A PERFORMANCE ASSESSMENT FRAMEWORK FOR MEASURING ONLINE STUDENT LEARNING OUTCOMES

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Abstract

Trends in higher education for the past ten years have shown that enrollments in online courses or online degree programs have been growing substantially faster than overall higher education enrollment [1]. There are few if any Accreditation Board for Engineering and Technology (ABET) accredited programs that are completely online. Not only is there a need for innovative approaches and an ability to offer laboratory courses online, but there is a parallel need for assessment tools that allow the collection and analysis of course outcomes and objectives, in a seamless manner. A web-based assessment system might have more potential in terms of access and flexibility for teachers and administrators in terms of overall effectiveness and efficiency of producing "Learning Analytics" [2]. The philosophy driving the approach in this work is to allow the instructor to focus on course outcomes via embedded problems and laboratory exercises while the program outcomes are derived from a mapping between the two levels. Subsequently, examining performance metrics and taking a proper course of action are conveniently done at all levels of administration. In this paper, we will present assessment results of online course student learning outcomes using a performance assessment framework (PAF) or (Searchlight Performance Assessment™), which was developed with feedback from our institution. This paper will give a firsthand view of how student assessment data is embedded, captured and analyzed, and how the data is aggregated and used to inform department progress. The paper will also review online course assessments for two academic years.

Introduction

Various approaches specifically geared toward helping programs document and measure ABET EC2000 program educational objectives and outcomes exist [3, 4] but few, such as Blackboard Learn and TK20, feature a fully electronic, rubric based approach that integrate well with existing student information systems [5]. The Searchlight Performance Assessment™ framework offers the means to perform program assessments through graphing both direct and indirect measures of course outcomes. The program outcomes are then mapped to each course with the associated performance criteria. The performance criteria measure specific outcomes, which are determined through the use of electronic rubrics. Mapping and the entry and setup of course and program outcomes are accomplished through parsing Microsoft Word formatted course syllabi and program annual report forms. Courses outcomes are satisfied through embedded questions and exercises during the academic term. At the program level, tabular and graphical outputs are created with drill down properties that allow one to determine the source of problematic results. At the end of the academic term, the instructor completes a Faculty Course Assessment Report (FCAR). In order to ensure continual improvement as part of the assessment process, adjustments are made at the course level to improve upon the instructional strategies employed for each class, and noted in the individual Searchlight Faculty FCAR reports.

SearchlightTM Performance Assessment Framework

Searchlight Performance Assessment is a very flexible performance assessment engine designed to help educational institutions effectively utilize data to drive decision-making. The software provides educational institutions with an assessment tool that will allow them to enter, generate, and analyze course or program based performance rubrics. While the software is optimized for the collection and analyses of information necessary for accreditation processes, it is also flexible enough to be tailored to the needs of nearly any entity. This assessment tool is intended to be standalone and requires no additional equipment or software.

Formative and summative assessment tools will be used to help faculty evaluate how students are meeting the learning goals in the program. The PAF facilitates the process of performing both formative and summative assessments. Appropriate assessment instruments are created and refined through the software by aggregating formative assessments at the course level in order to improve activities and processes that ensure attainment of program goals. Data collected each year are used for annual reports and to guide long term planning. Summative evaluations also aid in the achievement of program goals and objectives.

SearchLight™ also offers the means to perform program assessments through both direct and indirect means. Direct assessments are appropriate for determining the effectiveness of in-class teaching practices and course outcomes. Indirect assessments through various survey instruments are appropriate for determining best practices for STEM pedagogy and course outcomes. Both direct and indirect methods can be mapped to program outcomes to ensure program objectives are being met. The PAF is also capable of tracking changes to courses throughout the duration of the program.

Features of the Performance Assessment Framework

SearchlightTM is a web-based performance assessment tool that offers an electronic rubric-driven assessment entry method that models the assessment process closely; is easy to deploy, requires a short set-up time and has graphics-driven data-mining capabilities. The software offers additional features, which include:

- Multiple Course Assessment Methods
  - Direct and Indirect Assessments
  - Formative and Summative Assessments
- The ability to Import Data
  - MSWord, Excel, CMS e.g. Bb, SIS
  - syllabi automatically create course outcomes
- Flexible Assessment Metrics
  - Program outcomes with associated performance criteria-department
  - Course outcomes and course instruments, mapped to multiple course outcomes
- Multiple Assessment Entry Methods
  - Gradebook or Rubrics
- Performance Review
  - Aggregate by data tables and graphs
  - Drill down – program outcomes – pc – courses, surveys
- Course Progress Tracker – store data & track progress over different periods
- Automatic Reporting using Faculty Course Assessment Reports (FCARS)
- Training & Technical Support

Getting Started Using the Performance Assessment Software

The performance assessment software has four main functions – allows data importation, creating performance assessment metrics, implementing performance assessments and generating performance reviews and reports.

Program Outcomes and Performance Criteria

The program outcomes *(a-k)* and associated performance criteria are based on ABET accreditation guidelines. Performance criteria are linked to program outcomes and are specific measures of the program outcomes being assessed. Table 1 presents program-learning outcomes that are evaluated based on a 6-year accreditation cycle. These program outcomes and associated performance criteria (Figure 1) are imported into the performance assessment framework and are linked to courses and specific course outcomes

Table 1: Program Learning Outcomes (*a-k*) and 6-year Assessment Cycle.

Program Learning Outcomes	'06-07		'07-08	'08-09	'09-10	'10-11	'11-12	'12-13
a) an ability to apply knowledge of math, science, and engineering	●				●			●
b) an ability to design and conduct experiments, as well as to analyze and interpret	●		●			●		
c) an ability to design a system, component, or process to meet desired needs	●		●			●		
(d) an ability to function on multi-disciplinary teams	●				●			●
(e) an ability to identify, formulate, and solve engineering problems	●				●			●
(f) an understanding of professional and ethical responsibility	●			●			●	
(g) an ability to communicate effectively through oral and written communications	●			●			●	
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context	●				●			●
(i) a recognition of the need for, and the ability to engage in life-long learning	●		●			●		
(j) a knowledge of contemporary engineering issues	●			●			●	
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	●			●			●	

a) an ability to apply knowledge of mathematics, science, and engineering
1. Identifies mathematical and physical concepts needed to solve the problem (M, S)
2. Explains the role of mathematics as a tool for modeling systems and processes. (M)
3. Expresses problem in terms of mathematical and scientific statements (M, S)
4. Uses fundamental engineering principles to solve engineering related problems (E)

b) an ability to design and conduct experiments as well as analyze and interpret results
1. Develops a hypothesis and a plan (experimental method) to evaluate it using engineering principles and practice. (D)
2. Collects data using software and electronic test and measurement equipment (C)
3. Analyzes results and components of the design using engineering models. (A)
4. Explains experimental results as they relate to theoretical results. (I)

Figure 1: Sample Program Outcomes and Associated Performance Criteria.

Creating Performance Assessment Metrics and Mapping Outcomes

The performance assessment framework permits you to assess students through two types of metrics, program outcomes - defined by their performance criteria, and course outcomes - assessed through course instruments. While department heads typically establish program outcomes, instructors ideally create course outcomes. Course instruments are specific metrics, such as a question on an exam or homework, which satisfies one or more course outcomes. Outcomes and performance criteria are mapped to the courses using the matric mode.

For example, the following course outcome: "*Write steady state solution equations and analyze transmission line circuits operating in the steady state mode,*"- would map to the: program outcome: (*a*) *"an ability to apply knowledge of mathematics science and engineering.*"

Another course outcome example: "*Students will be expected to demonstrate their ability to apply logic in solving the charge neutrality equation, which is a transcendental function*" - would map to program outcomes [a, e]:

(*a*)*"an ability to apply knowledge of mathematics science and engineering;"* and
(*e*)*"an ability to identify, formulate, and solve engineering problems."*

Another example of a course outcome: "*Students will be expected to demonstrate their ability to cooperate with others, share information with others, and demonstrate their ability to take a leadership role in support of the team's goals while conducting Lab experiments.*" – would map to program outcomes [b, d, g]:

-(*b*) *"an ability to design and conduct experiments, as well as to analyze and interpret data;"*
-(*d*)*"an ability to function on multi-disciplinary teams;"*
-(*g*) *"an ability to communicate effectively through oral and written communications."*

Furthermore an instrument: "*Final Project, Question 1*" can be created that satisfies one or more of the performance criteria under program outcome (*a*), such as "*Uses fundamental engineering principles to solve engineering related problems.*"

Course Laboratory Outcomes Mapping Example

Students enrolled in the online ECE courses have to first complete introductory training laboratory experiments that familiarize them with the various features of the technology being used. Detailed discussions on how our university developed various design projects and laboratory experiments using various forms of online technology have been discussed in detail in our previous papers [6, 7]. One

question that has consistently been raised is whether students have acquired the laboratory skills commensurate with satisfying our program outcomes. Illustrations (Figure 2) show a section of an RC filter laboratory experiment where students are given instructions on how to build and test both High Pass and Low Pass filter circuits with a specified cut-off frequency. We were able to evaluate and compare the performance of the students using our performance assessment framework by entering the course objectives mapped to the program objectives. Figure 3 shows the online version of the RC filter lab experiment.

We were able to evaluate and compare the performance of the students using our performance assessment framework by entering the course objectives mapped to the program objectives as listed below. The corresponding program outcome is shown in square bracket.

EEGR203 Expected Course Outcomes

- Students will be expected to demonstrate their ability to apply basic circuit analysis techniques to design and conduct laboratory experiments, and to also be able to analyze and interpret the results they obtain. [b]
- Students will be expected to demonstrate their ability to cooperate and share information with others, while conducting laboratory experiments. [d]
- Students will be expected to demonstrate their ability to communicate effectively by writing weekly laboratory reports. [g]
- Students will be expected to demonstrate their ability to use modern hardware and software engineering tools to complete their weekly laboratory experiments. [k]

Relationship of EEGR202/203 Course Outcomes to Program Outcomes

- (b) An ability to design (D) and conduct (C) experiments as well as analyze (A) and Interpret results.

- (d) An ability to function on multi-disciplinary teams.
- (g) An ability to communicate effectively through oral and written (W) communications.
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for Engineering practice.

Performance Assessment

Once course and program outcomes have been mapped within the performance assessment framework, and individual student assessment can be generated to evaluate course or program effectiveness, performance reviews can be assessed by semester or by course and the data aggregated into data tables and/or graphs. Performance reviews can also be compiled based on specified outcomes and data drill-down depicted at the performance criteria level to accurately evaluate each element of a program outcome. The performance assessment reviews can be evaluated using the grade-book method, downloadable in excel format, or the rubric format based on a Likert scale. Performance assessment reports capture the results of the assessments which are generated based on results for individual courses, specific program or course outcomes or aggregated by courses or outcomes for a semester.

Course/Program Performance Assessment Review

Performance assessment reviews have been implemented for the past 6 years, using the performance assessment framework. The assessment data collected are analyzed and shared with faculty for review. Faculty then provides strategies for improving the courses and documents those changes in a faculty course assessment report (FCAR). The FCAR is utilized by Faculty to summarize course level observations and actions. The FCAR can be automatically generated for any course and serves as a record for all qualitative and quantitative information for the course and related outcomes that are assessed. This report

Lab 7 – Low Pass and High Pass Filter Circuit Design

The characteristics of the low pass and high pass filter circuits were discussed in the classroom. Please refer to your class notes for more information related to filter circuits. This laboratory experiment will be conducted in the regular laboratory room using the Agilent X-Series Oscilloscopes with integrated Function Generators.

Part I- Low Pass Filter: Design, build and test the low pass filter circuit shown in Figure#1a such that the cutoff frequency is about 5 KHz. Build the circuit and use the Agilent X-Series Oscilloscopes with integrated Function Generators to test the response of your circuit. Assume that Vin is a 1 Volt peak to peak sine wave.

You need to be able to answer the following questions after completing the experiment:

- What do you expect the output voltage Vout to be when you reach the cut-off frequency? Why?
- What happens to Vout after you pass the cut-off frequency? Why?
- Plot your data on Microsoft Excel using Vout versus frequency and (Vout/Vin) versus frequency and prove that the cut-off frequency that you have designed matches the one that is obtained after you build the circuit.
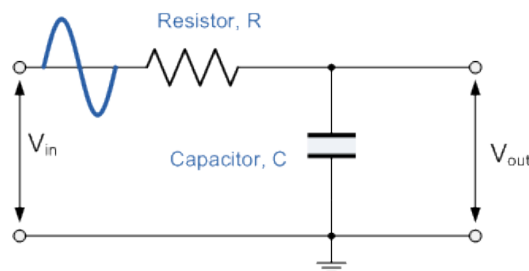

Figure 1a: Low Pass Filter

Part II- High Pass Filter: Design, build and test the high pass filter circuit shown in Figure#1b such that the cutoff frequency is about 5 KHz. Build the circuit and use the Agilent X-Series Oscilloscopes with integrated Function Generators to test the response of your circuit. Assume that Vin is a 1 Volt peak to peak sine wave.

You need to be able to answer the following questions after completing the experiment:

- What do you expect the output voltage Vout to be when you reach the cut-off frequency? Why?
- What happens to Vout after you pass the cut-off frequency? Why?
- Plot your data on Microsoft Excel using Vout versus frequency and (Vout/Vin) versus frequency and prove that the cut-off frequency that you have designed matches the one that is obtained after you build the circuit.

Figure 2: Sample RC lab given to all students enrolled in the laboratory course.

Lab 7-WEB – Low Pass and High Pass filter circuit design

The characteristics of the low pass and high pass filter circuits were discussed in the classroom. Please refer to your class notes for more information related to filter circuits. This laboratory experiment will be conducted completely online using the internet to connect to the Agilent X-Series Oscilloscopes with integrated Function Generators remotely. The goal of this experiment is to determine the type of filter that is attached to the instrumentation board after taking measurements and analyzing the data that is collected.

Part I- Determine the type of filter circuit connected to the laboratory equipment

The Agilent X-Series Oscilloscopes with integrated Function Generators located in the laboratory is connected to an unknown RC filter circuit as shown in Figure 2a. Assume that Vin is a 1 Volt peak to peak sine wave. Connect to the oscilloscope remotely and take measurements of Vout versus frequency by varying the frequency from 100Hz up to 10KHz.

You need to be able to answer the following questions after completing the experiment:

- What type of filter circuit do you think the circuit in the Black Box represent?
- Is it a High Pass or Low Pass filter? Why?
- What is your estimate for the cut-off frequency? Why?
- Plot your data on Microsoft Excel using Vout versus frequency and (Vout/Vin) versus frequency and prove that response of the filter circuit behaves as expected.
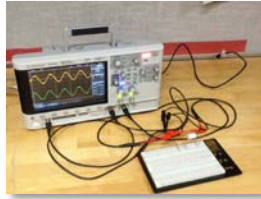

Figure 2a: Unknown Filter circuit connected to Agilent Equipment

Lab 7-WEB – Low Pass and High Pass filter circuit design

Part II- Design, build and test a new filter circuit that has the same cutoff frequency as the circuit tested in Part I. Use your Mobile Studio IOBoard ™, to test your filter circuit. Assume that Vin is a 1 Volt peak to peak sine wave. Choose the appropriate values for R and C such that the cut-off frequency is as close as possible to the estimated value obtained from part I of the laboratory experiment.

You need to be able to answer the following questions after completing the experiment:

- What do you expect the output voltage Vout to be when you reach the cut-off frequency? Why? Plot your data on Microsoft Excel using Vout versus frequency, and (Vout/Vin) versus frequency.
- How does the response of the new filter circuit compare to that of the original circuit given in Part I?
- Please discuss your results in detail by comparing the cut-off frequencies of the two filter circuits given in Part I and Part II.

Part III- Repeat the experiments in Part I and Part II after the circuit connected to the Agilent X-Series Oscilloscopes has been changed by the instructor.
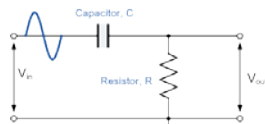

Figure 3: RC Filter Lab given to the students enrolled in the online course.

contains a breakdown of how well the course satisfied its assigned outcomes, as well as information on the modifications made to the course, the student feedback, reflections, actions, and grade distribution. Changes to any course can be tracked via the FCAR from one academic term to the next.

Course/Program Performance Assessment Review

An example of the analysis of program outcomes will be presented here for one year, 2009-2010. First, we present general results for outcomes across the program, and secondly results of outcomes measured for online courses only. This is done to provide a benchmark for the results of the outcomes specific to the online program outcomes.

In the 2009-2010 academic year outcomes *a, d, e & h* were scheduled for review. The aggregated results of the outcomes measured are presented in Figure 4 and Figure 5. Overall, outcomes during the spring 2010 semester did better on average than during the fall 2009 semester (Figure 4). The targeted threshold for each outcome to trigger a drill down is a value of "unacceptable" greater than or equal to 25%. None of the outcomes were within this target however, typically if "red or yellow" is at or about 10% we do further analysis to identify problem areas. Both outcome *a* and *e* were considered for further review in the succeeding semesters.

Sum of Pass Percentage

2009-2010 Outcomes

	(a) an ability to apply knowledge of mathematics science and engineering	(d) an ability to function on multi-disciplinary teams	(e) an ability to identify, formulate, and solve engineering problems	(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
■ FALL 2009	80%	96%	98%	100%
■ SPRING 2010	94%	100%	89%	100%

Outcomes ▾

Figure 4: Summary of Pass Percentage of 2009 – 2010 Outcomes (*a, d, e and h*).

2009-2010 Outcomes

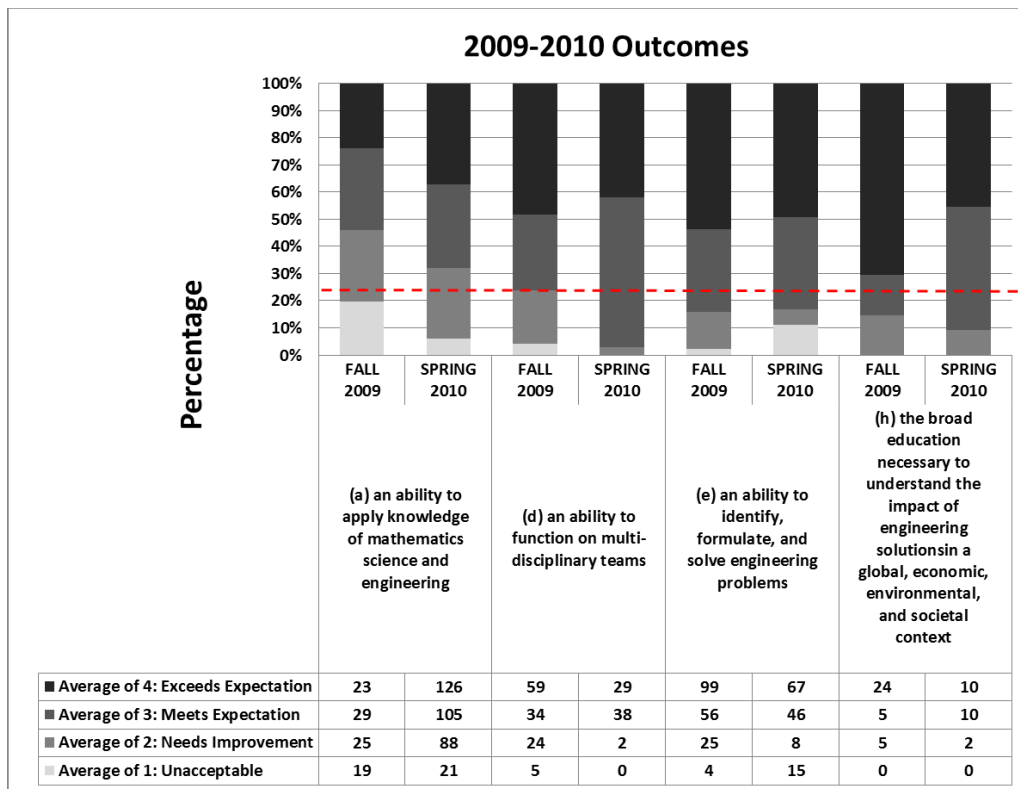|	FALL 2009	SPRING 2010	FALL 2009	SPRING 2010	FALL 2009	SPRING 2010	FALL 2009	SPRING 2010
	(a) an ability to apply knowledge of mathematics science and engineering		(d) an ability to function on multi-disciplinary teams		(e) an ability to identify, formulate, and solve engineering problems		(h) the broad education necessary to understand the impact of engineering solutionsin a global, economic, environmental, and societal context	
■ Average of 4: Exceeds Expectation	23	126	59	29	99	67	24	10
■ Average of 3: Meets Expectation	29	105	34	38	56	46	5	10
■ Average of 2: Needs Improvement	25	88	24	2	25	8	5	2
▨ Average of 1: Unacceptable	19	21	5	0	4	15	0	0

Figure 5: Comparison of Fall 2009 & Spring 2010 Outcomes Achievement (*a, d, e and h*).

Drill-down Analysis of Assessment Cycle 2009-2010 Outcomes (a, e)

A closer examination of outcomes *(a)* and *(e)* shows the performance criteria assessed (Figure 6 and Figure 7). While outcome *(a)* recorded an improvement from the fall 2009 to spring 2010 period, outcome *(e)* recorded an increase in the "unacceptable" rating and prompted a closer examination.

Examination of the performance criteria associated with outcome *(a)* illustrates the need for students to better appreciate the connection between math and the engineering process (Figure 6).

Examination of the performance criteria associated with outcome *(e)*, (Figure 7) suggest students are primarily having difficulty with identifying various approaches to solving problems and applying engineering concepts to solving problems.

Typically, such observations are discussed at the end of semester Faculty meetings and strategies suggested and implemented during the succeeding academic term.

Results of Program Outcomes for Online Sections

Over the two-year period 2010-2012, online sections were offered in all core courses and some upper level elective courses. Figure 8 shows the comparison in performance of all ABET outcomes (*a-k*) between the face to face (dark bars) and the online sections (white bars). For the most part the performance of the online sections outpaced or was equal to that of the fact-to-face sections.
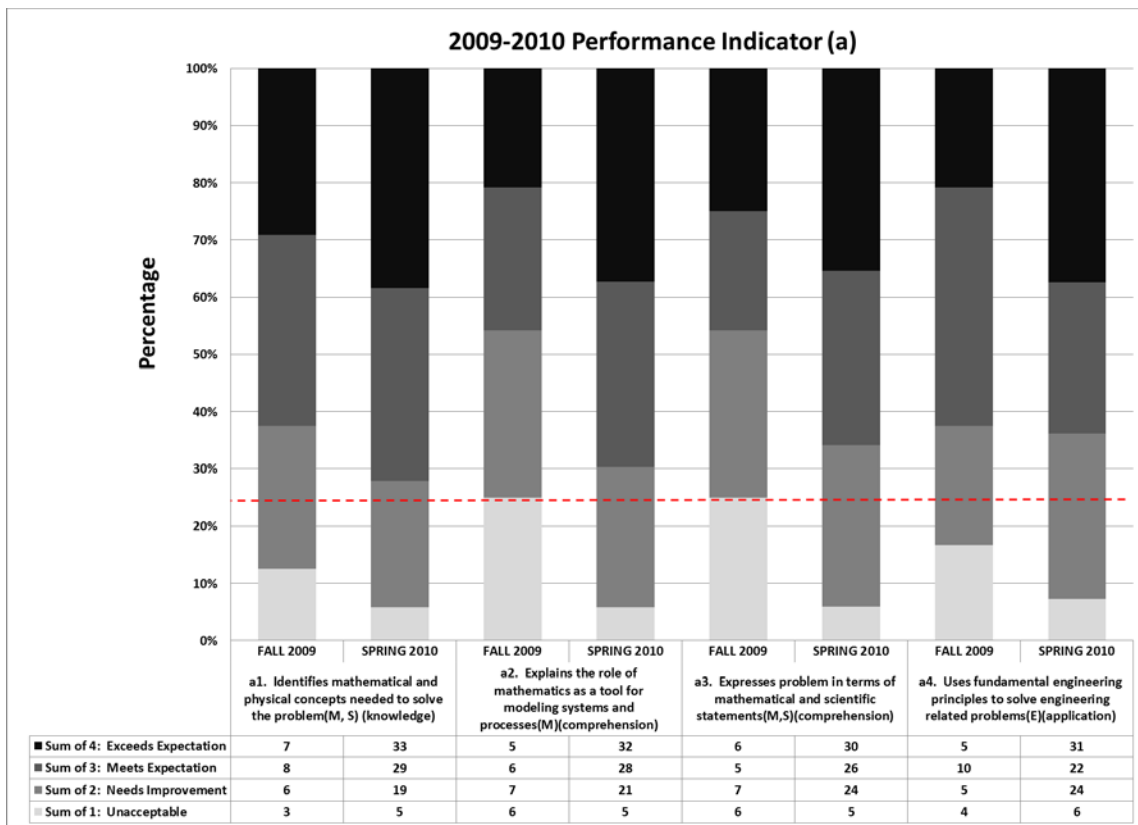
Figure 6: Drill-Down Performance Criteria for Fall 2009 & Spring 2010 - Outcome *(a)*.
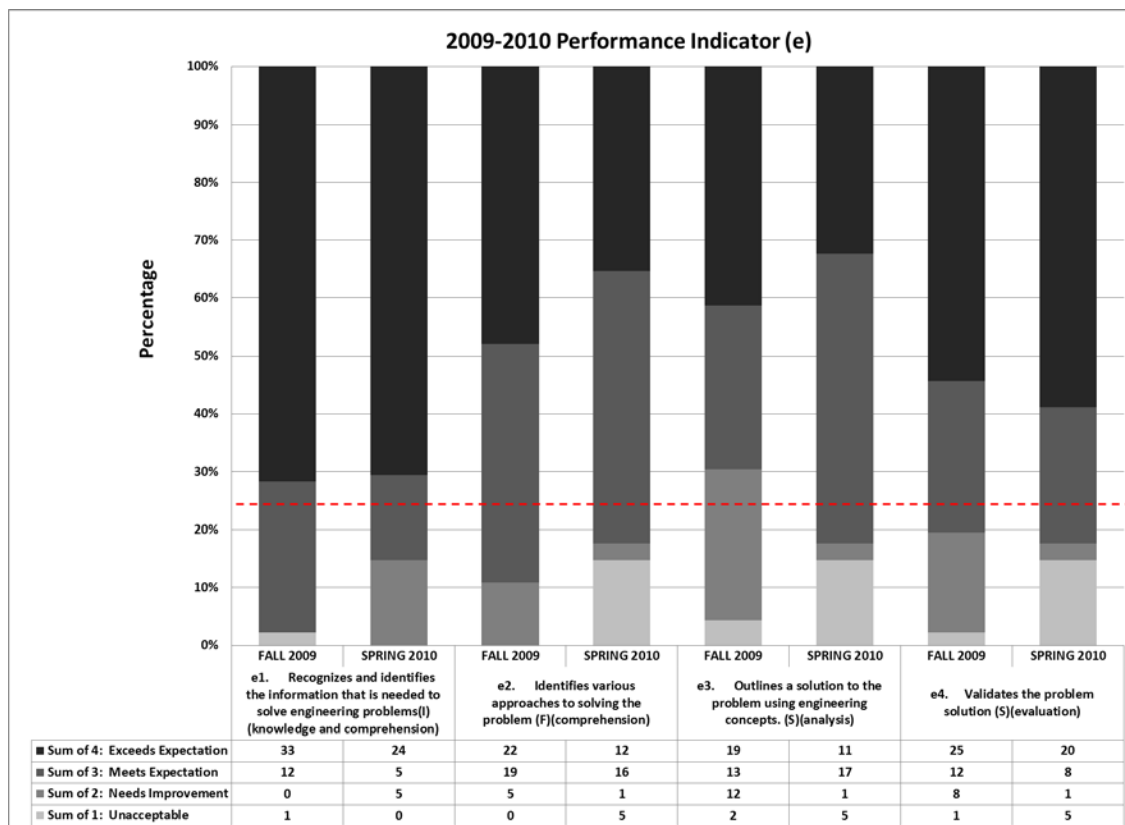

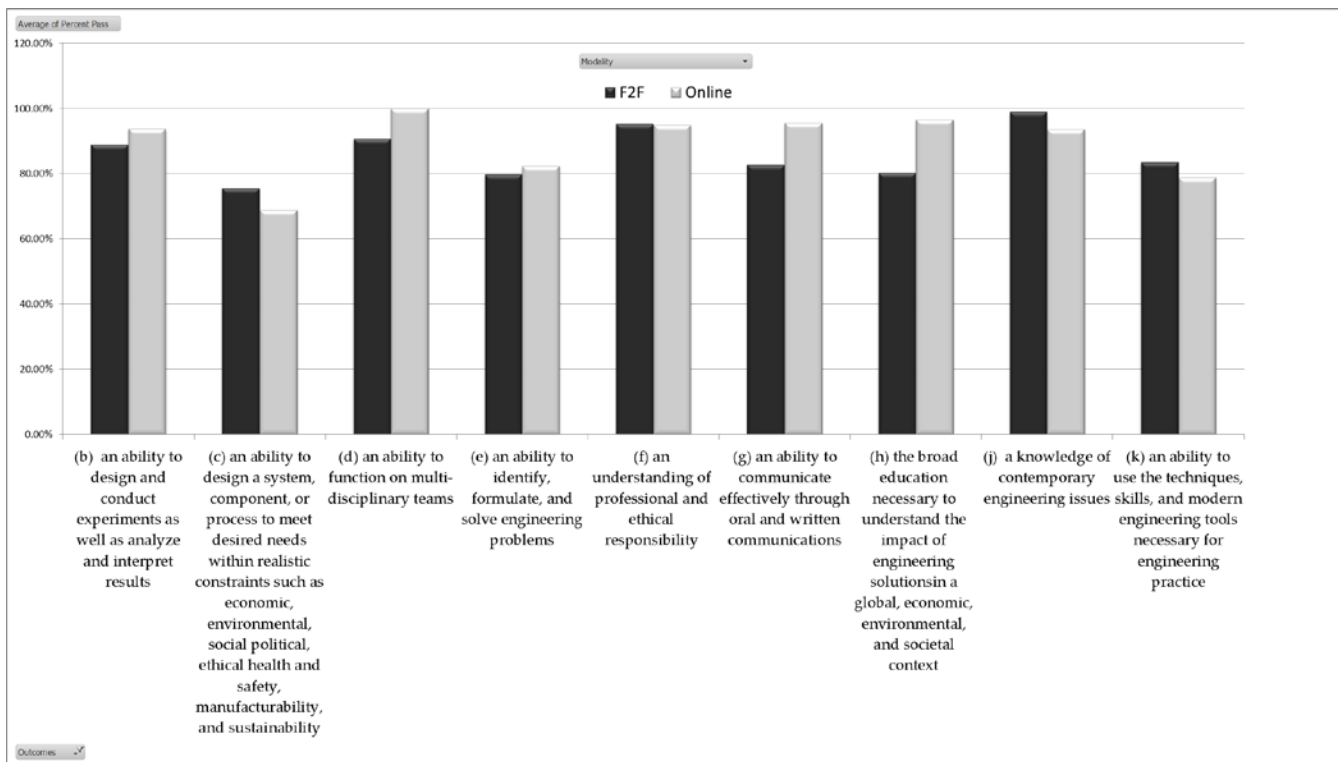Figure 7: Drill-Down Performance Criteria for Fall 2009 & Spring 2010 – Outcome (*e*).

Figure 8: Performance of face-to-face and online sections.

Performance Review – Online Sections - Continual Improvement

A sample drill-down analysis of the online sections is presented in Figure 9 and Figure 10 for outcomes *b, c, e and k*. Outcome *(e)* presented similar challenges in the online section as it did in the face-to-face sections, as seen with a 20% unacceptable rating (Figure 9). Further analysis of outcome *e* to determine the underlying problem areas is shown in Figure 10, where *e2-e4* shows that students continue to face challenges in defining and solving engineering problems.

Faculty and Administrative Impressions

Over the years spanning the evolution and improvement of this tool, the rubric entry approach is heavily favored over the grade book entry approach by faculty. This came as a surprise owing to the fact that the grade book entry method more closely mimics the conventional approach to submitting grades. Sample faculty comments were:

"It (the rubric method) feels just like using a paper rubric but the quantitative results are automatically tabulated for you"

"Teaching an online course is a lot of work. This tool allows me to do a good job of assessing my course outcomes without adding that much of a burden"

"I like being able to review my FCAR so that I can track and remember what I was thinking and what I was planning to do from semester to semester"

Program level administrators appreciate the ease in which it takes to setup from existing documents and maps. Typical setup times were under one day to get all objectives and outcomes set up. Comments from administrative personnel include:

"It's nice to be able to map course outcomes to program outcomes by extracting the information directly from the syllabi"
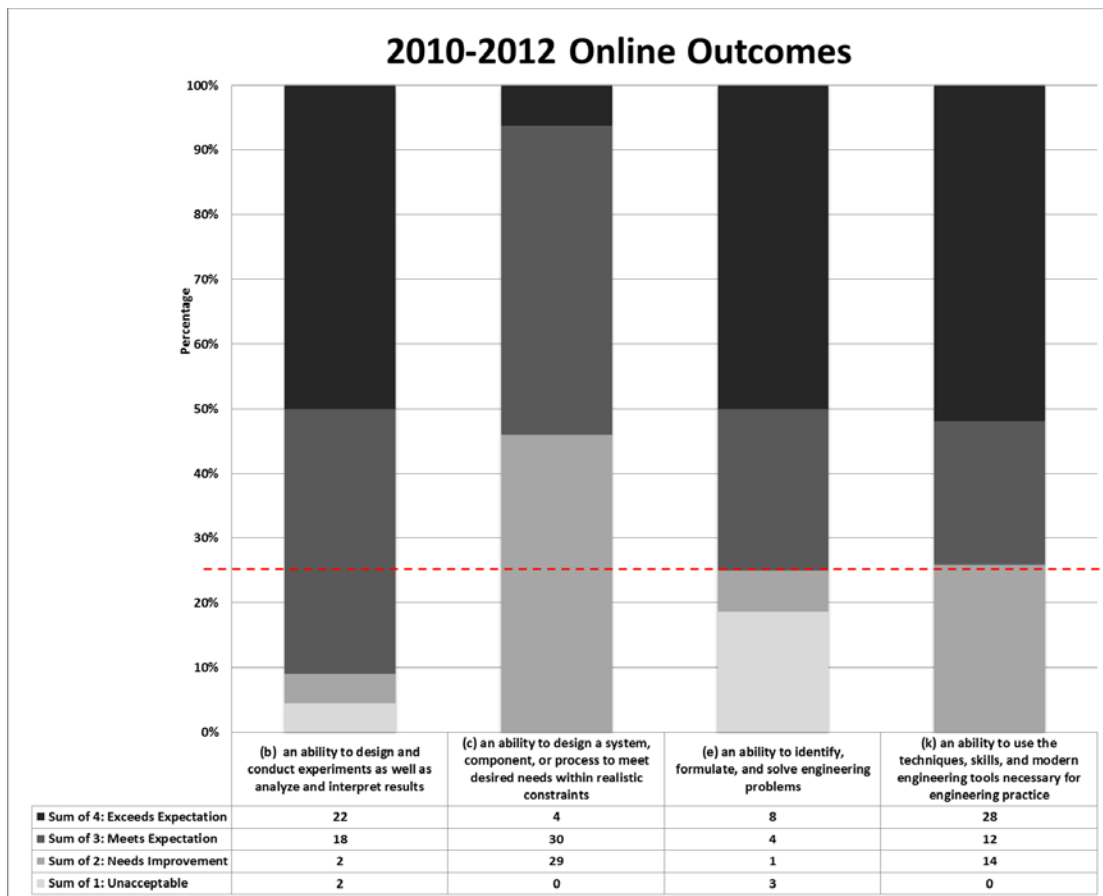
2010-2012 Online Outcomes

	(b) an ability to design and conduct experiments as well as analyze and interpret results	(c) an ability to design a system, component, or process to meet desired needs within realistic constraints	(e) an ability to identify, formulate, and solve engineering problems	(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
■ Sum of 4: Exceeds Expectation	22	4	8	28
■ Sum of 3: Meets Expectation	18	30	4	12
■ Sum of 2: Needs Improvement	2	29	1	14
▢ Sum of 1: Unacceptable	2	0	3	0

Figure 9: Online sections for 2010-2012 – Outcomes b, c, *e* and k.
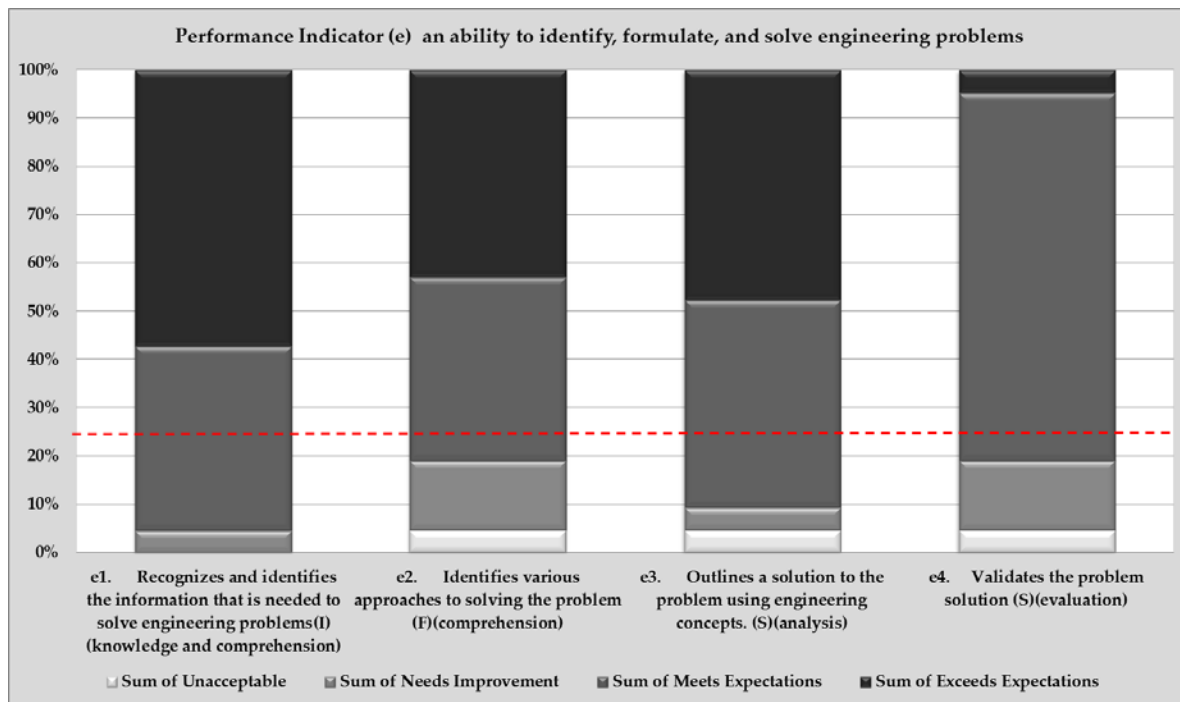

Figure 10: Online sections for 2010-2012 – performance criteria outcome *e*.

"This software lets me accomplish what used to take days in a matter of keystrokes we can now almost do our analysis in real time"

"I have never been able to drill down from program level statistics to identify the good and bad performing course sections. Asymmetries in teaching strategies can easily and objectively be identified for corrective action and student fairness"

Drawbacks were mainly from unimplemented features such as the inability to determine individual student performance metrics. Also time series reporting over periods other than term to term within one academic year was found to be in need of improvement. Another drawback is that it still requires the updating of course to program level mappings to be copied or setup from semester to semester. Some administrators would like for the mapping to occur automatically alleviating the need for a dedicated assessment/IT specialist.

Summary

In summary, our performance assessment framework facilitates an easier and data-driven effective analysis of both program and course outcomes, especially as applied to courses offered in an online environment. The application allows a hierarchical exploration of program and course level outcomes. Subsequently, this framework facilitates the process of performing both formative and summative assessments using both direct and indirect measures for our Electrical Engineering program, as well as other programs in other disciplines. The ability to map these outcomes allows the instructor to focus on improving the course, while the program director can focus on a process that supports continual program improvement. The ability to offer a tool to accomplish both visual and learning analytics of online performance trends has proven to be an extremely useful capability for maintaining a viable enhanced learning environment as our online program evolves.

References

1. E. Allen, J. Seaman, "Going the Distance: Online Education in the United States, 2011", *The Sloan Consortium*, published November 2011.

2. P. Baepler, and C. J. Murdoch, "Academic analytics and data mining in higher education". *International Journal for the Scholarship of Teaching and Learning, 4* (2), July 2010.

3. McGourty, Jack, Kevin Scoles, and Stephen Thorpe. "Web-based course evaluation: comparing the experience at two universities." Frontiers in Education, 2002. FIE 2002. 32nd Annual. Vol. 1. IEEE, 2002.

4. Buzzetto-More, Nicole A., and Ayodele Julius Alade. "Best practices in e-assessment." Journal of Information Technology Education 5.1 (2006): 251-269.

5. Williams, J. M. "Evaluating What Students Know: Using the RosE Portfolio System for Institutional and Program Outcomes Assessment." *Professional Communication, IEEE Transactions on* 53.1 2010: 46-57.

6. Y. Astatke, C. Scott, J. Ladeji-Osias, "Electric Circuits Online- Towards a completely Online Electrical Engineering Curriculum," *2011 American Society of Engineering Education (ASEE) Annual Conference,* Vancouver*,* British Columbia, Canada, June 26-29, 2011.

7. Y. Astatke, J. Ladeji-Osias, C. J. Scott, K. Abimbola, and K. Conner, "Developing and Teaching Sophomore Level Electrical Engineering Courses Completely Online", *Journal of Online Engineering Education*, 2(2) 2011.

Biographical Information

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