Welcome to the SDSU ASEE Best Practices in Engineering Education Series

Today's Topic:

Embedded Assessment: Quality Control vs. Quality Assurance

- Help yourself to pizza / drinks

Embedded Assessment: Quality Control vs. Quality Assurance

Carrie Steinlicht & Byron Garry
Dept. of Engineering Technology & Management
College of Engineering

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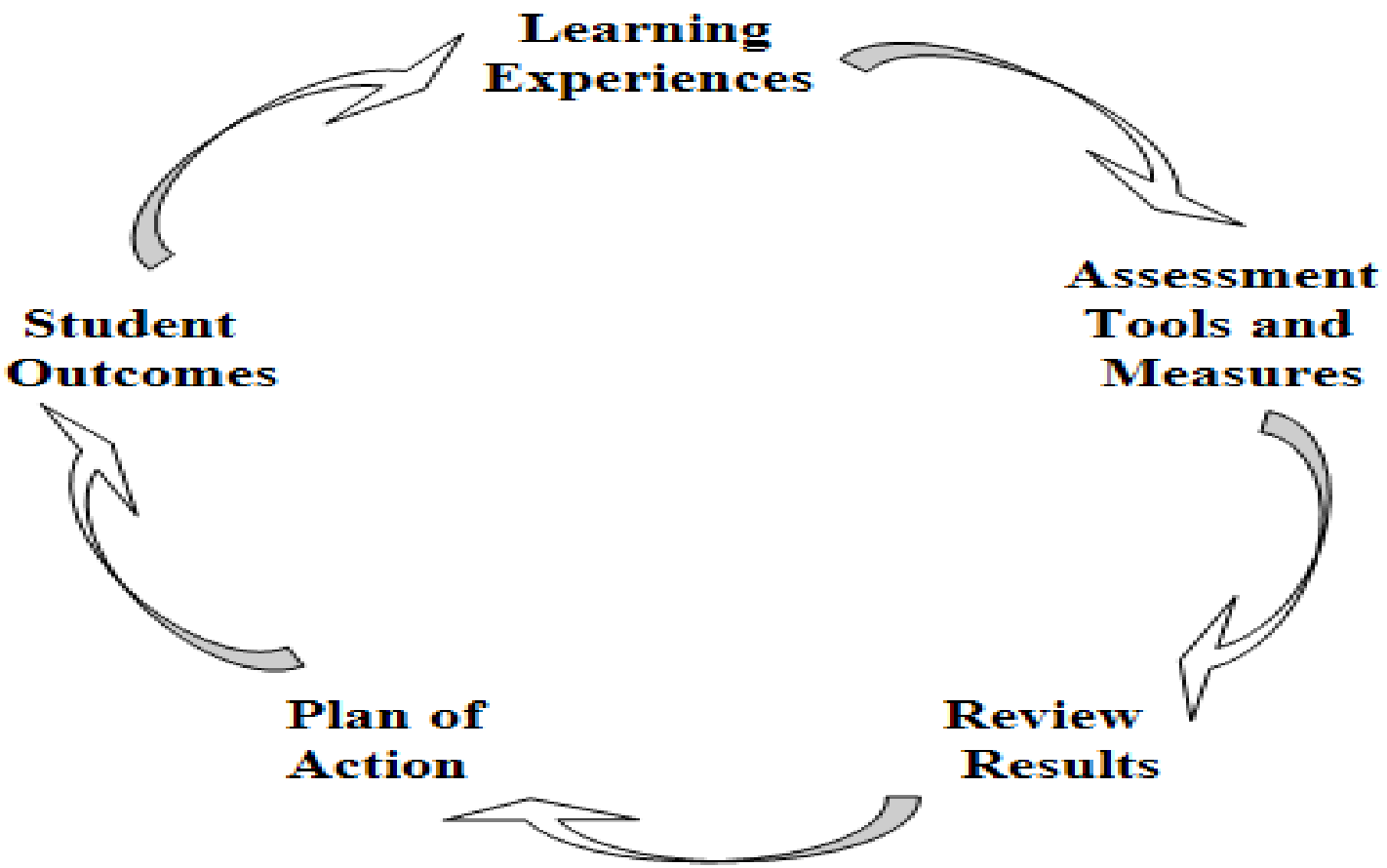
ABET Requirements for Assessment

General Criteria 4. Continuous Improvement
The program must regularly use appropriate, documented processes for assessing and evaluating the extent to which both the program educational objectives and the student outcomes are being attained. The results of these evaluations must be systematically utilized as input for the continuous improvement of the program. Other available information may also be used to assist in the continuous improvement of the program.

Deming PDCA (Plan, Do, Check, Act) Cycle



Embedded Assessment

- While the overall assessment may shift from outcome to outcome every year, ongoing assessment can facilitate continuous improvement at the course level much more effectively, especially if the curriculum or instruction is not consistent from year to year. This can also be invaluable in analysis of poor results.

Quality Control vs. Quality Assurance

Quality Assurance (QA) is an end-of-cycle test

- In education, we tend to use Senior Exit Exams as the only means of program assessment. This can result in several years of students who do not meet outcomes.

Quality Control (QC) is an in-process or embedded technique

- QC identifies potential problems before large numbers of students are affected.
- Corrective action can be taken quickly; the next time the class is taught
- It can also be used to test or evaluate innovative teaching methods for effectiveness.

Identify potential assessment points in individual courses

Figure 4: Objectives and Outcomes addressed in individual MNET courses

Objective & Outcome		MNET Courses Grouped by Competence Area																		
		Mfg. Processes & Design Technologies				Systems & Components for Automation				Management & Productivity Improvements							Other	Applied Sciences		
		231	320	334	436	251	252	451	453	260	365	367	460	462	463	470 471	494	241	243	350
1	a	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X
	b	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
	h	X			X				X			X		X		X	X		X	
	m	X			X	X	X	X	X	X	X	X	X		X	X			X	X
2	c	X				X	X	X	X					X			X		X	X
	d		X	X	X			X	X			X	X			X				
	f		X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
	k				X			X	X	X			X	X	X	X	X			
	l	X	X	X	X			X	X	X	X	X		X	X	X				
3	e		X	X	X			X	X			X	X	X		X	X		X	
	g	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	n									X		X				X				
4	i	X							X	X	X	X	X	X		X	X			X
	j	X			X				X	X	X	X		X	X	X	X		X	

Each point above represents an already existing assignment, test, project, or learning exercise in each class.

Pick a few points from a few courses for your assessment.

Figure 5: Objectives and Outcomes assessed in individual MNET courses

Objective & Outcome		MNET Courses Grouped by Competence Area																		
		Mfg Processes and Design Technologies				Systems and Components for Automation				Management and Productivity Improvements							Other	Applied Sciences		
		231	320	334	436	251	252	451	453	260	365	367	460	462	463	470 471	494	241	243	350
1	a	X				X	X									X				
	b		X	X				X	X					X				X		X
	h	X														X	X			
	m	X			X						X					X				
2	c								X					X					X	
	d											X	X			X				
	f		X	X	X				X					X		X				
	k													X	X	X	X			
	l													X	X					
3	e				X											X	X		X	
	g		X		X											X	X		X	
	n									X						X				
4	i										X						X			
	j									X					X		X			

Course assessments were picked to represent progress from lower level courses to more advanced courses. ABET suggests focusing on upper level courses.

Example 1: Continuous Improvement

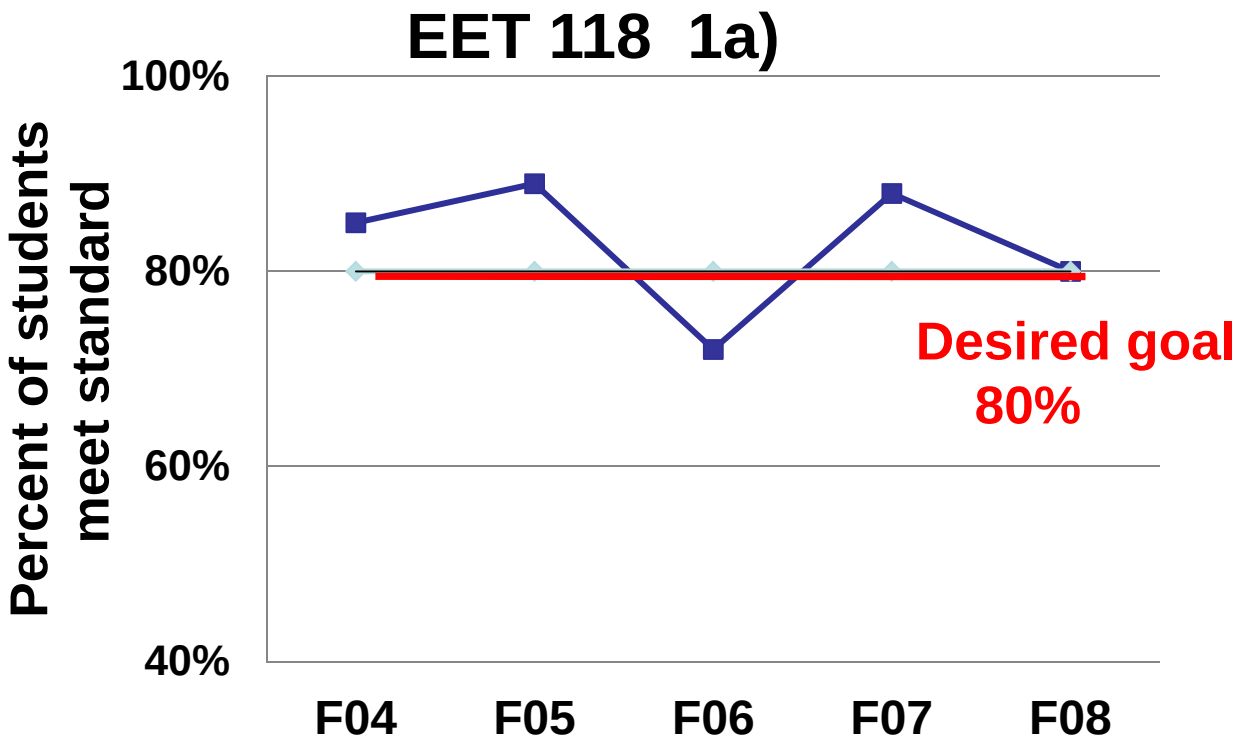
- Embedded assessment is used to identify and make adjustments to reverse trends toward poor outcomes.
  - Semester data recorded
  - Levels evaluated
  - Small changes made to the course for the next semester/year

Example 1: Continuous Improvement

- Outcome: Assessment 1a. EET graduates have an appropriate mastery of the knowledge, techniques, skills, and modern tools of electronics engineering technology
- Specifics: Demonstrate a working knowledge of the math required to solve problems in DC circuits in EET 118 class, on a test.
- Measure of Success: 80% of students score 8 out of 10, or better, in assessment

Example 1: Continuous Improvement – Control Chart

Sem.	% meet standard
F04	88
F05	89
F06	72
F07	88
F08	80



- After F06, the decision was made to add a couple more quizzes before the time the assessment is made

Example 2: The case of "academic ambivalence"

- Identify anomalies that affect overall assessment and avoid unnecessary actions
  - Poor performance on assessment noted
  - Faculty discussion identifies root cause
  - Action to correct may not be necessary

Example 2:

- Data: Poor assessment results noted:
  - Fall 2004: MNET 251
  - Spring 2005: MNET 252, 243, 334
  - Fall 2005: MNET 463
  - Spring 2006: MNET 453, 320, 462
  - Fall 2006: MNET 471
- Discussion identified a group of students whose prevailing attitude was “D’s get degrees”
- Corrective action taken by faculty committee to change graduation requirements to a minimum of a C in all major coursework.

Example 3: Process changes

- Identifying process shifts that require changes to make sure outcomes remain consistent.
  - Note poor assessment results
  - Discover process change
  - Take corrective action

Example 3: Process changes: The case of new course delivery methods

- Data: Course assessment indicated a drop in performance of basic skills.
- Root cause: One science department on campus changed delivery method to test all students entirely online. Students learning changed with the delivery methods.
- Corrective Action: More review of relevant material added to the MNET course to assure that the outcomes could be met.

Example 4: Process changes: Introducing Concept Quizzes in Mechanics

- Testing or evaluating innovative teaching methods.
  - Introduce new idea in class
  - Collect data
  - Note whether a performance shift occurs.

Example 4: Process changes: Introducing Concept Quizzes in Mechanic

- Method: Utilization of concept quizzes initiated in one semester. Utilization continued for another semester.
- Data: No improvement in assessment results was noted for either semester.
- Action: Since no improvement was noted, the concept quiz idea was discarded. While the idea has merit, the amount of extra work necessary had no measureable return.

From Gloria Rogers – Former Advisor to ABET

Establishing Timelines and Responsibilities for Outcomes

- In program assessment planning, it is important to let common sense prevail. You can't do everything - programs cannot assess everything that they believe students should know or be able to do.

From Gloria Rogers – Former Advisor to ABET

The timeline illustrated in Table 1 demonstrates a three year cycle where each outcome is assessed every three years.

Because there are only six outcomes, this means that the data collection process takes place on only two outcomes per year.

The timeline provides for two cycles of data collection every six years.

From Gloria Rogers – Former Advisor to ABET

Learning Outcomes (each with measurable performance indicators):	'08-09	'09-10	'10-11	'11-12	'12-13	'13-14
A recognition of ethical and professional responsibilities	●			●		
An understanding of how contemporary issues shape and are shaped by mathematics, science, & engineering		●			●	
An ability to recognize the role of professionals in the global society			●			●
An understanding of diverse cultural and humanistic traditions	●			●		
An ability to work effectively in teams		●			●	
An ability to communicate effectively in oral, written, graphical, and visual forms			●			●

Table 1. Data collection cycle for six learning outcomes

From Assessment Planning Flow Chart ©2004, Gloria M. Rogers, Ph.D., ABET, Inc. (grogers@abet.org) Copyright 2008

From Gloria Rogers – Former Advisor to ABET

- Table 2 below represents an assessment and evaluation timeline for multiple processes for a single outcome.

Outcome: An ability to recognize the role of professionals in the global society

Assessment and Evaluation Activity	'08-09	'09-10	'10-11	'11-12	'12-13	'13-14
Review of performance indicators that define the outcome	●			●		
Map educational strategies related to performance indicators		●			●	
Review mapping and identify where data will be collected		●			●	
Develop and/or review assessment methods used to assess performance indicators		●			●	
Collect data			●			●
Evaluate assessment data including processes				●		
Report findings				●		
Take action where necessary				●		

Table 2. Assessment and evaluation activity timeline for a single outcome

From Gloria Rogers – Former Advisor to ABET

To get a general view of what one cycle of an assessment program might look like, Table 3 represents three academic years of activity for six learning outcomes by assessment and evaluation activities.

From Gloria Rogers – Former Advisor to ABET

Activities	'08-09						'09-10						'10-11					
	Ethics	Contemporary Issues	Global	Cultural	Teams	Communication	Ethics	Contemporary Issues	Global	Cultural	Teams	Communication	Ethics	Contemporary Issues	Global	Cultural	Teams	Communication
Review of performance indicators defining that outcome			●			●	●			●				●			●	
Map educational strategies related to performance indicators		●			●				●			●	●			●		
Review mapping and identify where data will be collected		●			●				●			●	●			●		
Develop or review assessment methods related to outcome		●			●				●			●	●			●		
Collect and analyze data	●			●				●			●				●			●
Evaluate assessment data including processes			●			●	●			●				●			●	
Report findings			●			●	●			●				●			●	
Take action where necessary			●			●	●			●				●			●	

Table 3. Three-year cycle of assessment and evaluation activity

Questions?