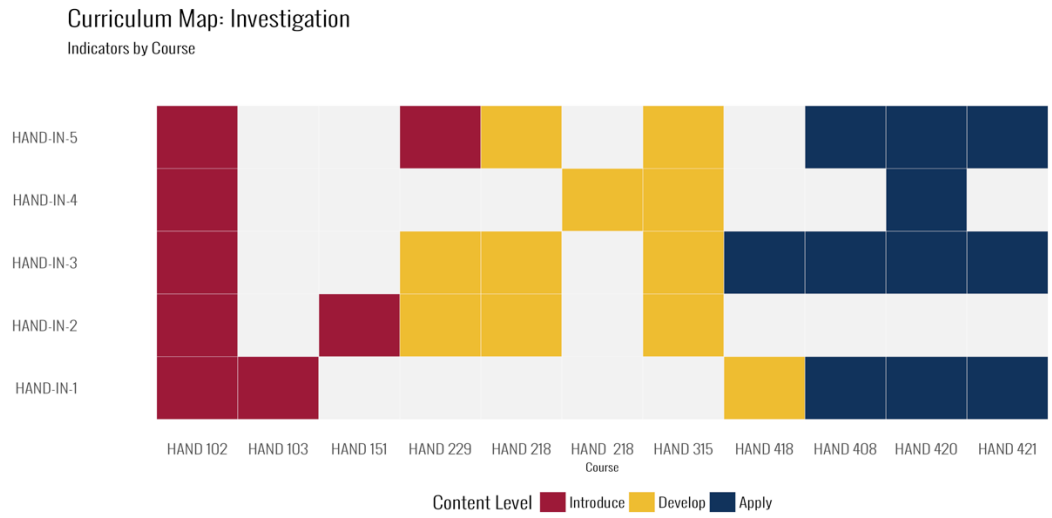


The GA#3 Investigation Indicators for Handwavium Engineering were developed by the Handwavium Engineering GA committee (which has now evolved into the Handwavium Engineering PCIC). The committee carefully considered the required investigation skills in Handwavium Engineering, and retooled the Indicators initially developed by the FEAS working groups. In total there are five indicators used for the assessment of Investigation in Handwavium Engineering. These reflect experimental design, laboratory safety and the collection, use, and evaluation of experimental data.

Indicators
HAND-IN-1: Conducts experimental investigations to test working or research hypothesis.
HAND-IN-2: Uses and documents appropriate measurement techniques and tools to collect, organize and analyze data and information.
HAND-IN-3: Understands research methods to gather information from a range of sources
HAND-IN-4: Assesses validity of conclusions within limitations of data and methodologies; describes nature and possible causes of uncertainty
HAND-IN-5: Describes safety protocols in laboratory environment

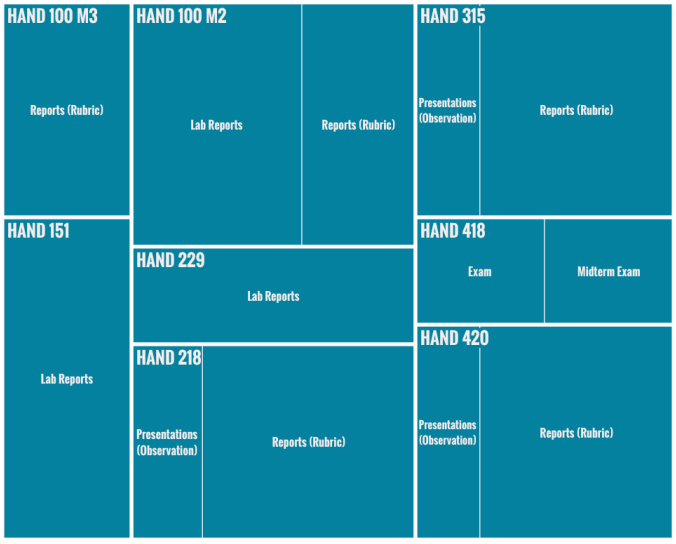
Curriculum maps:

The curriculum map for GA#3 Investigation is shown below for the Handwavium Engineering program. The y-axis lists the 5 indicators discussed in the previous section, with the relevant courses across 4 years on the x-axis. The colours reflect where content is Introduced (red), Developed (yellow) and Advanced (blue). Investigation begins in year 1 with HAND 100 – Introduction to experimentation, where students develop the skills necessary to design a simple experimental investigation. Upper year HAND courses focus increasingly on the development of the indicators.



Assessment tools:

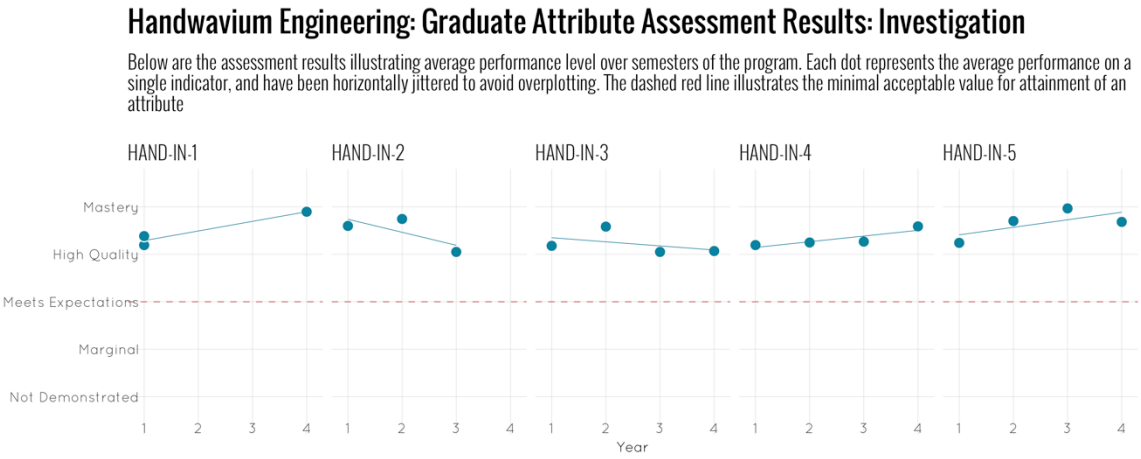
The assessment tools used for each course are shown below in the treemap. Each block represents a course, and the size of the subdivisions within each block represent the number of times an assessment tool is used to measure student performance. The tools used to assess the indicators in the general first year program are lab reports and a detailed "experimental design" rubric. In upper year courses, lab reports and presentations are used most often and evaluated either by a rubric or a rubric-type assessment method. Exams and midterms are also used.



Assessment results:

The figure below represents an overall snapshot in Handwavium Engineering of the assessment results for GA#3 Investigation. Each data point on this plot represents the mean score of an Indicator in a given semester. All five of the Investigation indicators are included together on this plot. As illustrated, all students are operating well above the "Meets Expectation" level, and average performance is relatively consistent across semesters.

The figure below is just one way to examine the data. It is possible also to look at a specific Indicator (e.g. HAND-IN-2) over all 4 years for a particular cohort of students, or at multiple measurements of one Indicator in the same year. The flexibility of this data analysis offers the program ample information to enact improvement at many stages in the program, and within those courses used to develop the Investigation attribute.



2. Continuous program improvement

Improvement Process:

The schools approach utilizes the EGAD 6 step framework for outcomes-based assessment and continuous program improvement[EGAD Project]. Each program has been working within this process to develop and approach that meets Faculty and CEAB requirements.

We have been diligently working on the initial steps of the EGAD process, and are making significant headway on the later steps of analyzing, improving using data, and managing change. There is some dissatisfaction amongst faculty members with the overall process at our school, with many detractors citing workloads, difficulty with assessing indicators, and the limited availability of support and resources. The process is shown below.

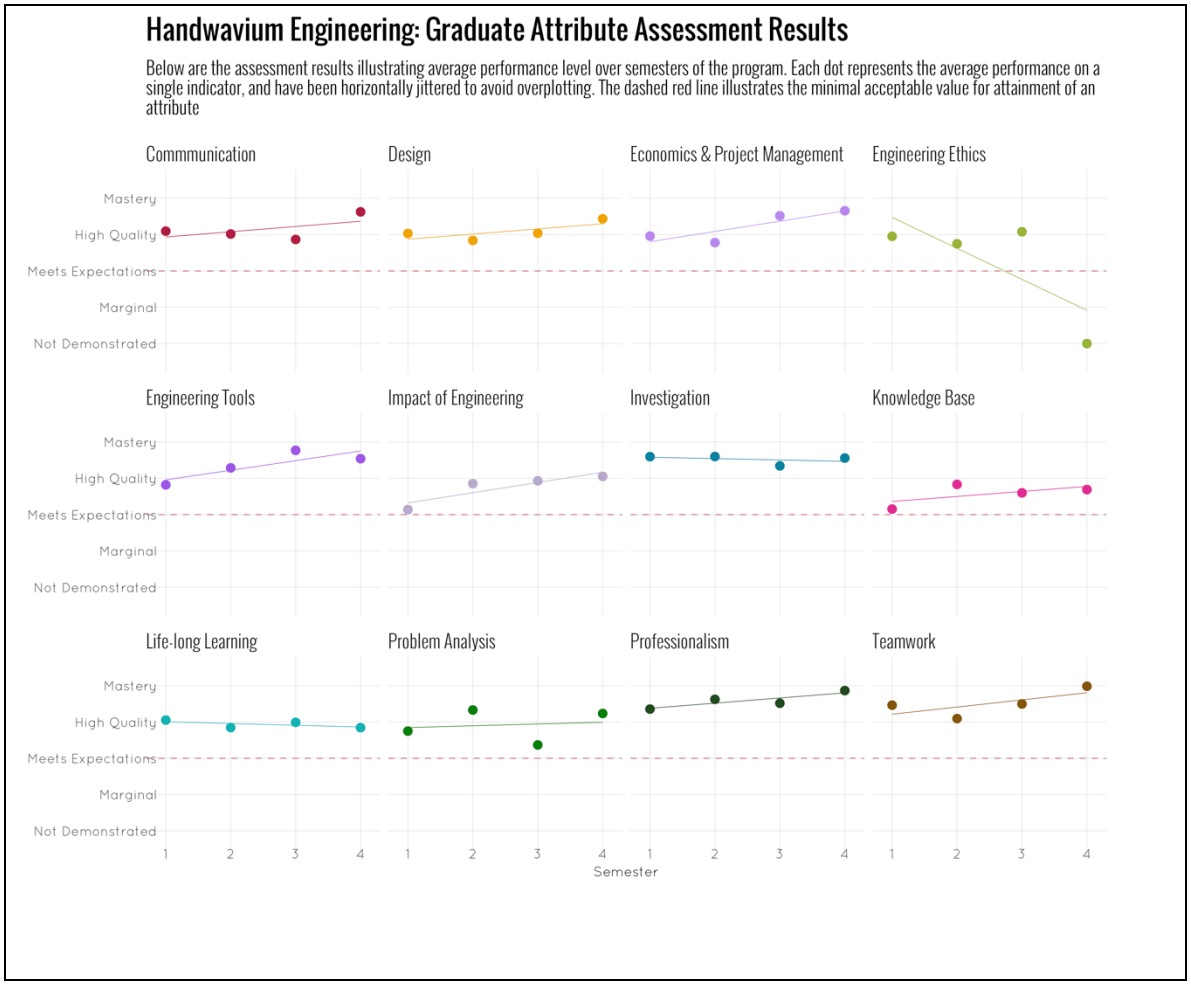
Stakeholder Engagement

Each program is also encouraged to include stakeholder representatives as they fit within their program. They are encouraged to discuss the GA results with those representatives, to see if industry can provide any insight and feedback to better prepare our graduates for professional work.

Students are engaged in the process via the student executive at the faculty and program level. Programs are encouraged to collect student feedback about GA results, to provide any context or explanation about any irregularities or issues with the results.

Improvement Actions

Data is analyzed by reviewing the aggregated data for each year of the program. We ensure students are meeting the expectations of the program by flagging items that fall below the program and faculty expectation. The overview report below quickly allows program representatives to flag attributes that require further detailed investigation by looking at measures that fall below expectations. By our results we can concluded that all of our students possess all of the graduate attributes at the time of graduation.


Handwavium Engineering: Graduate Attribute Assessment Results
Below are the assessment results illustrating average performance level over semesters of the program. Each dot represents the average performance on a single indicator, and have been horizontally jittered to avoid overplotting. The dashed red line illustrates the minimal acceptable value for attainment of an attribute
Commmunication
Design
Economics & Project Management
Engineering Ethics
Engineering Tools
Impact of Engineering
Investigation
Knowledge Base
Life-long Learning
Problem Analysis
Professionalism
Teamwork
Mastery
High Quality
Meets Expectations
Marginal
Not Demonstrated
1
2
3
4
Semester

Task 3 - Make a timeline which shows how would you would collect and document information, so the results are useful.
Consider: Governance, Engagement, Triggers & Timelines, Communication with Data, Improvement Strategies.