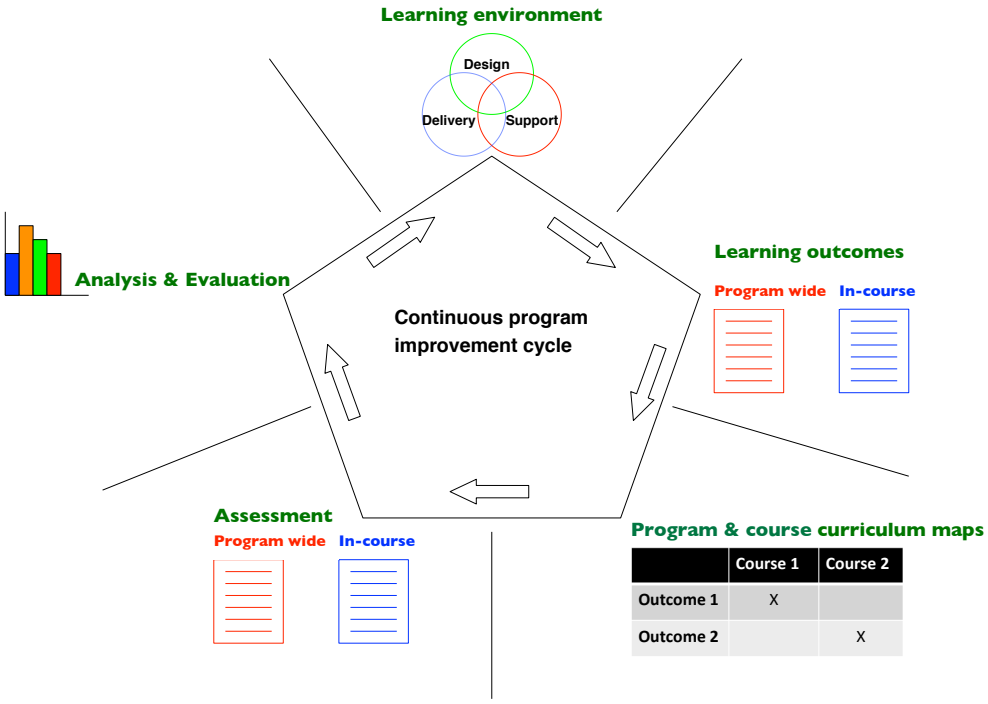
Data informed improvement workshop

December 4, 2014

OVERVIEW

EGAD Continuous Improvement Cycle

The figure below shows a continual process of improvement, that starts with what is known about the learning environment, including the design of the program, the student support system, and the delivery of courses. The information gathered in this process is used to make informed decisions about how these three can be improved.



BACKGROUND AND CONTEXT

Course Description

EDPS 101 is a first year design course, composed of three modules covering aspects of engineering design and professional practice: module 1 on problem analysis and modelling; module 2 on experimentation and measurement; and module 3 on engineering design. Each of these is one semester long and equivalent in weight to a standard one-semester engineering course.

Module 1 is designed to promote a sense of curiosity about engineering and provide opportunity for students to develop judgment and problem solving skills by tackling tasks that emulate engineering activities. It uses concepts from engineering sciences, natural sciences and mathematics courses to solve complex open-ended problems. The module is structured around two projects that were addressed sequentially over the semester, with classroom and studio activities providing explicit instruction and just in time learning for students to use in developing their solutions.

1. PROGRAM & COURSE LEARNING OUTCOMES

Program Learning Outcomes (indicators)

The indicators presented on the following pages are program level indicators and are specific to the first year program, and only for Problem Analysis, Design, Communication and Lifelong Learning. Attached to each indicator is a unique numeric code, providing a quick reference as to the attribute and year assessed by each particular indicator.

Course Learning Outcomes

The course learning outcomes presented on the following pages are specific indicators for the first module of the design course. These outcomes were developed by the course instructor, and reflect desired outcomes that the instructor has for the students. These course learning outcomes were developed to align with first year program learning outcomes (indicators) where possible.

CLO1 - Apply a prescribed process for solving complex problems

CLO2 - Select and apply appropriate quantitative model and analysis to solve problems.

CLO3 - Effectively communicate in written document following a prescribed format, using standard grammar and mechanics.

CLO4 - Apply concepts including occupational health and safety, economics, law, and equity to engineering problems.

CLO5 - Apply critical and creative thinking principles to solve contextualized problems.

CLO6 - Apply numerical modelling tool to create model used for solving complex problems.

CEAB Graduate Attribute	Indicator Code	Description
Problem analysis: An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions (3.1.2)	APSC-1-PA-1	Identifies known and unknown information, uncertainties, and biases when presented a complex ill-structured problem.
	APSC-1-PA-2	Constructs process for solving problem including justified approximations and assumptions.
	APSC-1-PA-3	Applies critical and creative thinking principles to solve contextualized problems.
	APSC-1-PA-4	Creates and applies appropriate quantitative model and analysis to solve problems.
	APSC-1-PA-5	Applies numerical modeling tool to construct model used for solving complex problems.
	APSC-1-PA-6	Identifies key questions to be asked in resolving a problem.
	APSC-1-PA-7	Evaluates validity of results and model for error, uncertainty.
	APSC-1-PA-8	Draws conclusions supported by evidence, with explicit reference to context in which they are true.
Design: An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations. (3.1.4)	APSC-1-DE-1	Follows a general design process to design system, component, or process to solve open-ended complex problem.
	APSC-1-DE-2	Accurately defines a problem, including constraints, goals, questions, stakeholders, and client needs.
	APSC-1-DE-3	
	APSC-1-DE-4	Produces a variety of potential design solutions suited to meet functional specifications based on stakeholder needs.
	APSC-1-DE-5	Performs systematic evaluations of the degree to which several design concept options meet project criteria.
	APSC-1-DE-6	Compares the design solution against the problem objective.
Communications: An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write eff ective reports and design documentation, and to give and eff ectively respond to clear instructions. (3.1.7)	APSC-1-CO-1	
	APSC-1-CO-2	Summarizes and paraphrases written work accurately.
	APSC-1-CO-3	Effectively communicates technical information following a prescribed format and using standard grammar and mechanics.
	APSC-1-CO-4	Delivers clear and organized formal presentation following established guidelines.
	APSC-1-CO-5	
	APSC-1-CO-6	Constructs effective figures, tables, and drawings employing standard conventions to compliment text.
Lifelong learning: An ability to identify and to 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. (3.1.12)	APSC-1-LL-1	Identifies the needed information resulting from an assigned project using a recommended structure.
	APSC-1-LL-2	Identifies appropriate information sources to meet the information need using a prescribed methodology from prescribed sources (e.g. Library Catalogue and a multidisciplinary database).
	APSC-1-LL-3	Evaluates information using simple prescribed criteria such as authority, currency, and objectivity.
	APSC-1-LL-4	Organises and manages information using a simple prescribed structure and format.
	APSC-1-LL-5	
	APSC-1-LL-6	Reviews, reflects on and makes improvements on individual learning performance.
	APSC-1-LL-7	Awareness of different learning approaches.

2. COURSE CURRICULUM MAP

The course level curriculum is more readily viewed, as a well crafted course syllabus will contain a detailed description of the objectives and themes of the course and the course learning outcomes. The full syllabus can be viewed here (bit.ly/1wy9gOk).

Presented below is the following pages is the mapping of the course outcomes to the specific program level outcomes. This course map provides an additional level of detail, mapping both program and course outcome to the assessment used in the course (Project 1 & 2).

CEAB Graduate Attribute	Indicator Code	EDPS101		
		Course Outcome	Project 1	Project 2
Problem analysis: An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions (3.1.2)	APSC-1-PA-1			
	APSC-1-PA-2	**CLO1**	**x**	
	APSC-1-PA-3			
	APSC-1-PA-4	**CLO3**		**x**
	APSC-1-PA-5	**CLO4**	**x**	
	APSC-1-PA-6			
	APSC-1-PA-7	**CLO2**	**x**	**x**
	APSC-1-PA-8	**CLO2**	**x**	**x**
Design: An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations. (3.1.4)	APSC-1-DE-1			
	APSC-1-DE-2	**CLO1**		**x**
	APSC-1-DE-3			
	APSC-1-DE-4	**CLO1**		**x**
	APSC-1-DE-5	**CLO1**		**x**
	APSC-1-DE-6			
Communications: An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write eff ective reports and design documentation, and to give and eff ectively respond to clear instructions. (3.1.7)	APSC-1-CO-1			
	APSC-1-CO-2			
	APSC-1-CO-3	**CLO5**	**x**	**x**
	APSC-1-CO-4			
	APSC-1-CO-5			
	APSC-1-CO-6	**CLO5**		
Lifelong learning: An ability to identify and to 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. (3.1.12)	APSC-1-LL-1			
	APSC-1-LL-2	**CLO2**	**x**	
	APSC-1-LL-3			
	APSC-1-LL-4			
	APSC-1-LL-5			
	APSC-1-LL-6	**CLO2**	**x**	**x**
	APSC-1-LL-7			

A more visual and detailed representation of the course mapping can be viewed here (bit.ly/1ClQl6E), and it provides mapping from program outcome down to the rubric outcome.

3. ASSESSMENT

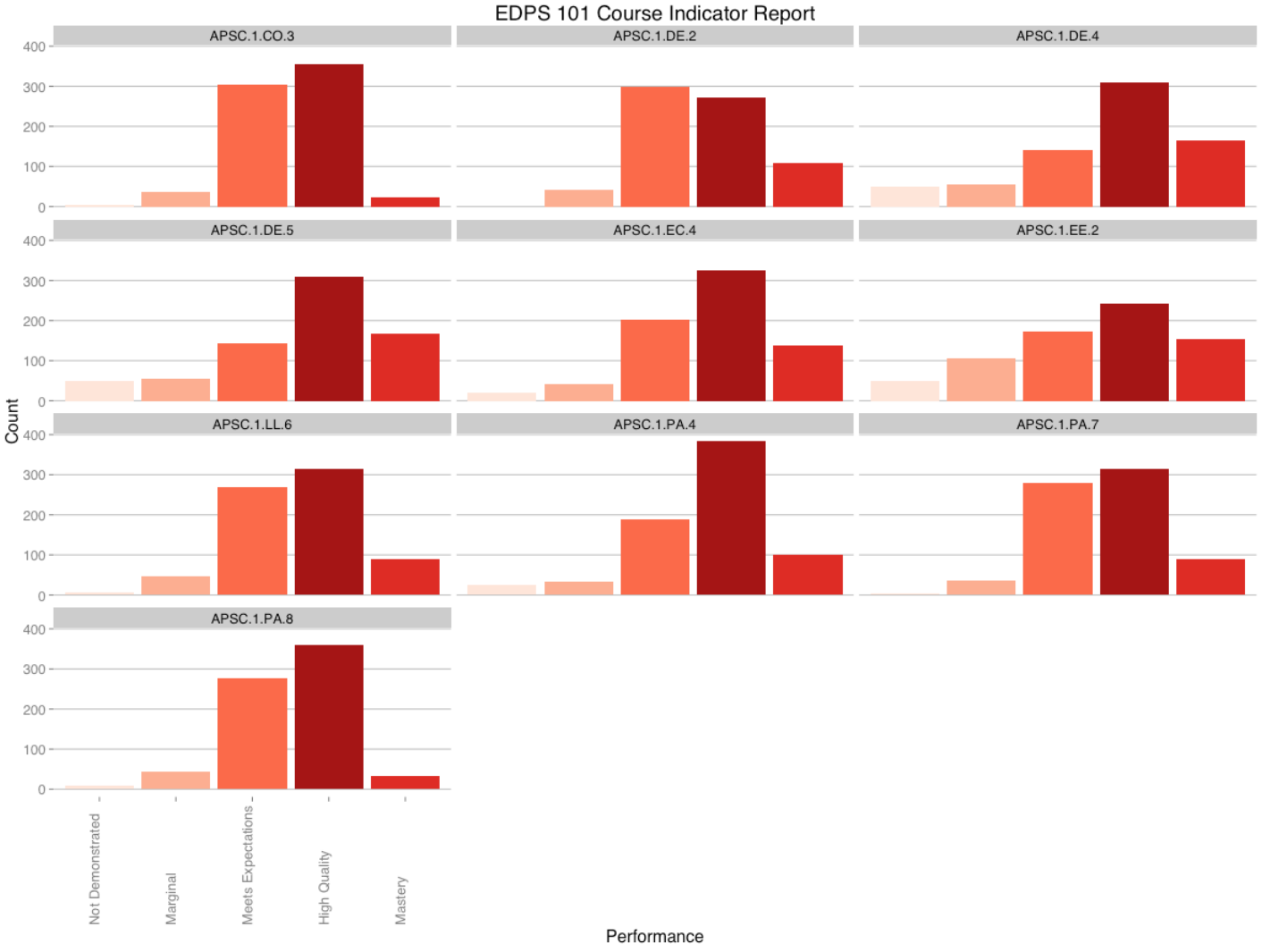
In this case study, we present an example of an assessment plan that includes in-course assessment as well as program-wide measures.

Level of Assessment	Approaches	Additional Information
Course Based Assessment (direct assessment of outcomes)	Project 1 Project 2	bit.ly/EDPS-P1 bit.ly/EDPS-P2
Program-wide Rubrics (direct & alternative assessment of outcomes and attributes)	Program-Wide Rubrics	aacu.org/value/rubrics
Standardized Instrument (direct & alternative assessment of outcomes and attributes)	Collegiate Leanring Assessment Plus (Critical Thinking, Problem Solving, Written Communication)	bit.ly/1yjKooU

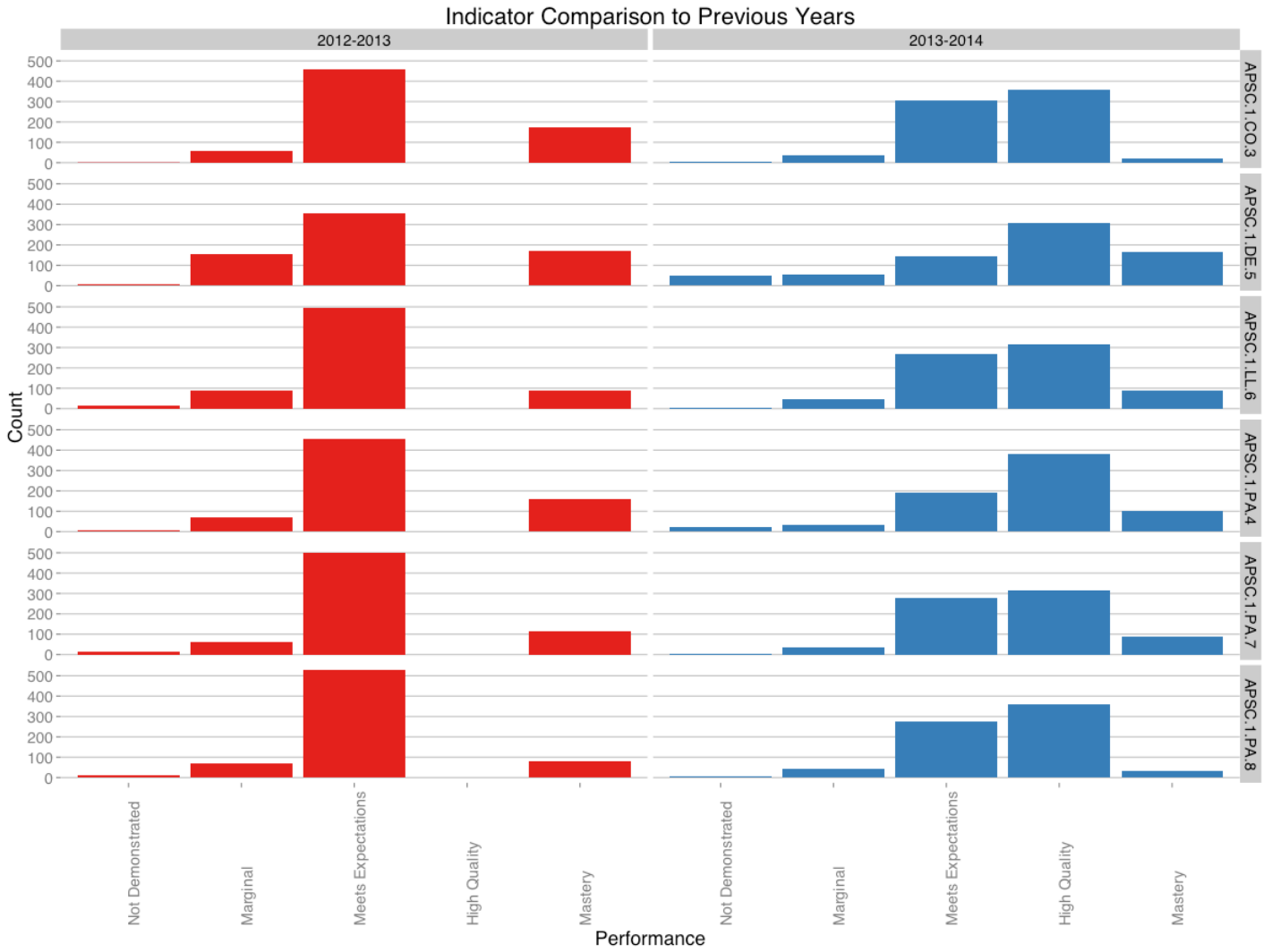
4. ASSESSMENT DATA & REPORTS

Course level Reporting

Course Indicator Report, displays the aggregate student performance across the entire course.



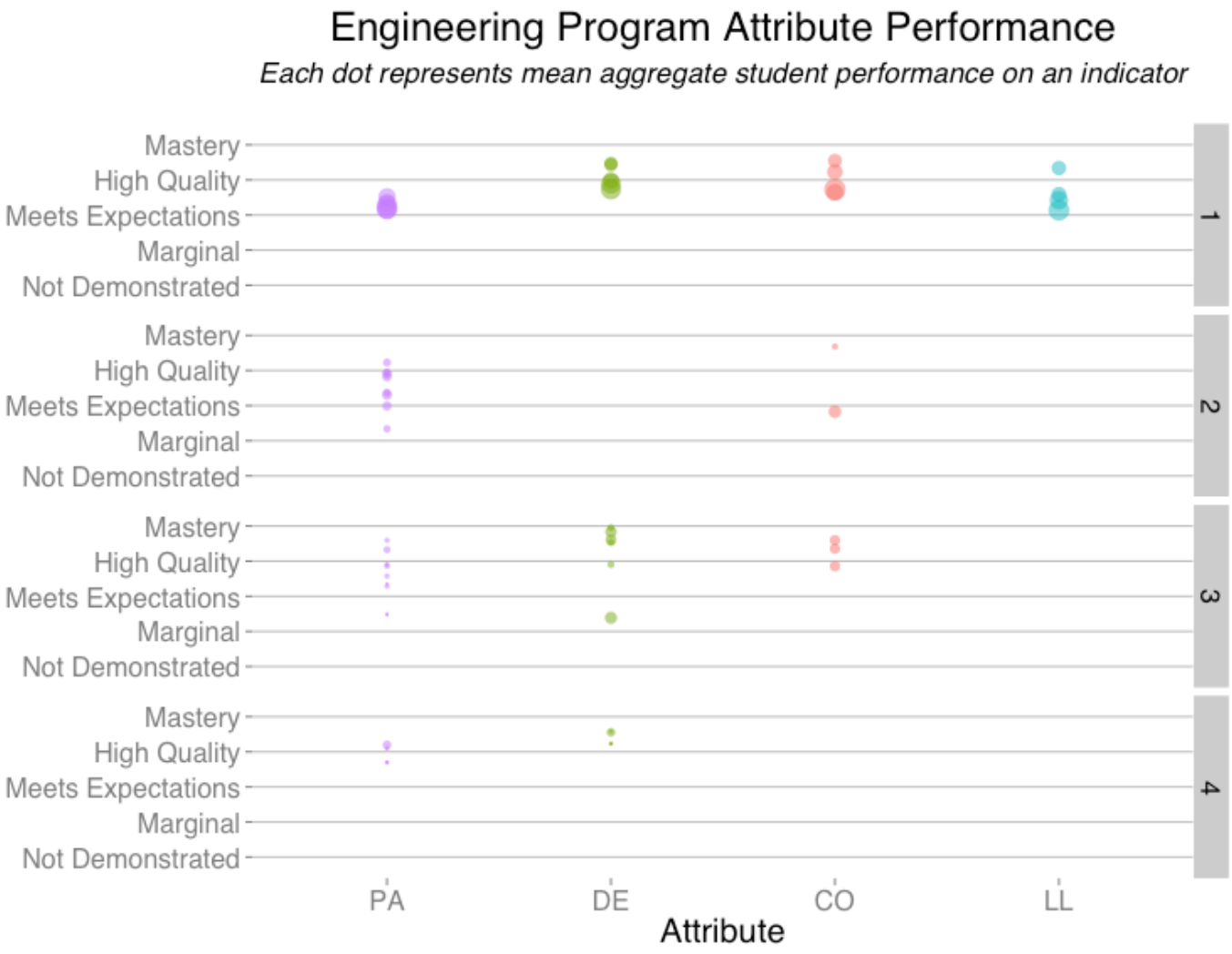
Historic Performance Reports, Please note, that the 2012-2013 years were on a 4 level rubric, while 2013-2014 on a 5 level rubric.



Program Level Reporting

Full Engineering Program Attribute Performance. In the plot below, assessment data is presented for each year of the program, by attribute (using short forms for each attribute, e.g. PA=Problem Analysis, DE=DEsign, CO=COmmunication, LL=Lifelong Learning), with each respective dot representing the aggregate student performance for a particular indicator. Colour is used to distinguish between indicators, and size is used to indicate the the number of assessments per indicator. (Small size indicates less assessments of that indicator, while larger sizes indicate a greater number of assessments).

Each year of the program has indicators for each attribute, with specific performance descriptors that show a clear progression from the previous years expectation. This means that a problem analysis indicator for first, second, third and fourth years are the same indicator; yet each have a different level of expectation for that particular outcome.



Standardized Instruments

The plot below shows the results from one such standardized test, the CLA+, showing mean performance of first year and upper year students on three elements: analysis and problem solving, writing effectiveness, and writing mechanics. These can link to graduate attributes, indicated below.

Analysis and Problem Solving

Making a logical decision or conclusion (or taking a position) and supporting it by utilizing appropriate information (facts, ideas, computed values, or salient features) from the Document Library

Problem Analysis Design

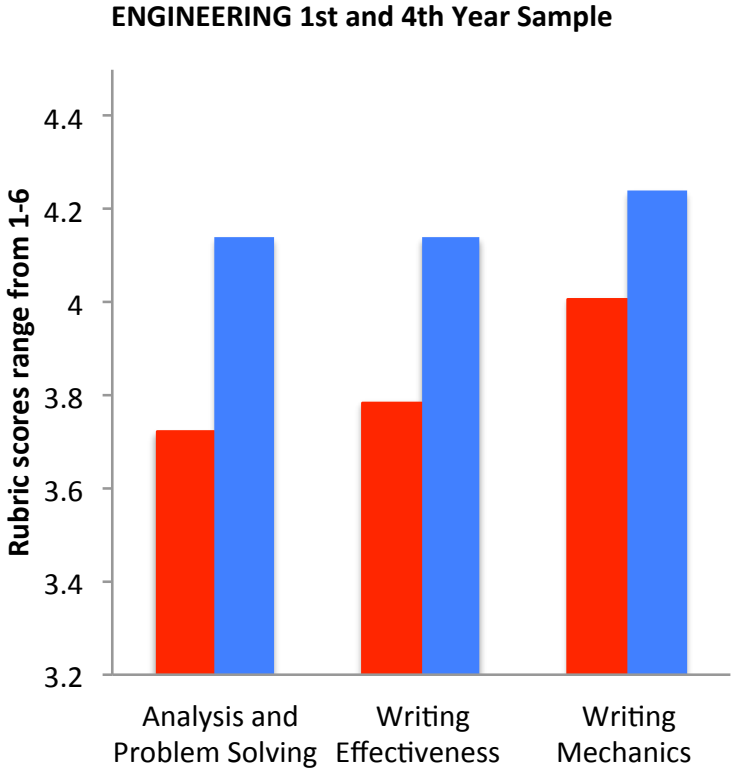
Writing Effectiveness

Constructing organized and logically cohesive arguments. Strengthening the writer's position by providing elaboration on facts or ideas (e.g., explaining how evidence bears on the problem, providing examples, and emphasizing especially convincing evidence)

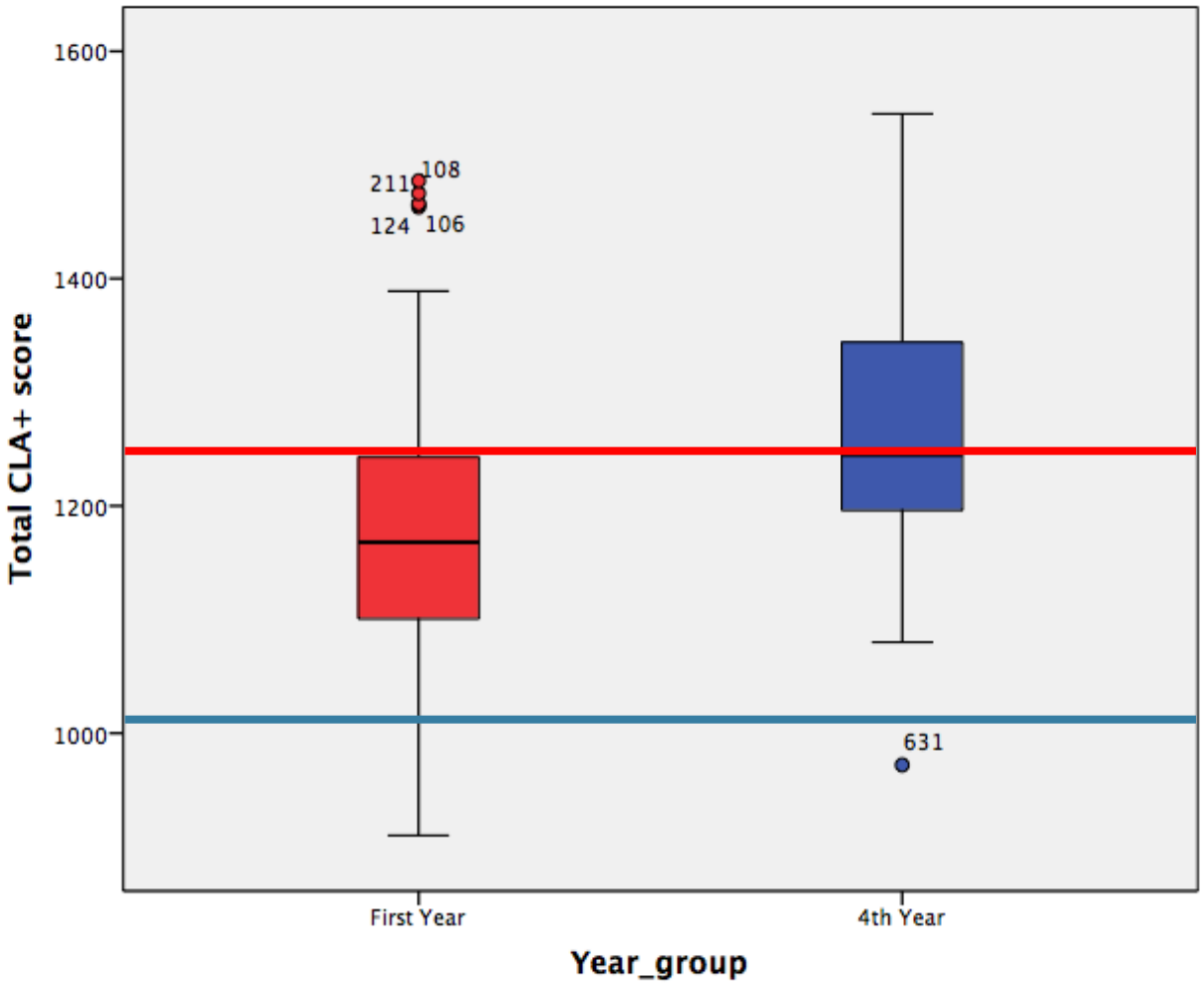
Writing Mechanics

Demonstrating facility with the conventions of standard written English (agreement, tense, capitalization, punctuation, and spelling) and control of the English language, including syntax (sentence structure) and diction (word choice and usage)

Communications



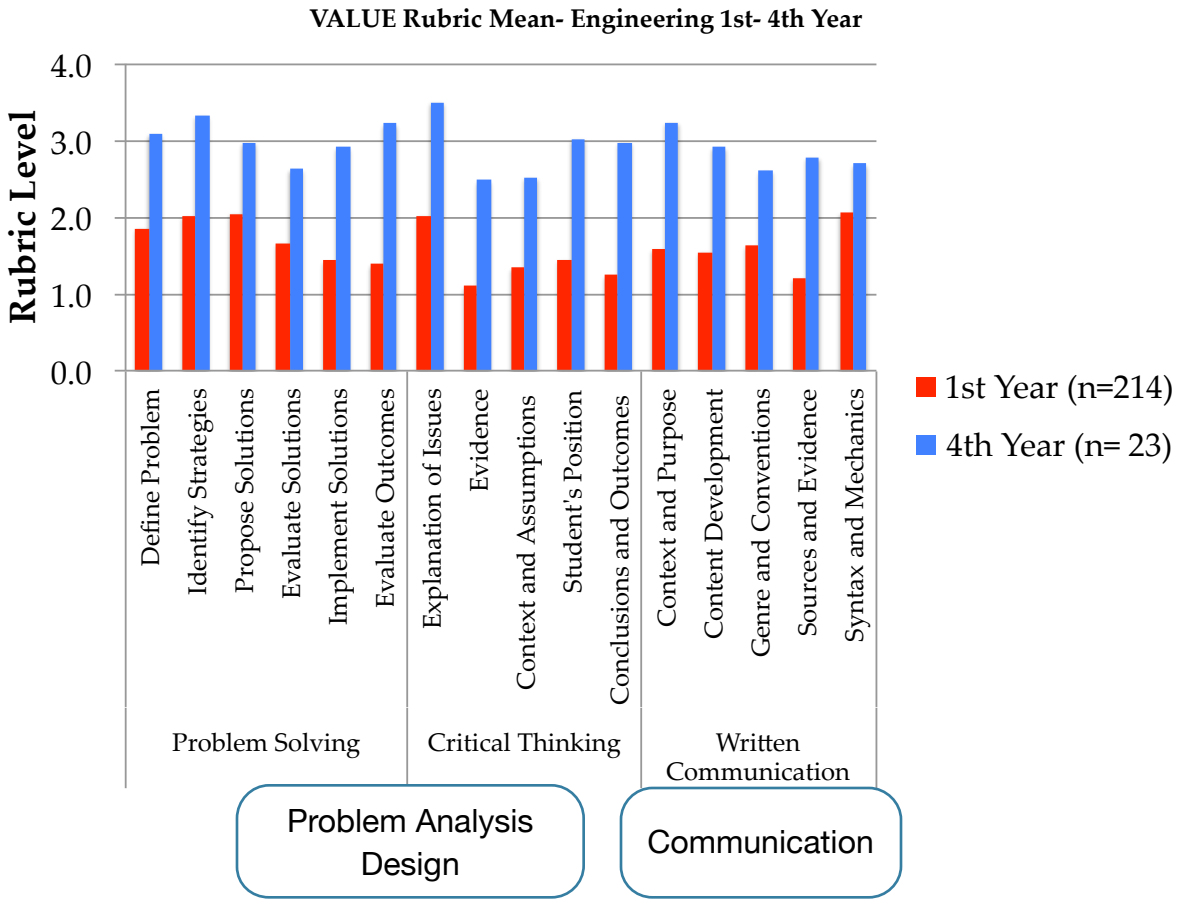
The figure below shows the mean of the first year and fourth year student scores compared, alongside the fourth year 90th percentile and mean scores.



Program-wide Rubrics

The graph below represents means of scores assessed using the program-wide rubrics from two sets of student work: (1) a significant report drawn from EDPS 101 (Project 2), and (2) a final design report drawn from a number of capstone courses from 4 different programs across the faculty. The sample sizes differ from the course-based measures, as the scoring of student work was sampled from the student population and first year courses being more populous than fourth year courses.

Level 1.0 is considered to be generally appropriate for incoming students, and 4.0 appropriate for graduating students. The plot below shows a significant improvement between first and fourth year on the measures of critical thinking, problem solving and communication, which can be related to graduate attributes, indicated below.



5. WORKSHOP INSTRUCTIONS

The goal of the program improvement process is of course, program improvement. The data from the previous sections, along with knowledge of the curriculum development can be used to provide direction to curriculum committees. In this case study, your group is that curriculum committee.

We recommend the following workflow to get discussion going.

Phase 1: All members review pages 3-6 to understand the context of the case study.

Phase 2: Break up the document, for example into first year course assessment (pages 7-8), the overall program assessment (page 9), standardized instrument (pages 10-11) program-wide rubrics (page 12)

With your group, discuss and consider the following:

1. **Do you think there is enough data present to make any decisions regarding course and program improvement, and do you trust the data? Why or Why not?**
2. **Do you see any particular problems, areas of concern or weaknesses in the EDPS 101 course or the first year program, what data-informed improvements would your recommend to the course or first year program?**