

# Workshop 3A

## Planning an Outcomes-Based Process

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# Agenda

**Program Overview  
(Background)**

**Methodology-  
Data Collection Plan**

**Results**

**Recommendations**

Together we  
will explore the  
elements of a  
continuous  
improvement  
process to further  
develop an  
assessment plan  
for the  
accreditation  
process

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## Continuous Program Improvement Resources

### Welcome

The EGAD Project group has adopted an approach to supporting outcomes-based curriculum development based on the following 4 tenets of effective practice. Through them our intention is to engage engineering educators, students and the engineering community in ensuring that engineering programs graduate students who are ready to meet the needs of an increasingly changing and complex society, while at the same time supporting the tenets of academic freedom and respecting the learning culture and resource parameters of individual institutions.

1. Outcomes-based curriculum development is a process of the continuous improvement of sustainable practices
2. Outcomes achievement is a responsibility shared by faculty and students.
3. There is a culture of autonomy and academic freedom within courses and curriculum in higher education
4. A scholarly approach to curriculum development includes processes that are faculty-driven, data-informed and literature-supported. The process is further supported by a scholarly approach to analysis, application, teaching and assessment.

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## Continuous Program Improvement Resources

### Welcome

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# Graduate Attributes Evaluation

- The program is assessed, not the students
- Continuous improvement process
- Not required to assess every student
- Not required to assess in every course
- Not required to assess every year

Goal: gather evidence on learning to

- i) Benchmark program
- ii) Improve curriculum

# Continuous Improvement Process

## “Big Picture”

- Are students meeting expectations?
  - In what areas are they successful
  - What areas require improvement
- What data would help us improve our program?
- Example: Retention study

# What to look for: Program Background

- Is the program clearly described?
  - Is there a curriculum map?
- Is the context of the program clear?



A curriculum map is like a process design on paper

It describes how the curriculum should work



# What to look for: Curriculum Mapping

- Information in the map is
  - Accurate, with some depth
  - Identifies intended outcomes from learning experiences
  - Not simply a list of topics “covered”
- Map provides information for each attribute
  - Can include curricular and other experiences



## What to look for:

# Curriculum Mapping

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# Curriculum Map

Examples from UofT report  
(cue example)

# Methodology: Data Collection Plan

- On what does the program propose collecting data (i.e. indicators)?
- What methods are proposed for collecting data?
- Is the data collection plan good?

An indicator is like a sensor: what indicators has the program chosen?

Where have they placed their indicators? Where are the data collection points?

Does the proposed data collection plan make sense?



# Terminology for data collection

## **Direct measures**

- directly observable or measurable assessments of student learning

## **Indirect measures**

- opinion or self-reports of student learning or educational experiences

## **Valid**

- measure what they are supposed to measure

## **Reliable**

- the results are consistent; the measurements are the same when repeated with the same subjects under the same conditions

# What to look for: Overall

- Integrity:
  - Quality of the data collection plan
    - Indicators
    - Assessment points chosen
  - Valid, reliable data collection proposed
  - Plan is cyclic, continuous
- Results will be useful for informing curriculum change

# What to look for: Indicators

What to look for:

- Indicators align with attributes and questions
- Indicators are “leading indicators”:  
central to attribute; indicate competency
- Enough indicators defined to identify strength areas  
and weak areas within an attribute
- Not too many indicators – resulting in reams of data  
but little deep information
- Indicators are clearly articulated and measurable

# Discussion: Indicators

1) For Attribute #3 (Investigation), which of the following potential indicators are appropriate?

- a) Complete a minimum of three physical experiments in each year of study.
- b) Be able to develop an experiment to classify material behaviour as brittle, plastic, or elastic.
- c) Be able to design investigations involving information and data gathering, analysis, and/or experimentation
- d) Learn the safe use of laboratory equipment
- e) Understand how to investigate a complex problem

**Investigation:**

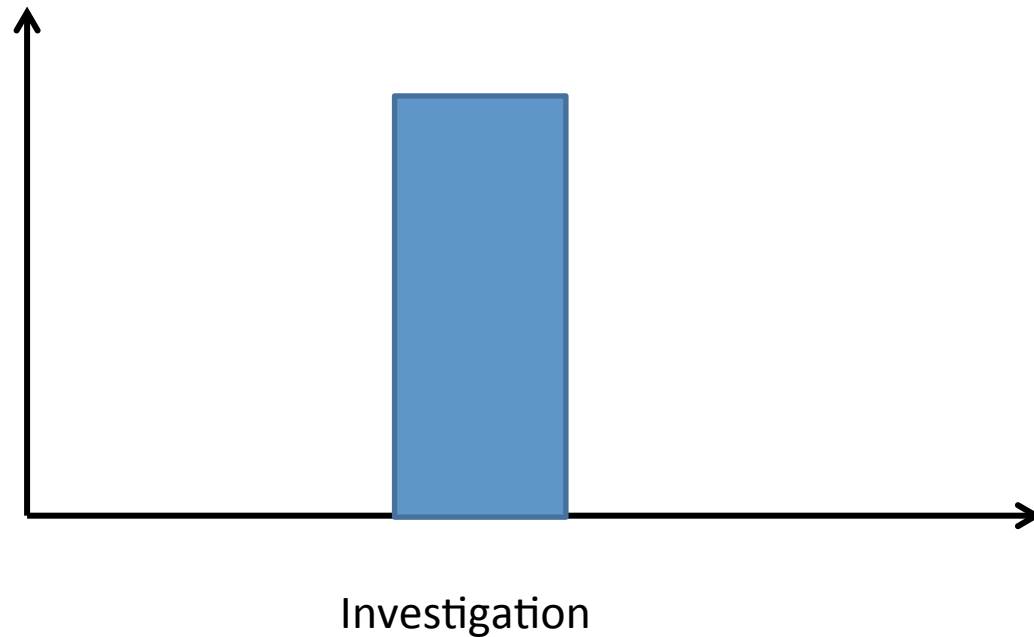
An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions



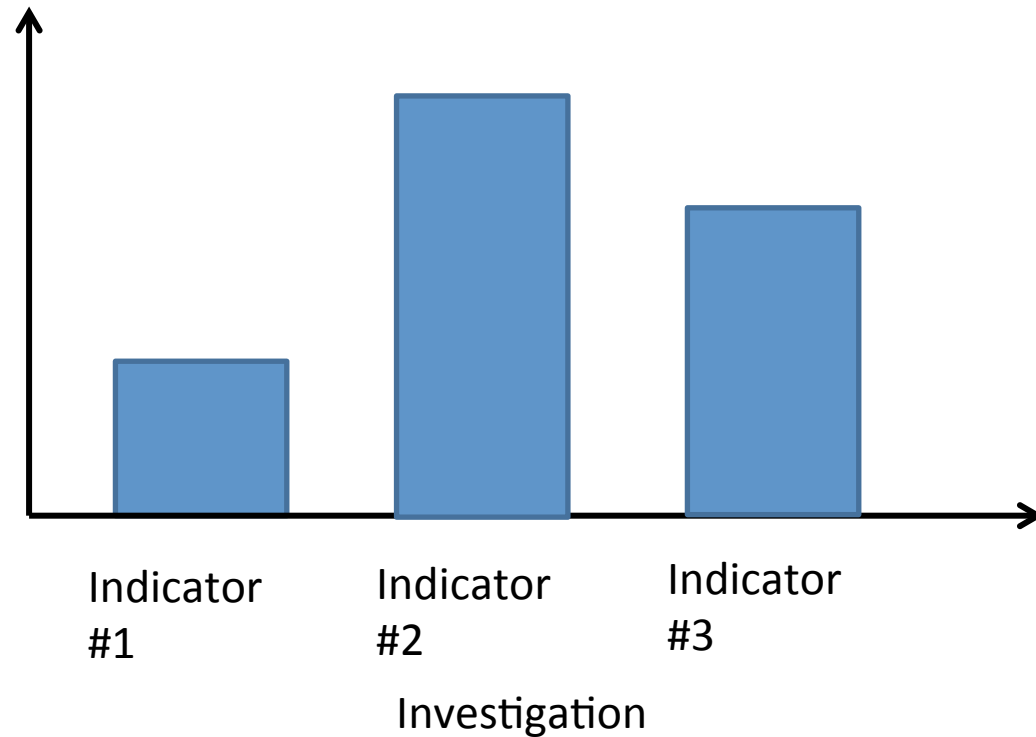
# Indicators

Examples from UofT report  
(cue example)

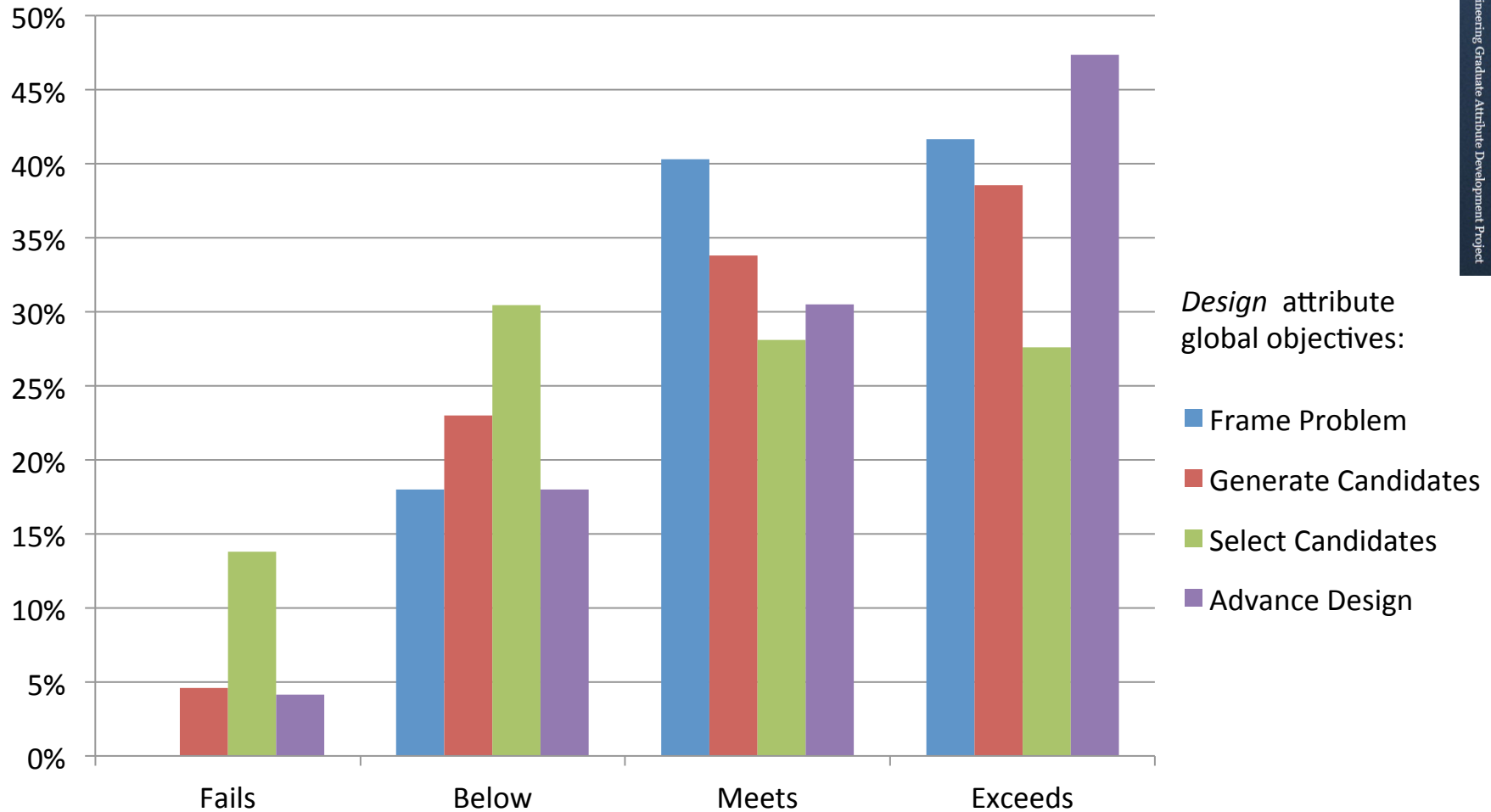
# How many indicators is enough?



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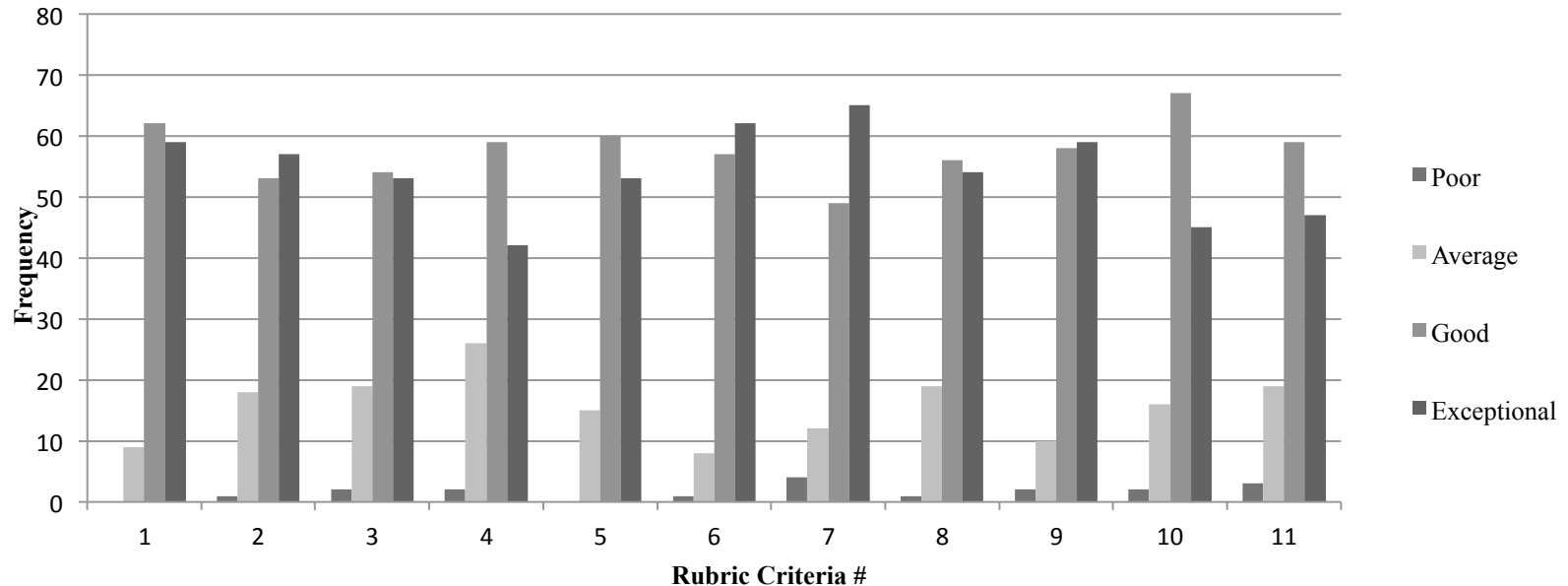
# How many indicators is enough?



**Figure 10: Percentage by category for *Design* attribute global objectives**  
(taken from UofT 1<sup>st</sup> year report, 2012)

# How many indicators is enough?

## Thesis Final Report: Investigation



- 1.Establishes context necessary to facilitate thorough understanding of thesis work in a concise manner.
  - 2.Explains theoretical concepts important to understanding of thesis work.
  - 3.Identifies, summarizes and synthesizes relevant research in constructing an understanding of current state of field.
  - 4.Enables deeper understanding of research question/design problem through analysis of research in the field, indicating a path for moving research forward.
  - 5.Establishes a clear research gap/design problem, makes a convincing case for the significance of proposed research work.
  - 6.Identifies goal for thesis work that explicitly addresses this gap/problem; provides clear purpose statement.
  - 7.Describes methods or design in sufficient detail to enable understanding of work done.
  - 8.Provides justification for methods chosen or design decisions made.
  - 9.Results displayed clearly in organized manner, using appropriate figures or graphics; key results highlighted.
  - 10.Engages with and explains results intelligently.
  - 11.Identifies key claims to be drawn from results of research or design evaluation, qualifies them appropriately.
- (UofT Eng. Sci. report, 2012)

# Selecting Assessment Points

- Learning is generally demonstrated through:
  - Artifacts, e.g. written test, report, built project
  - Performances, e.g. oral presentation, observed practice
- What to look for:



Indicators are well aligned to the proposed assessment points

Enough assessment points are utilized

Expectations of performance quality are clear, i.e. the scale is defined

# Why not JUST use grades?

## Student transcript

Electric Circuits I	78
Electromagnetics I	56
Signals and Systems I	82
Electronics I	71
Electrical Engineering Laboratory	86
Engineering Communications	76
Engineering Economics	88
...	
Electrical Design Capstone	86

How well does the program prepare students to solve open-ended problems?

Are students prepared to continue learning independently after graduation?

Do students consider the social and environmental implications of their work?

Course grades usually aggregate assessment of multiple objectives, and are *indirect* evidence for *some* expectations

What can students do with knowledge (plug-and-chug vs. evaluate)?



## Ethics and Equity

### 3.1.10.A: Demonstrate the ability to recognize ethical and equity based dilemmas.

3.1.10.A.1: Distinguish the differences between ethics, and legality (i.e. legal standard).

3.1.10.A.2: Articulate the issues involved in ethical case studies (given a case study).

3.1.10.A.3: Articulate the issues involved in case studies involving equity problems.

### 3.1.10.B: Demonstrate the ability to apply the Code of Ethics and equity principles.

3.1.10.B.1: Analyze a case, describe and defend an appropriate response in which the Code of Ethics is applied .

3.1.10.B.2: Ability to work with a diverse group of people(s) in a mutually respectful manner.

3.1.10.B.3: Apply a code of ethics and/or equity principles in the context of a course project or team project.

## APS 111: ES&P I

**Final Exam Long Answer Grading Rubric, Criteria 1-9**

## APS 150: Ethics in Engineering

*Formal assessment required*

# Triangulation

1. Include opportunities for informal assessment, students' self-reports of learning, and even unsolicited data from placement supervisors or employers
2. Use more than one type of assessment when analyzing data
3. Value all assessment not just major events
4. Use the data gained from assessment to answer questions about authentic learning
5. Look at data across time intervals

**Improves reliability and data value**

# Rubrics: Provide a scale/benchmark

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 graders (increase reliability)

Describes clear expectations for both instructor and students (increase validity)

Rubric example  
(cue rubric example)

# Assessment Plan

- Continuous
- Sustainable
- Collects usable data → information
- Used to improve curriculum  
not fulfill a data volume requirement

## What to look for:

# Results

- Is the data clearly presented? Did the program follow through the data collection plan?
- On which Graduate Attributes is programming focused?
- Where are the focus attributes being best supported?
- Which Graduate Attributes are reported as getting the least attention?
- Where are the strengths: where are students meeting or exceeding expectations?
- What gaps exist in the program? Where are the weaknesses in student learning?
- Where in the program is student development being best supported?  
And where is there need for better support?
- Timing of data collection & analysis

# Results

- What do you look for in the Results



# *Recommendations*

- What do you look for in the Recommendations?
  - Analysis of the data is clear and well grounded
  - Results are used to inform curriculum changes
  - Loop is closed:
    - plan in place to implement recommendations
    - plan in place to measure efficacy of changes