# Continuous program improvement processes for **accreditation**

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**http://egad.engineering.queensu.ca**

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# Agenda

| Time | | |
|---|---|---|
| **Session 1**<br>**9:00-10:30** | Introduction to continuous program improvement processes | |
| **10:30-10:45** | BREAK | |
| **Session 2**<br>**10:45-12:15** | **Determine program objectives and indicators**<br>*We will be selecting/creating indicators.* | |
| **12:15-13:30** | Lunch break | |
| **Session 3**<br>**13:30-15:00** | 3A: Planning an outcomes-based process (for administrators) | 3B: Graduate attribute assessment as a course instructor<br>*We will be creating plans for assessing indicators in courses.* |
| **15:00-16:00** | Follow-up discussion if needed | |

# SESSION 1: CONTINUOUS PROGRAM IMPROVEMENT PROCESSES

# Workshop outcomes

1. Be able to describe the process required for outcomes-based continuous curriculum improvement
2. Be able to define and use terminology in graduate attribute assessment
3. Be able to work collaboratively with colleagues to apply methods and tools for the continuous program improvement

# Material from this workshop

Slides and online resources are posted on the EGAD website http://egad.engineering.queensu.ca

More detail at the end of the session

Feel free to ask questions throughout the session

# International agreement for outcomes assessment

- Accreditation bodies in countries who are signatories to the Washington Accord use outcomes-based assessment
- Washington Accord allows substantial equivalency of graduates from Australia, Canada, Hong Kong, Republic of Ireland, New Zealand, South Africa, United Kingdom, and United States, Japan, Singapore, Korea, and Chinese Taipei

# Who we are: Engineering Graduate Attribute Development Project

- Collecting and developing resources and training for faculty and administration on continuous program improvement processes
- Composed of engineering educators and educational developers across Canada, and sponsored by deans of engineering (NCDEAS)
- Working collaboratively with CEAB

# Context: CEAB Criterion 3.1 & 3.2


3.1: Demonstrate that graduates of a program possess the 12 attributes

3.2: Continual program improvement processes in place using results of graduate attribute assessment

# Starting point:

We're starting from the question

**"How do we create a process to improve our program that demonstrates what our students can do?"** (which CEAB requires)

# Graduate Attribute Assessment

- Outcomes based: In general, the term *outcomes assessment* is used to answer questions like:
  - What can students *do*? How does their performance compare to our stated expectations?
- It **identifies gaps** between

**our perceptions of what we teach**

**actual knowledge, skills, and attitudes students develop program-wide.**

# Inputs and Outcomes

| Inputs | Outcomes |
| --- | --- |
| Course materials (text, notes)<br>Student pre-university background<br>Faculty education, professional status<br>Ongoing faculty development<br>Class sizes<br>Content<br>Campus resources<br>Contact hours<br>Laboratory equipment<br>Support services | Demonstrated abilities (cognitive, skills, attitudes) |

# Inputs and Outcomes

**Inputs**

Student pre-university background
Faculty education, professional
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Laboratory equipment
Support services

**Outcomes**

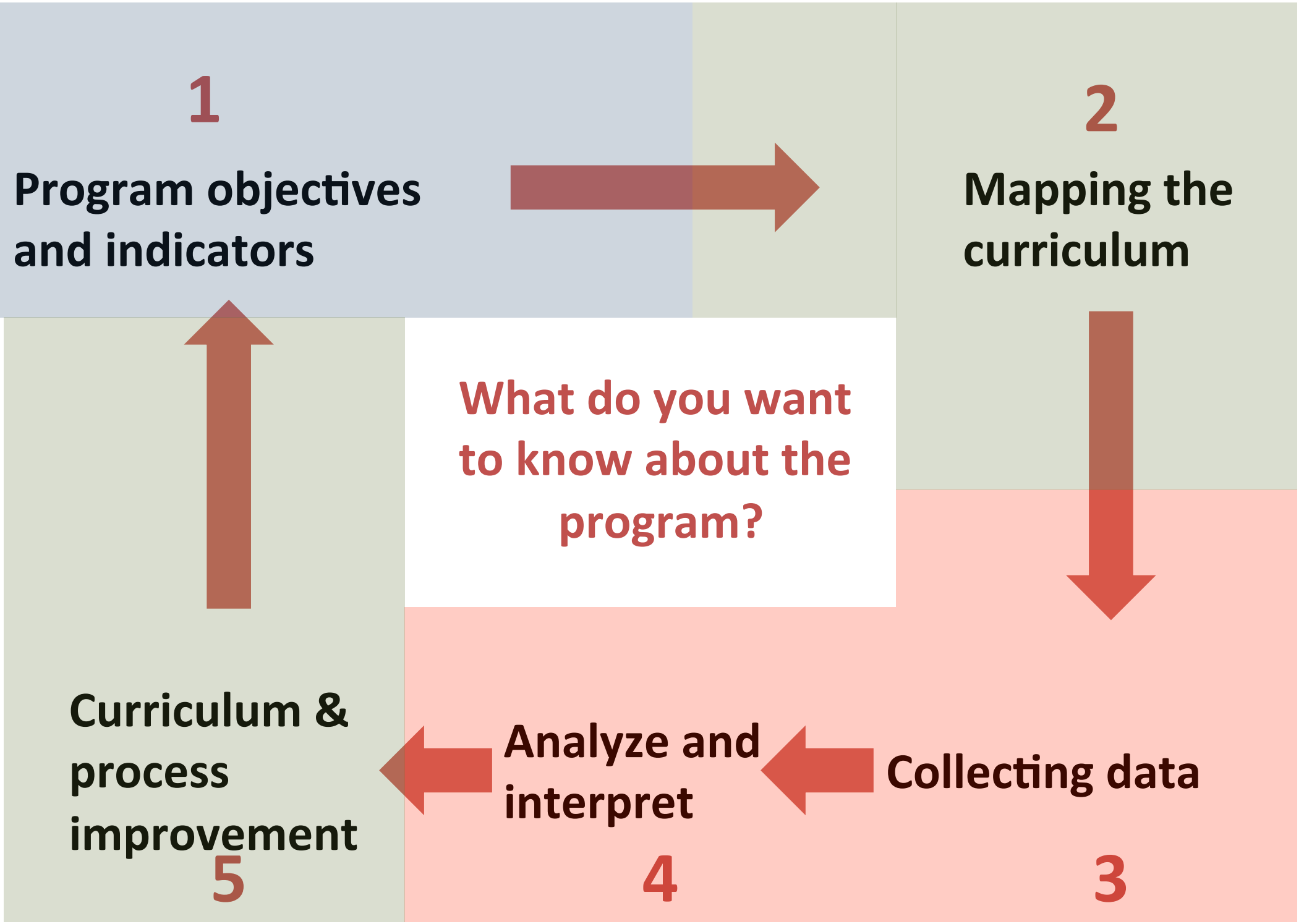
Demonstrated abilities
(cognitive, skills, attitudes)

Current CEAB Accreditation System

Remains in place (for foreseeable future)

Graduate Attributes Accreditation

Emphasis on continuous program improvement


1
Program objectives and indicators
2
Mapping the curriculum
What do you want to know about the program?
3
Collecting data
4
Analyze and interpret
5
Curriculum & process improvement

# What do you want to know about the program?

- Goal is NOT to collect loads of data

- Goal is to generate information

  …… so you need to know the questions you are asking to plan your data collection.

# 12 Graduate Attributes

1. Knowledge base for engineering
2. Problem analysis
3. Investigation
4. Design
5. Use of engineering tools
6. Individual and team work
7. Communication skills
8. Professionalism
9. Impact on society and environment
10. Ethics and equity
11. Economics and project management
12. Lifelong learning

# CEAB requirements include:


***a) indicators*** that describe specific abilities expected of students

b) A **mapping** of where attributes are developed and assessed within the program

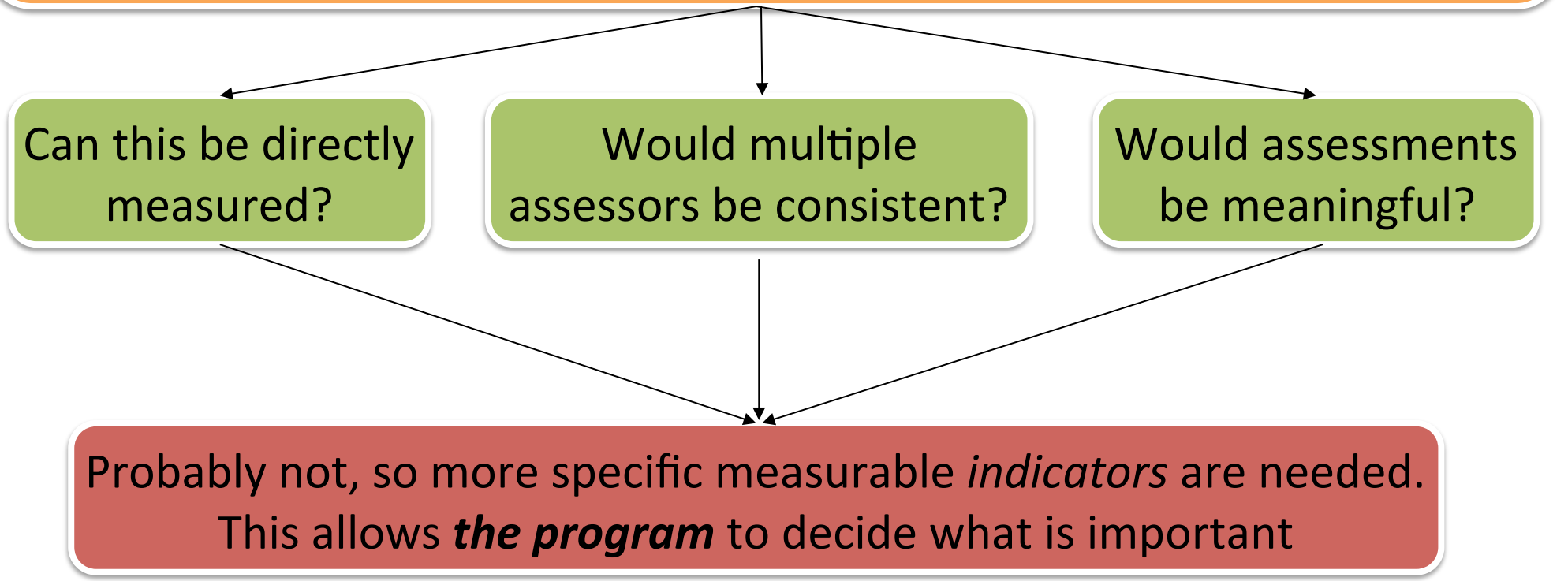
c) Description of ***assessment tools*** used to measure student performance (reports, exams, oral presentations, …)

d) **Evaluation** of measured student performance relative to program expectations

e) a description of the **program improvement** resulting from process

# Assess lifelong learning

**Lifelong learning**
An ability to identify and address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge



# Indicators: examples

*Graduate attribute*

**Lifelong learning**

An ability to identify and address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge

The student:

*Indicators*

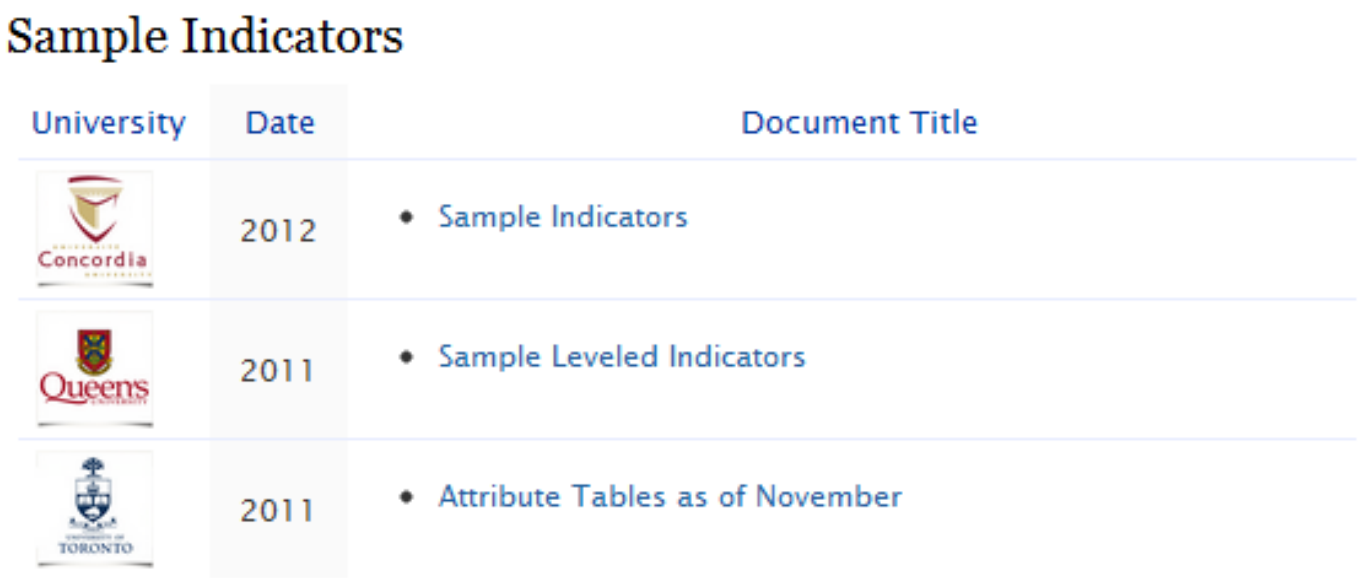
- Critically evaluates information for authority, currency, and objectivity when referencing literature.
- Identifies gaps in knowledge and develops a plan to address
- Describes opportunities for future professional development.
- Uses information ethically and legally to accomplish a specific purpose

# Leveled indicators (Queen's)

1. Follow a provided design process to design system, component, or process to solve an open-ended complex problem as directed by a mentor.
2. Employ and apply design processes and tools with emphasis on problem definition, idea generation and decision making in a structured environment to solve a multidisciplinary open-ended complex problem.
3. Applies specified disciplinary technical knowledge, models/simulations, and computer aided design tools and design tools in a structured environment to solve complex open-ended problems
4. Selects, applies, and adapts disciplinary technical knowledge and skills and design concepts to solve a complex client-driven open-ended problems

# Sample indicators

- EGAD website has sample draft indicators from some programs, and links to other examples under “Additional Resources” page



Sample Indicators

| University | Date | Document Title |
|---|---|---|
| Concordia | 2012 | • Sample Indicators |
| Queen's | 2011 | • Sample Leveled Indicators |
| Toronto | 2011 | • Attribute Tables as of November |

**http://egad.engineering.queensu.ca**

# Curriculum Mapping

Where are attributes/ indicators developed?

Where are attributes/ indicators assessed?

- This is important to ensure
  1. The program deliberately develops the attributes
  2. The program assesses attributes in appropriate times/courses
  3. Targeted program improvements can be made

# Where can we assess students?

- Important to identify where students:
  - develop competency in attributes
  - are assessed:
    a performance (e.g. oral presentation)
    or artifact (e.g. a report, exam, assignment)

- Usually a program would:
  - Conduct surveys or formal mapping exercises to determine where attributes are being developed
  - Identify/select courses used to assess attributes

# Assessment schedule and mapping

- Not required to assess every student
  - Graduate Attributes is not a “minimum path” assessment
  - Not required to track individual students
  - Can use sampling to gather representative data
- Not required to develop or assess in every course
- Not required to develop or assess in every year

# Curriculum Mapping

- Mapping software
  - Kuali (open source, http://www.kuali.org/)
  - U Guelph developing Currickit ( http://currickit.wikispaces.com/)
- Surveys
  - CDIO: Introduced, Developed, or Utilized (ITU)
  - Custom survey (e.g. UBC Grad Attribute survey, http://tinyurl.com/EGADSurvey)
- Informal discussions

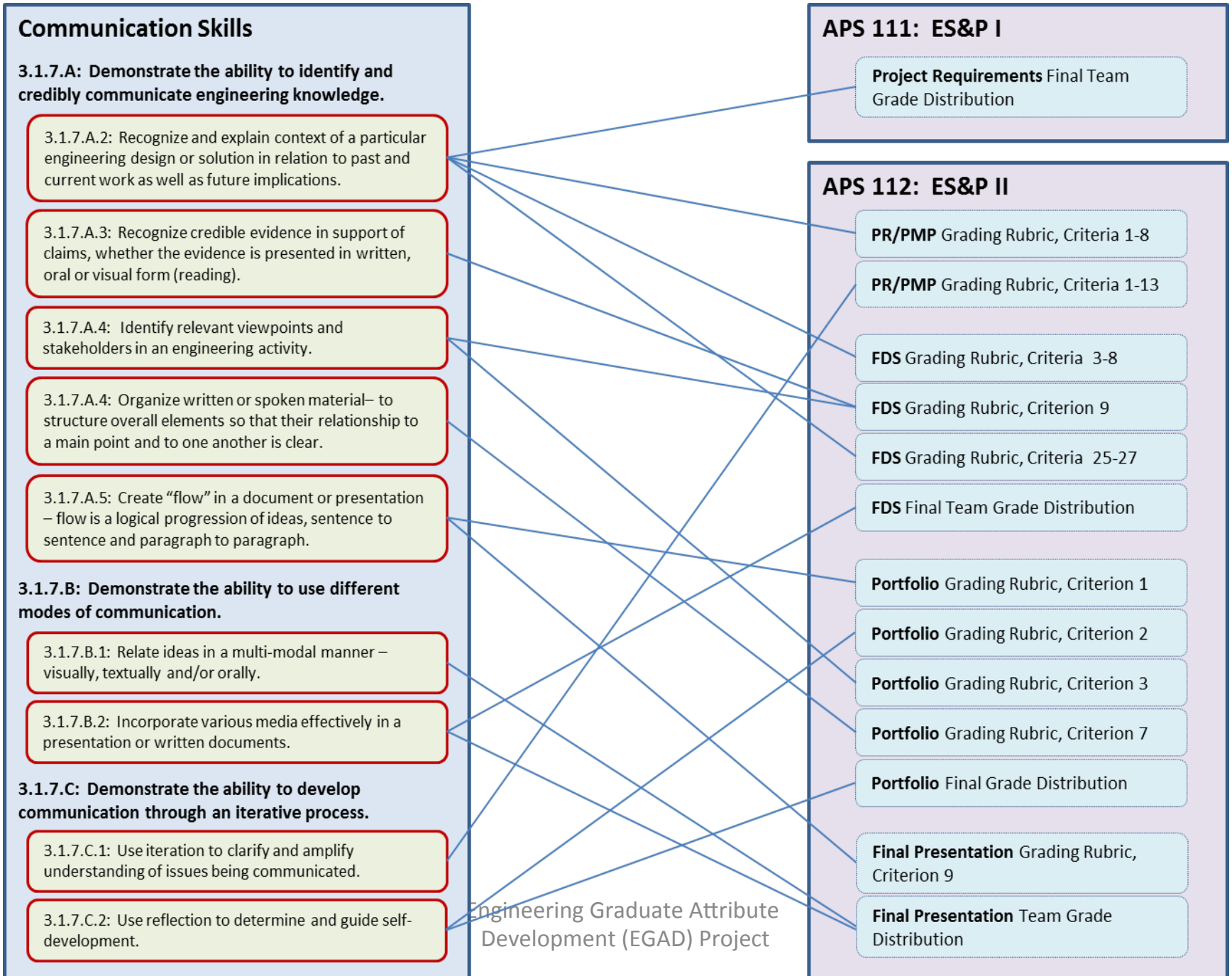
# Example: Mapping to Courses (UBC)

| Course | Number | 1 Knowledge Base | 2 Problem Analysis | 3 Investigation | 4 Design | 5 Engineering Tools | 6 Individual / Team Work | 7 Communication | 8 Professionalism | 9 Impact of Engineering | 10 Ethics / Equity | 11 Econ. / Project Management | 12 Life-long Learning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APSC | 150 | I | I | | I | I | I | | I | U | I | | I |
| MATH | 100 | E | U | I | | | | U | | I | | | I |
| MATH | 101 | E | U | I | | | | U | | I | | | I |
| MATH | 152 | E | I | E | | E | | | | | | | I |
| PHYS | 153 | E | E | E | I | I | E | U | U | U | U | I | U |
| PHYS | 170 | E | E | U | I | U | I | I | | | | | |
| APSC | 201 | U | E | U | U | U | E | E | E | | E | I | U |
| MATH | 253 | E | E | I | E | | I | U | | I | U | | U |
| MATH | 256 | E | E | U | I | I | | | | | | | |
| MECH | 220 | E | I | U | U | E | U | I | I | I | I | | I |
| MECH | 221 | E | E | E | I | E | U | U | I | I | I | | I |
| MECH | 222 | E | E | E | U | E | U | U | I | I | I | I | I |
| MECH | 223 | E | E | E | E | E | E | U | U | E | I | E | I |

# Assessment Mapping to Courses (UBC)

| Course | | 1 Knowledge Base | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course | Number | Emphasis | Exams | Quizzes | Assignments | In-class | Reports | Project / lab | Presentations | No Assesmt | Other | Other description |
| MATH | 100 | E | X | X | X | | | | | | | |
| MATH | 101 | E | X | X | X | | | | | | | |
| APSC | 150 | I | | | | | | | | | | |
| MATH | 152 | E | X | X | X | | X | X | | | | |
| PHYS | 153 | E | X | X | X | X | X | | | | | |
| PHYS | 170 | E | X | X | X | X | | | | | | |
| APSC | 201 | U | | | | | | | | | | |
| MECH | 220 | E | X | X | X | | | X | | | | |
| MECH | 221 | E | X | X | X | | X | X | | | X | Question / Answer sessions |
| MECH | 222 | E | X | X | X | X | X | X | | | | |
| MECH | 223 | E | X | X | X | X | X | X | X | | X | Prototype Demonstration |
| MATH | 253 | E | X | X | X | X | | | | | | |
| MATH | 256 | E | X | | X | | | | | | | |

# Example: Mapping to Assessments (UofT)




Engineering Graduate Attribute Development (EGAD) Project

# Terminology Check-In

# Assessment tools

- Direct and Indirect

Key terms:

- Validity: does your assessment measure what it purports to measure?
- Reliability: improved using triangulation

# Assessment Tools

How to measure learning against specific expectations?

- **Direct measures** – directly observable or measurable assessments of student learning
  - E.g. Student exams, reports, oral examinations, portfolios, concept inventories etc.
- **Indirect measures** – opinion or self-reports of student learning or educational experiences
  - E.g. grades, surveys, focus group data, graduation rates, reputation, etc.

# Assessment Tools

- Local written exam (e.g. question on final)
- Standardized written exam (e.g. Force concept inventory)
- Performance appraisal (e.g. Lab skill assessment)
- Simulation (e.g. Emergency simulation)
- Behavioural observation (e.g. Team functioning)
- Portfolios (student maintained material)
- External examiner (e.g. Reviewer on design projects)
- Oral exam (e.g. Design projects presentation)
- Oral interviews
- Surveys and questionnaires
- Focus group
- Archival records (registrar's data, records, ...)

# Analytic Rubrics

| **Dimensions (Indicator)** | **Scale (Level of Mastery)** | | | |
|---|---|---|---|---|
| | Not demonstrated | Marginal | Meets expectations | Exceeds expectations |
| Indicator 1 | Descriptor 1a | Descriptor 1b | Descriptor 1c | Descriptor 1d |
| Indicator 2 | Descriptor 2a | Descriptor 2b | Descriptor 2c | Descriptor 2d |
| Indicator 3 | Descriptor 3a | Descriptor 3b | Descriptor 3c | Descriptor 3d |

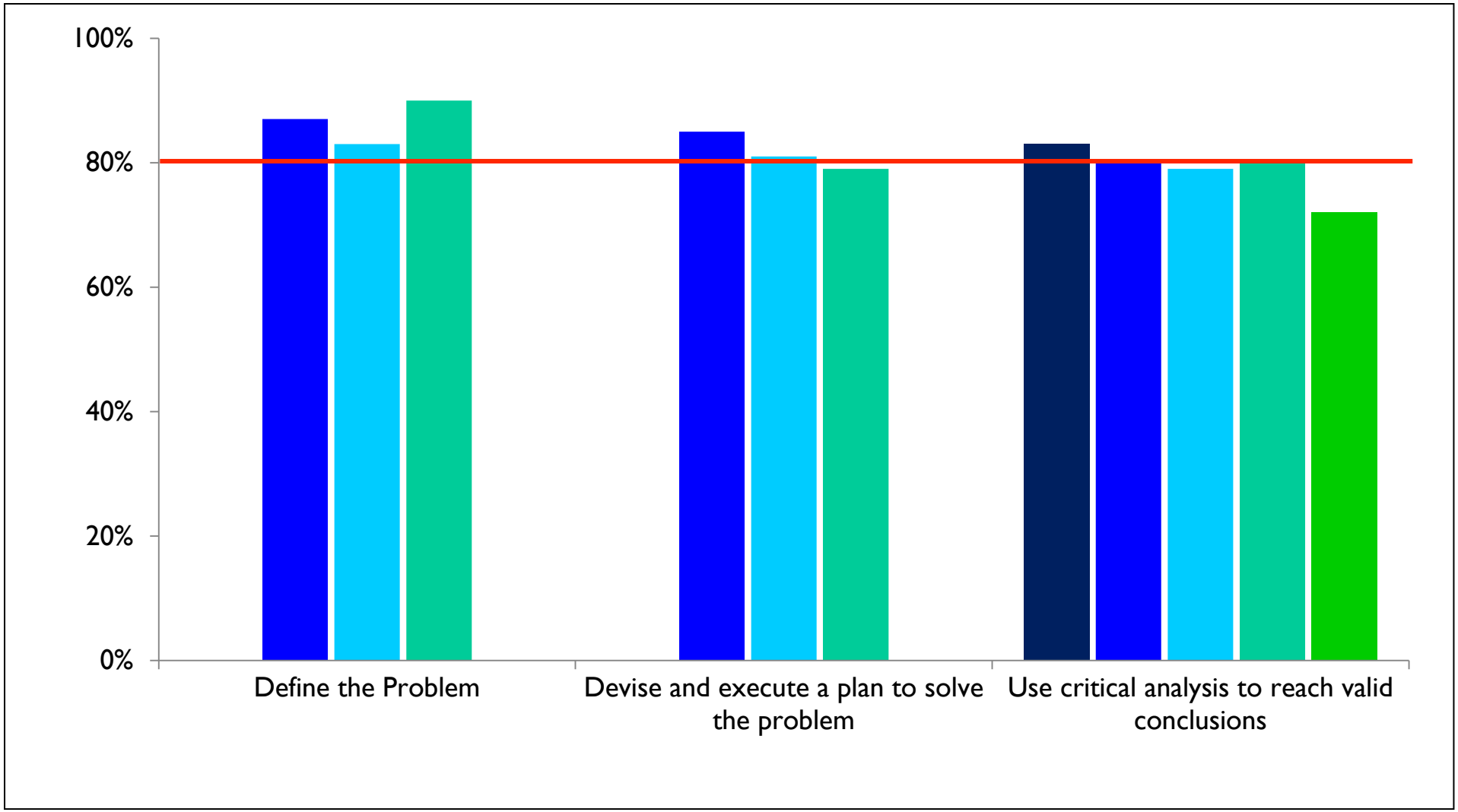
Reduces variations between grades (increase reliability)
Describes clear expectations for both instructor and students (increase validity)

# Evaluation Reformatted as Rubric (UBC)

| Criterion | Level of Mastery | | | |
|---|---|---|---|---|
| | **Unacceptable** **0** | **Below Expectations** **1** | **Meets Expectations** **2** | **Exceeds Expectations** **3** |
| **2.1 Problem Identification** | Team is NOT able to identify the parameter they are using the prototype to study. | Parameter studied is NOT directly relevant to project success. | Parameter studied is appropriate for project, AND the team is able to provide *some* justification why. | Parameter studied is appropriate for project, AND the team is able to provide *strong* justification why. |
| **3.2 Investigation Design** | Team has NOT built a prototype. | Prototyping method is NOT appropriate for the parameter being studied (i.e. will not yield desired data). | Prototyping method is *at least somewhat* appropriate for the parameter being studied; a simpler approach MAY exist | Prototyping method is appropriate for the parameter being studied, AND the team is able to *clearly* justify why the physical prototype used is superior to other physical or virtual prototypes. |
| **3.3 Data Collection** | No data collected; prototype does NOT work | The prototype works BUT data collection / analysis techniques are inappropriate. | Data collection and analysis are done appropriately AND data quality is *fair*. | Data collection and analysis are done appropriately AND data is of *high* quality. |
| **3.4 Data Synthesis** | No conclusions are drawn, OR inappropriate conclusions are drawn. | Appropriate conclusions are drawn from the data, BUT the team is NOT able to explain the how the data affects the project. | Appropriate conclusions are drawn from the data, AND the team is able to provide *some* explanation of how the data affects the project. Some implications are overlooked. | Appropriate conclusions are drawn from the data, AND the team is able to provide *strong and complete* explanation of how the data affects the project. |
| **3.5 Analysis of Results** | The team does NOT consider limitations or errors in the tests, or validity of the conclusions. | The team considers errors, limitations, and validity in the tests, BUT does NOT quantify errors or take appropriate action. | The team quantifies errors, and considers limitations and validity, AND takes action, BUT action is *limited* or somewhat inappropriate. | The team quantifies errors, and considers limitations and validity, AND is able to *justify* and take appropriate action. |

# Histogram for Communication (UofT)

Percentage of students who meet or exceed performance expectations in indicators



# Assessment schedule

- Some programs are using a rolling 3 year cycle, e.g. divide 12 attributes into 3 groups (A, B, C)
  - Year 1: Gather data on group A
  - Year 2: Gather data on group B, analyze data and develop improvement for group A
  - Year 3: Gather data on group C, analyze data and develop improvement for group B, implement changes from group A

  etc.
- Another approach: follow cohorts through program

# Now that we have data… analyze and evaluate

- Remember: the driving question is “what do we want to know to improve our program?”, not “what does CEAB want us to do?”
- Not a “checklist” or “hoop jumping” exercise
- Organize data in a meaningful way that allows you to identify strengths, trouble spots, trends,…
- Look for how many students are meeting program expectations
- Look for validity and reliability in your assessments

- Some examples…

# General advice

- Capitalize on what you're already doing: innovators, first adopters, experimenters
- Start from the question “what do we want to know to improve our program”, rather than “what does CEAB want us to do” – think of this as self-directed learning!
- Don't generate reams of data that you don't know what to do with: create *information*, not *data*
- Dean/chair support can help encourage large scale curriculum development

# Summary: Analysis and interpretation

- Use measured data to evaluate how well students are meeting expectations
- Consider how valid and reliable data is
- What areas need to be strengthened?

Questions/comments?

# End of workshop 1