Running a Continuous Program Improvement Process in Engineering

CEEA 2018 EGAD Workshop 1
Brian Frank, Margaret Gwyn, Peter Ostafichuk

Instructions: Please form groups with people from different institutions and introduce yourself. Please individually respond to the survey.
Use link at http://bit.ly/egad-3d or QR code

EGAD Project

Who: 17 Faculty and Staff across Canada, supported by engineering deans

Goal: Training and resources to support assessment and curriculum development

How: Encourage good practices to support learning in engineering that will also meet CEAB requirements.

egad.engineering.queensu.ca

Goal: Resources and training to support engineering program improvement.

(that aligns with CEAB GA/CI requirements)

Workshop goals

By the end, be able to:

1. Analyze your institution's continuous improvement (CI) process using a CI framework
2. Be able to compare key elements of the Continuous Improvement (CI) process at your institution to those at other institutions.
3. Identify at least three specific ways that your CI process could be improved.

Slides (for reference) are available at: http://bit.ly/CEEA2018-EGAD1

CEEA 2018: EGAD Workshops

EGAD Workshop # 1 - Running a continuous improvement process in engineering
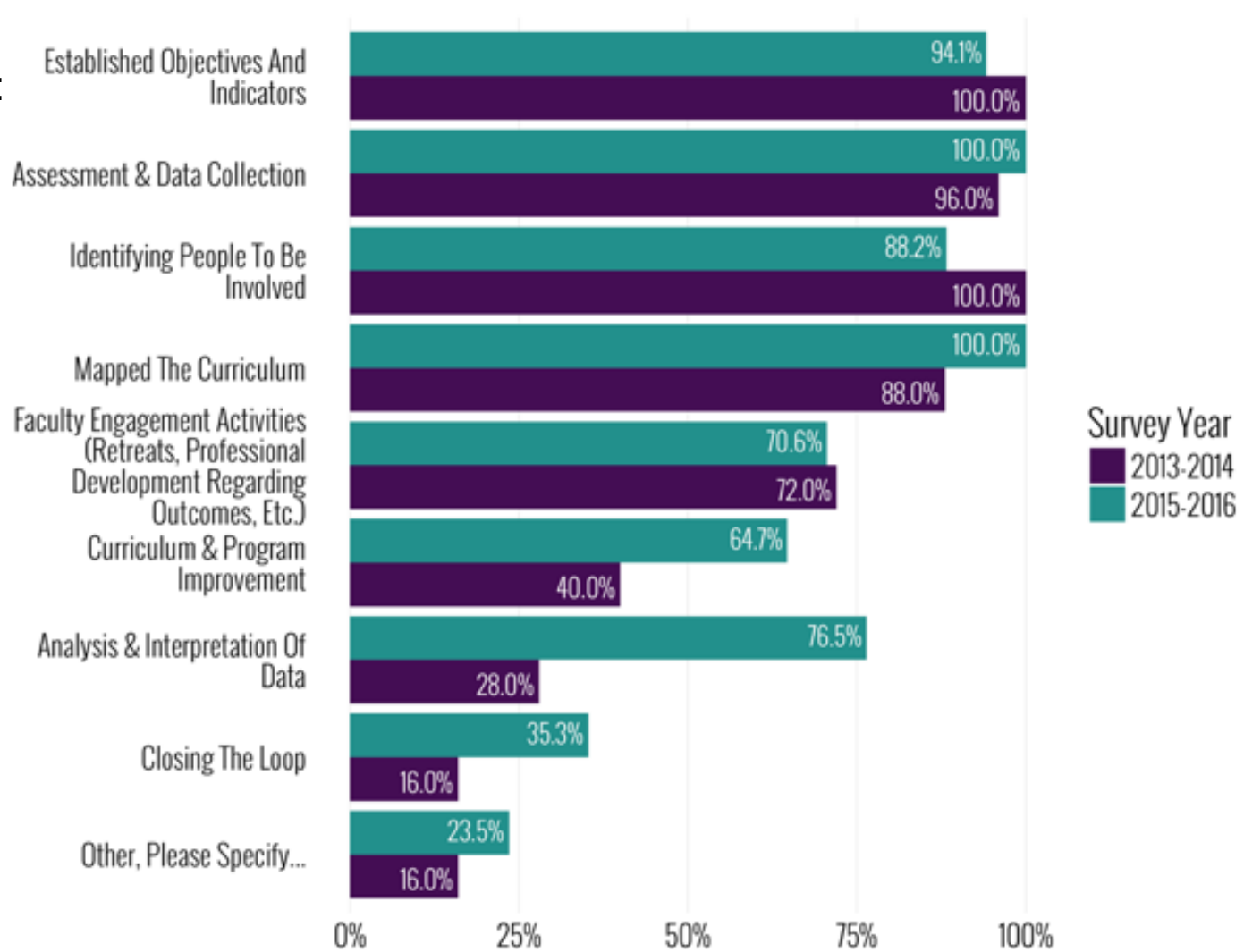
EGAD Workshop # 2 - Working with Data

Workflow and tools

Follow-up on temperature in the room survey

https://www.mentimeter.com/

2 Mapping
the Curriculum

3 Collecting
the Data

1 Defining
Program Objectives and Indicators

4 Analysing
and Interpreting the Data

6 Managing
and Implementing Change

5 Improving
Curriculum and Processes

Survey of Canadian Engineering Programs: 2013, 2015

Established Objectives And Indicators: 94.1%, 100.0%

Assessment & Data Collection: 100.0%, 96.0%

Identifying People To Be Involved: 88.2%, 100.0%

Mapped The Curriculum: 100.0%, 88.0%

Faculty Engagement Activities (Retreats, Professional Development Regarding Outcomes, Etc.): 70.6%, 72.0%

Curriculum & Program Improvement: 64.7%, 40.0%

Analysis & Interpretation Of Data: 76.5%, 28.0%

Closing The Loop: 35.3%, 16.0%

Other, Please Specify...: 23.5%, 16.0%

Survey Year
2013-2014
2015-2016

How many feel they can draw *some* valid conclusions from assessment data sufficient to warrant a change in a course or program?

Six step process	People (think about faculty, staff, students, alumni, industry, administration in Department, Faculty, and University)	Processes (think about workflow, tools, organizational structure, documents, guides)	Data (think about qualitative and quantitative, direct and indirect)
Common questions about all steps	PE1. Who implements vs. who manages and reviews? PE2. Who communicates/consults, and to which groups? PE3. How is community educated?	PR1. How often is this reviewed? PR2. How is it linked to governance? PR3. What guides, forms, and templates are used?	D1. How is this stored and updated? D2. How is this communicated? D3. How is this used?
1.Objectives and indicators			
2. Mapping			
3. Collecting data		?	
4. Analyzing & interpreting			
5. Decision making			
6. Managing and implementing change			

Like the CI process, our survey used quantitative and qualitative data…

#	Field	People		Processes		Data		Total
1	Objectives and indicators	40.00%	2	20.00%	1	40.00%	2	5
2	Curriculum Mapping	0.00%	0	60.00%	3	40.00%	2	5
3	Collecting Data	0.00%	0	50.00%	4	50.00%	4	8
4	Analyzing and Interpreting (Sensemaking)	18.75%	3	43.75%	7	37.50%	6	16
5	Decision Making	25.00%	2	25.00%	2	50.00%	4	8
6	Managing and Implementing Change	40.00%	4	30.00%	3	30.00%	3	10

Questions from survey

How much detail is enough when **processing data**?

What techniques are people using to **gather, document, and communicate their data** in a way that is not time and resource prohibitive?

How can **GA data can be presented, interpreted, and used** as a productive part of the CI process, with practical examples

Get familiar with the processes involved in **closing the loop** and **making decision** for improvement actions.

Learn about others' CPI processes to improve my process

How to **make the process more efficient**, so that is not too overwhelming and can be implemented in a way that can keep continuously running during the delivery of the curriculum and not at the end.
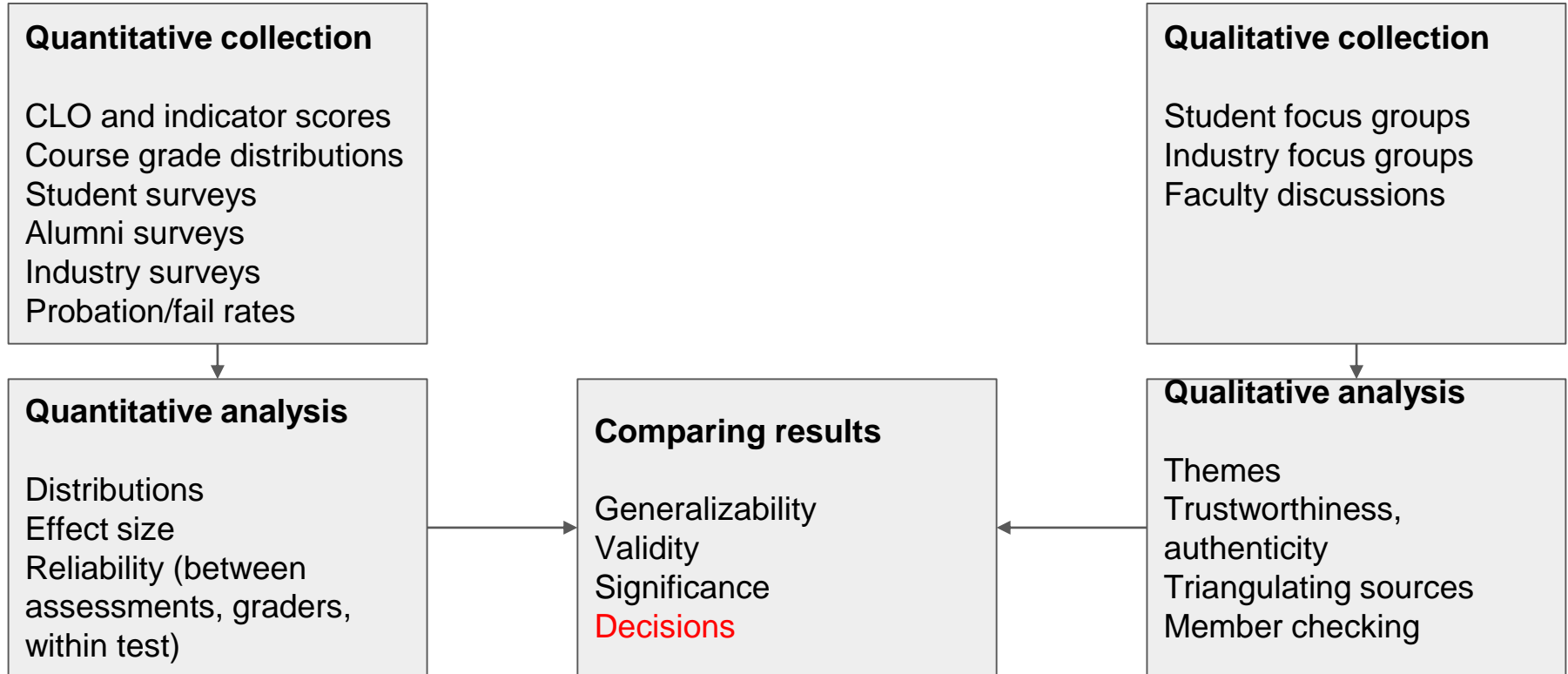
Data normalization, in particular to the weighting of data skewing validity of results.

Questions from survey

How much detail is enough when **processing data**?

What te[...]**e their data** in [...]

How ca[...]ve part of the C[...]

Get fam[...]

decisio[...]

Learn about others' CPI processes to improve my process

How to **make the process more efficient**, so that is not too overwhelming and can be implemented in a way that can keep continuously running during the delivery of the curriculum and not at the end.

Data normalization, in particular to the weighting of data skewing validity of results.

Overall: building an efficient CPI process with an emphasis on data collection and analysis

Six step process	People (think about faculty, staff, students, alumni, industry, administration in Department, Faculty, and University)	Processes (think about workflow, tools, organizational structure, documents, guides)	Data (think about qualitative and quantitative, direct and indirect)
Common questions about all steps	PE1. Who implements vs. who manages and reviews? PE2. Who communicates/consults, and to which groups? PE3. How is community educated?	PR1. How often is this reviewed? PR2. How is it linked to governance? PR3. What guides, forms, and templates are used?	D1. How is this stored and updated? D2. How is this communicated? D3. How is this used?
3. Collecting data	*Common questions PE1, 2, 3* Who aggregates and stores all data?	*Common questions PR1, 2, 3* How is collection managed year to year? Are all attributes collected every year?	What range of data is collected? How is consistency ensured in how data is coded and communicated?
4. Analyzing & interpreting	Who implements vs. who manages and reviews? Who communicates/consults, and to which groups? How is community educated? Who analyzes and validates?	What tools are used for analyzing and validation? What guides, forms, and templates are used? How is it linked to governance? How often is this reviewed?	How is it analyzed, including evaluating reliability/validity? How is it reported? How are conclusions drawn?
5. Decision making	*Common questions PE1, 2, 3*	*Common questions PR1, 2, 3*	*Common questions D1, 2, 3*
6. Managing and implementing change	What is the clear shared purpose for the CPI process? Who implements workflow?	How is purpose of the process communicated? What is the overall workflow?	

3 Priming models to think about

1. Analyzing and interpreting (adapted from mixed method concurrent triangulation strategy, Creswell)

Quantitative collection

CLO and indicator scores
Course grade distributions
Student surveys
Alumni surveys
Industry surveys
Probation/fail rates

Quantitative analysis

Distributions
Effect size
Reliability (between assessments, graders, within test)

Comparing results

Generalizability
Validity
Significance
Decisions

Qualitative collection

Student focus groups
Industry focus groups
Faculty discussions

Qualitative analysis

Themes
Trustworthiness, authenticity
Triangulating sources
Member checking

2. Change management process in higher ed (Kezar, Kotter, Leuke)

1. Establish commitment of stakeholders
2. Develop a shared vision
3. Identify data, expertise, challenges
4. Identify leadership
5. Select strategies and interventions
6. Create short-term wins, consolidate and build on gains
7. Monitor impact, adjust strategies
8. Institutionalize the changes

3. Framework of change strategies.

Borrego, M. & Henderson, C. Increasing the Use of Evidence-Based Teaching in STEM Higher Education: A Comparison of Eight Change Strategies. *J. Eng. Educ.* **103,** 220–252 (2014).

Examples of Facilitating Change in Engineering at Queen's

ASPECTS OF SYSTEM TO BE CHANGED			
	Individuals	1. Disseminating: Curriculum and pedagogy	2. Developing: Reflective teachers
		A. Support and reward innovators through educational enhancement grants and support by educational developer B. Faculty and TA training	A. Research project to support individuals to rethink assessment
	Environments and Structures	3. Enacting: Policy	4. Developing: Shared vision
		A. Building *meaningful* continuous improvement process for accreditation	A. Teaching and learning fellows working intensely with and connecting instructors in a department to support shared plan B. Engineering Change Lab
		Prescribed	Emergent
		INTENDED OUTCOME	

Let's form discussion groups

Five groups of roughly 4 people

Topics:
1. Analyzing & interpreting
2. Managing and implementing change

Task 1: Identify your current process and issues

Instructions: Move to a table that reflects the aspect of the CPI process you would like to discuss.

1. Individually take 3 minutes to
   ○ Summarize your current process for that aspect, 3-5 points
   ○ Identify lingering questions or areas of concern you have that you would like input on
2. At your table, each person take 2 minutes to share the above and answer brief questions
3. As a table, identify 1-2 key elements that you think others in the session would like to hear, and designate a speaker.

Task 1 *Report out*

Instructions

Each table: Identify key elements about your aspect that you think others would like to hear.

A facilitator will take notes.

Questions about process

Are they supporting continuous improvement in student learning?
Are they built to encourage participation and support from most faculty and students?
Are they built to be informed by future knowledge about *what* and *how* to teach?

Task 2: Making **improvements** to your program **improvement** process

Instructions

1. Using the instructions so far, take 3 minutes to individually identify some possible improvements to your process
2. Each person take 2 minutes to share what could be improved, and how they could do it. Others provide feedback.
3. Identify 1-2 things you think others would like to hear, and designate a speaker.

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Followup

Can we summarize the information from institutions and circulate out for information?

End of planned workshop slides
The remainder are to allow us to flip to as necessary.

Topic: Use of assessment data

Steps in order to *close the loop*
(i.e. gather evidence, make change, and gather evidence that change was effective)…

- Gather, evaluate, improve assessment (1-5 years)
- Re-assess until data is trustworthy (more years)
- Make curriculum changes (another year)
- Evaluate success of changes (another year)

This is a multi-year process!

Can assessment data be useful more quickly?

How else can this process be useful?

Broadening thinking about influence of assessment

Jonson, J. L., Guetterman, T., & Thompson Jr, R. J. (2014). An integrated model of influence: Use of assessment data in higher education. *Research & Practice in Assessment*, 9. http://bit.ly/Jonson2014-UsingData

"… a narrow conception of what constitutes *use* contributes to the conclusion that assessment results typically do not lead to improved educational practices and student learning. If definitions of use are too narrowly defined, some assessment efforts may be considered failures when those **efforts actually may have been very transformative but in unexpected or *slowly evolving ways*.**"

Broaden *Using* data to *Influence*

Jonson et al. (2014) used a model to code 19 reports documenting assessment methods, results, and conclusions at a research university.

Effects of assessment data can include:

Instrumental	Findings influence actions or decision making (traditional interpretation of "use");
Conceptual	Evaluation leads to different understandings or enlightenment
Affect	Disposition, emotion, or tendency
Affirmation	Findings confirm effectiveness of existing practices, policies or understandings

Assessment Data and Influence (Jonson 2014)

Table 1

Heuristic Model of Influence: Dimensions, Subtypes, and Definitions

Dimension	Subtype	Definition
Sources of Influence	Findings-based	Based on student learning evidence
	Process-based	Based on evidence about the process of assessment rather than on learning evidence including consideration of methodology or data (e.g., measurement issues, sample size).
Effects of Influence	Instrumental	Involves a direct action or a decision and commitment to take educational practice or policy actions.
	Conceptual/Cognitive	Involves new understandings, ways of thinking, or processing information that may lead to considering action but lacks the actual commitment to act.
	Affect	Involves participant's disposition, emotions, or tendency regarding assessment process or assessment evidence
	Affirmation	Involves a confirmation of the appropriateness or effectiveness of an existing practice, policy, or understanding.
Results of Influence	Improved student learning	Results in evidence of improved student learning.
	Personal transformation	Results in a personal transformation of stakeholders (e.g., feeling empowered and motivated, changes of beliefs).
	Communities of practice	Results in building new or strengthening existing communities of practice.
	Symbolic/Political	Results in generating or sustaining support for policies or practices.
Time of Influence	Immediate	Occurs concurrent with the assessment process.
	End of Cycle	Occurs surrounding the conclusion of an assessment cycle (e.g., end of term)
	Long-term	Occurs in the future or extends beyond the assessment cycle.

Examples (Jonson 2014)

Coding Results: Findings-based Sources of Influence and Effects of Influence Dimensions (n = 28 cases)
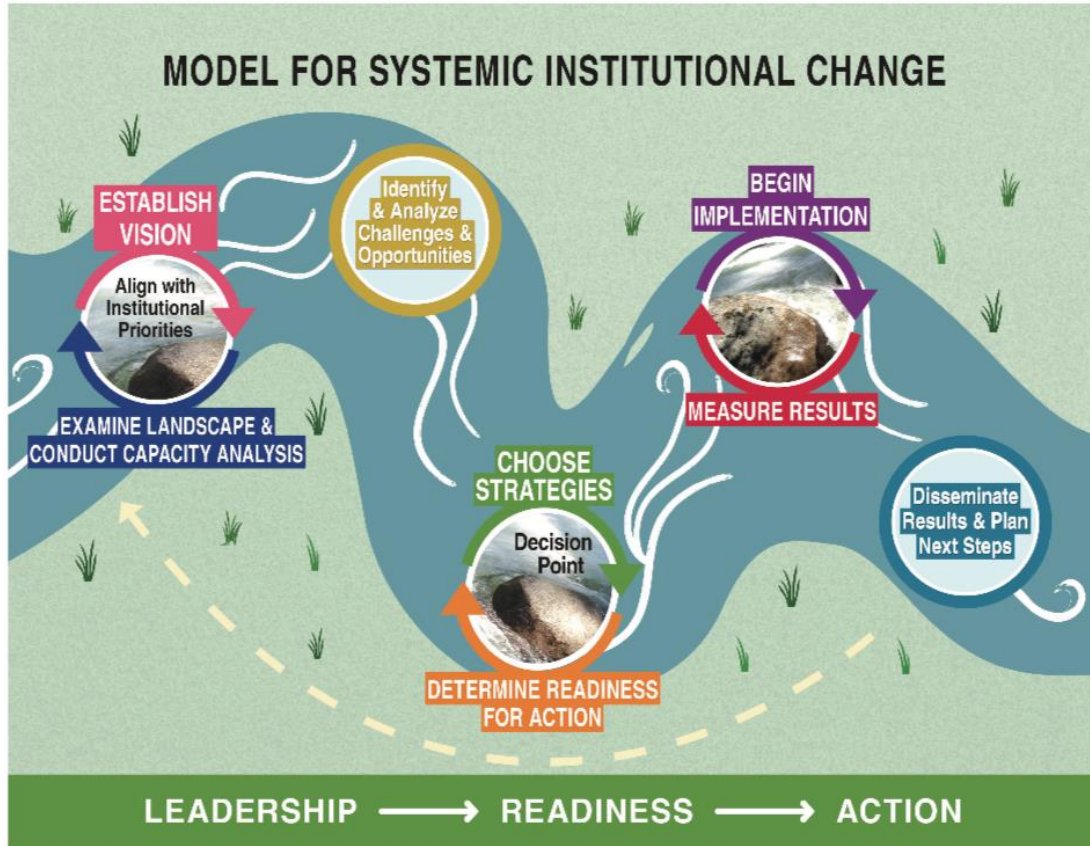
Effects of Influence	Case Examples
Instrumental (n = 6)	*Students write at an acceptable level but continue to struggle with expressing their ideas in a concise and readable way. Several adjustments have been made to help students produce acceptable writing. Specifically, a phased sequence of topic selection, outlining, rough drafts reviewed by instructor and peer groups members has been used.*
	Paper structure is being modified to focus on the application of core concepts. Specifically, common … problems are presented to students; students select one and (i) identify three core concepts related to the problem, (ii) develop an intervention, (iii) discuss how the intervention will impact core concepts, and (iv) develop a plan to assess the efficacy of the intervention. Hopefully this will force student to relate what they learn to the (real world environment)
Conceptual (n = 6)	*Faculty submitted samples of various types of questions with a range of difficulty, indicating that students found defining terms and identifying images easier than the more interpretive, analytical question that links work with more than one issue/answer.*
	Based on the letters evaluated, students demonstrated good technical knowledge, but some are in need of improved writing skills. Additional writing exercises may need to be incorporated into subsequent courses, so that students have additional opportunities to enhance their writing skills.
Affirmation (n = 9)	*Results of artifacts that demonstrate students' mastery of the student learning outcome seem to affirm the effectiveness of the department's efforts.*
	Assessment results confirmed what we already knew from the (exam) reports that student learning (of) the learning outcomes is high. No program changes are planned.

Engineering examples

Effects	Examples
Instrumental	• Course modification as instructor identifies deficiency in certain learning outcomes (e.g. evaluating information credibility) • Weakness in one attribute (e.g. problem analysis) • Program modification resulting from gap in curriculum map (e.g. ethics) • Reconsider volume of content (e.g. reduce workload) • Decision to spread workload better over a term • Decision to revisit indicators to be more relevant and measurable
Conceptual	• Better understanding of industry and student concerns as a result of involving them as a stakeholder (e.g. importance of multidisciplinary groups)
Affect	• Interest in regular agenda item on department meeting to talk about learning • Widespread recognition of value of active learning
Affirmation	• Able to articulate student abilities to prospective students and employers ("Your students are able to communicate and collaborate on their first day, and students are better prepared to work on teams than those from other engineering programs.") • A common departmental perspective on ability

Change Management

Change processes

MODEL FOR SYSTEMIC INSTITUTIONAL CHANGE

ESTABLISH VISION
Align with Institutional Priorities
EXAMINE LANDSCAPE & CONDUCT CAPACITY ANALYSIS

Identify & Analyze Challenges & Opportunities

BEGIN IMPLEMENTATION
MEASURE RESULTS

CHOOSE STRATEGIES
Decision Point
DETERMINE READINESS FOR ACTION

Disseminate Results & Plan Next Steps

LEADERSHIP → READINESS → ACTION

Elrod, S., & Kezar, A. (2017). Increasing Student Success in STEM: Summary of A Guide to Systemic Institutional Change. Change: The Magazine of Higher Learning, 49(4), 26–34.

Workshop Goals

1. Identify how assessment can influence program improvement.

2. Identify factors that influence decisions based on your assessment data.

Addressing CEAB Criteria:

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.

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.
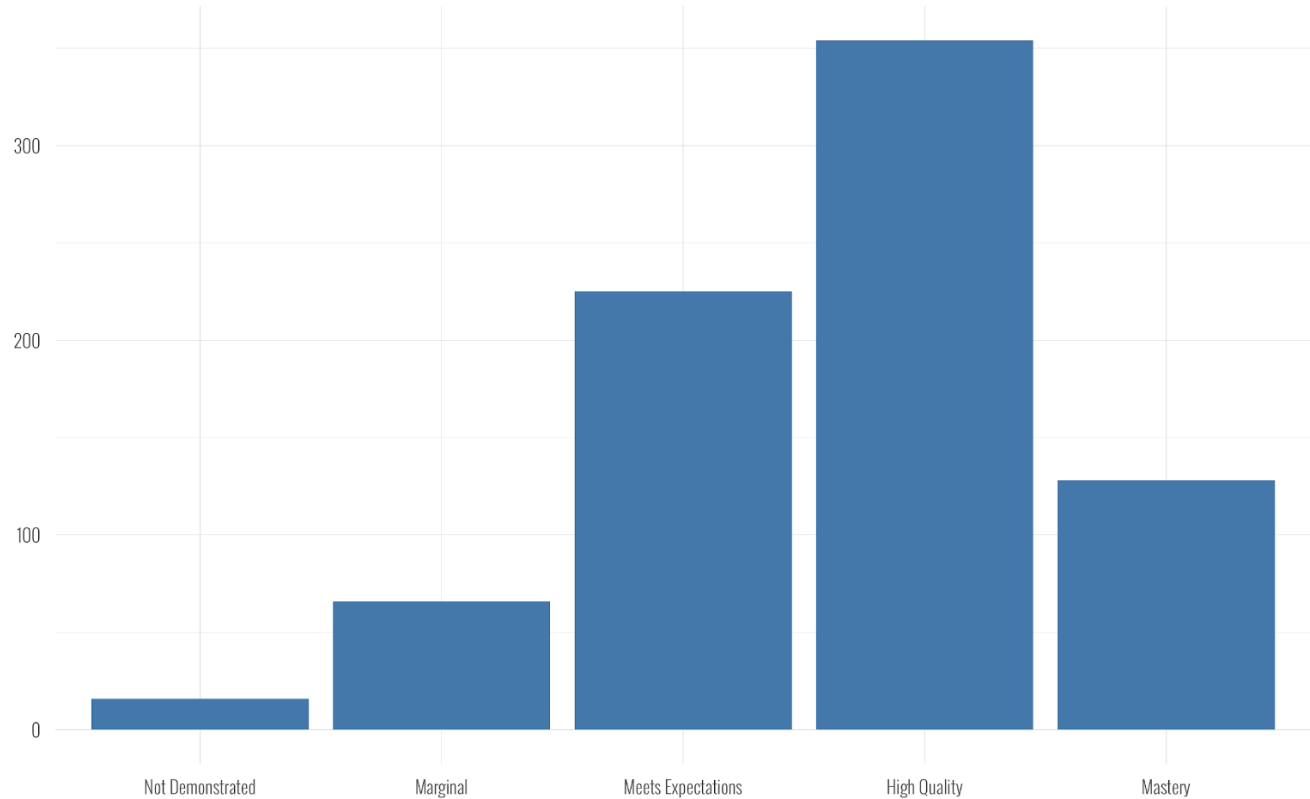
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What influence is assessment having?

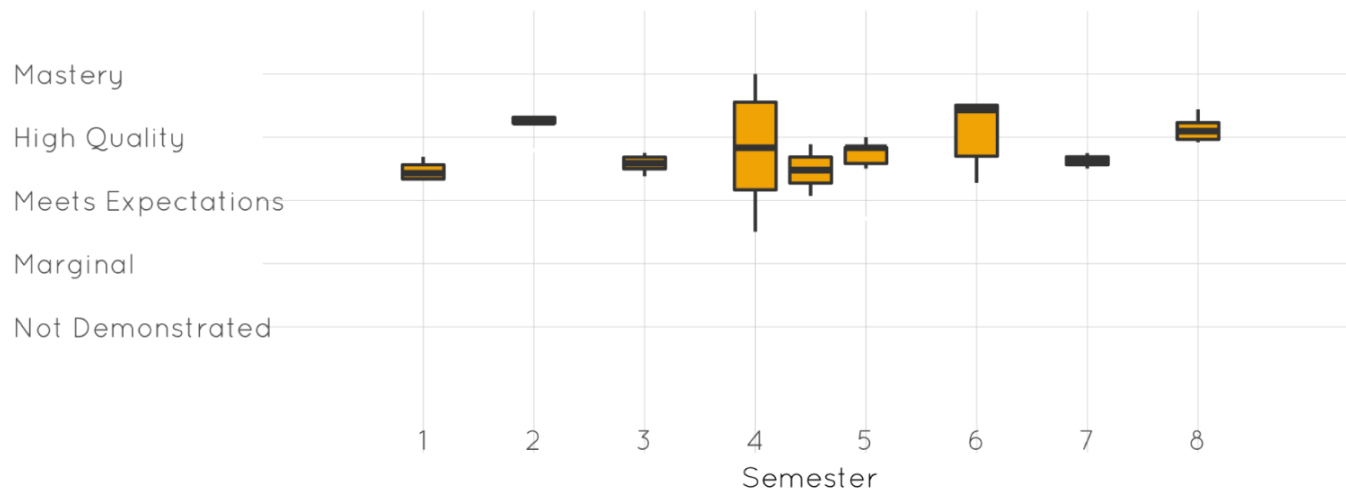# Within 1 course after 1 year of assessment

Histogram/Bar Chart of Student Performance
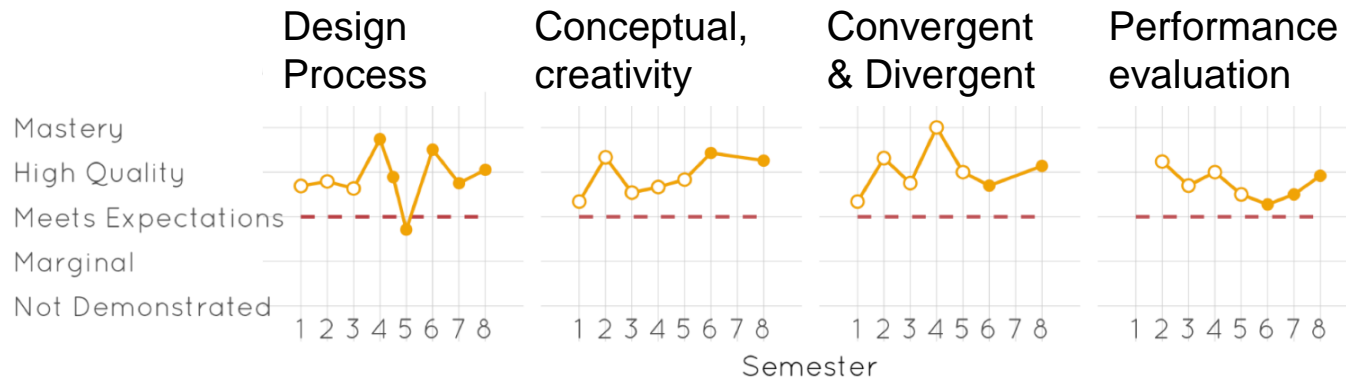
Number of students by performance level

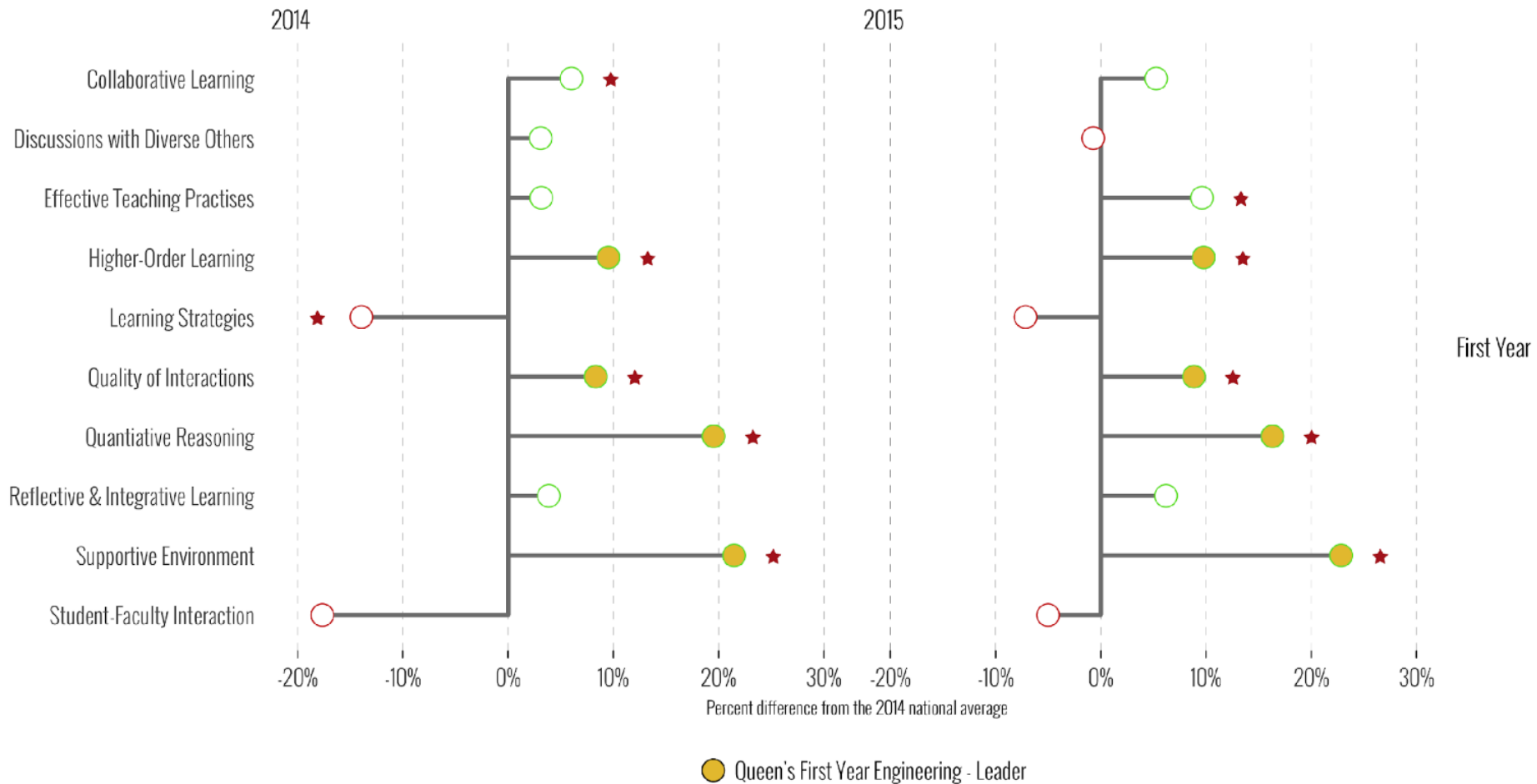| Not Demonstrated | Marginal | Meets Expectations | High Quality | Mastery |

Data from one year's assessment from all years of program
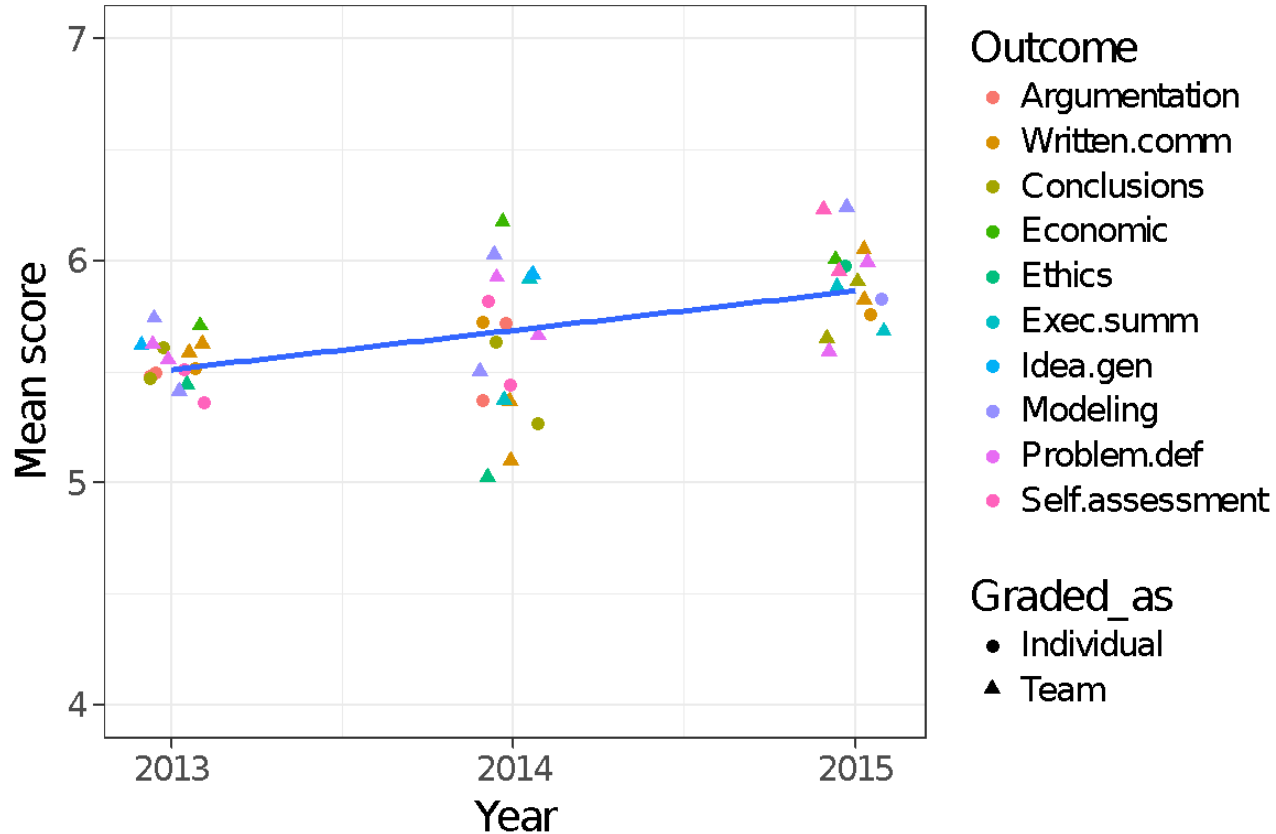
Design Overview

Samples of Design Indicators

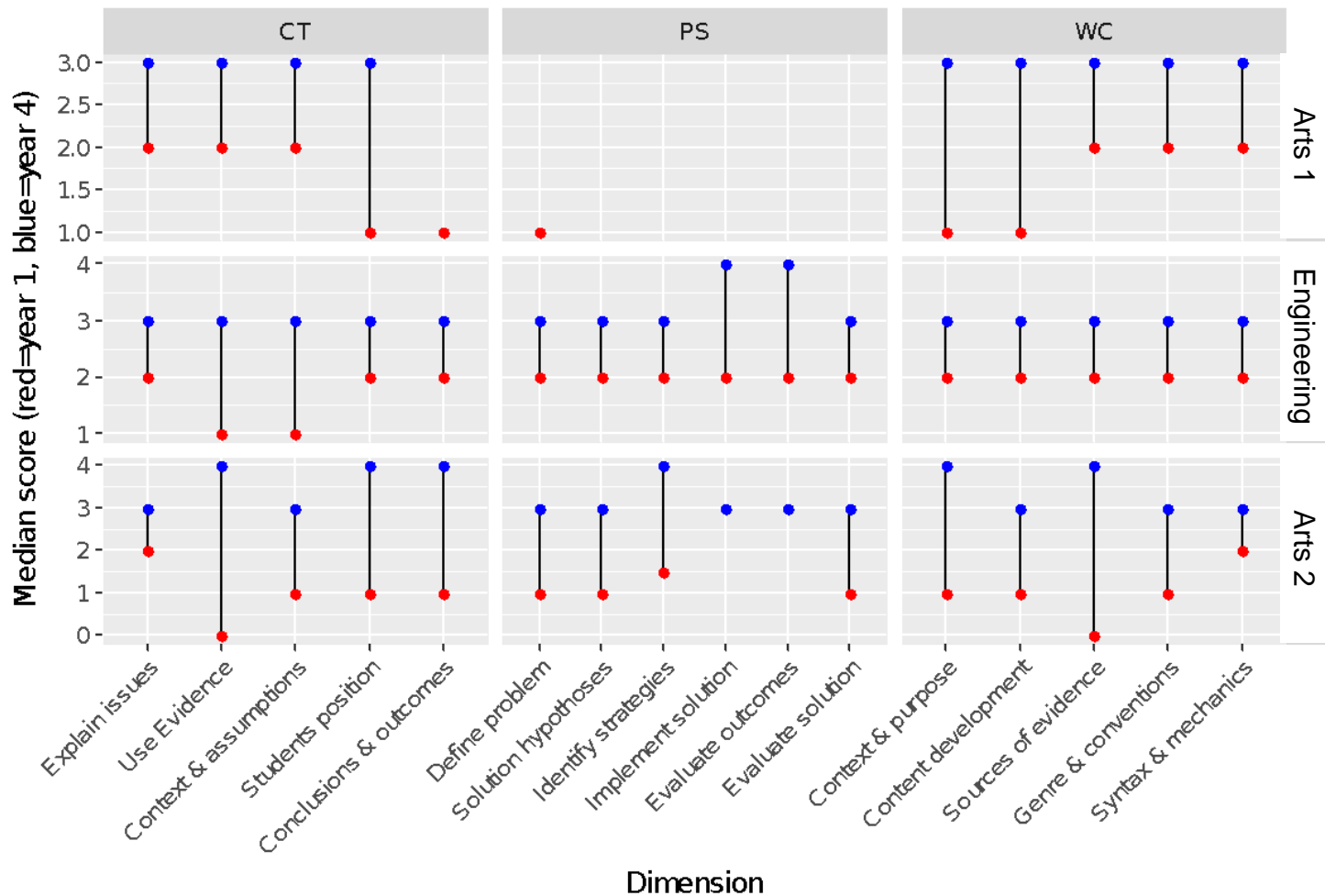National Survey of Student Engagement (from national sharing agreement)

Within 1 course after multiple years of assessment

Change in mean outcome scores from 2013–2015

Within program after 5 years of tracking a cohort

Change in rubric dimension from year 1 to 4

4th year
1st year

Workshop Goals

1. Identify how assessment influences program improvement.

2. Identify factors for making decisions based on your assessment data.

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.

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.

Factors that impact making decisions from data

A. Factors about data validity

- Reliability - consider multiple direct measures, plus indirect measures
- Significance of performance gap
- Known context about source of data

B. Factors about people

- What stakeholders are involved, and at what point in the process? People as data sources vs. Decision makers
- Who influences vs. makes decisions?

C. Factors about process

- Is work involved appropriate for the significance of the issue
- Timing - how often is evidence discussed, when
- Degree to which it supports long-term goal of improving student ability
- What is the official process (flowchart)
- How is data aggregated and reported at various points in process