ECA 2007
International Conference on Learning Outcomes

"How to design and assess learning outcomes in higher education"©

September 4, 2007

Gloria Rogers, Ph.D.
Associate Executive Director,
Professional Services
ABET, Inc.

Continuous Quality Improvement and Accreditation

Accreditation criteria have been developed on the principles of continuous quality improvement (CQI). The principles of CQI rest on an underlying philosophy of quality which has implications for processes which need to be in place within the educational organization.

CQI Implications for Education

We need to systematically analyze our systems for variance, make decisions based on fact, consciously define the organization's internal and external customers and actively seek input from both. It drives out fear by encouraging organization members to risk making mistakes in order to learn more about the system. (Mimi Wolverton, "A New Alliance: Continuous Quality and Classroom Effectiveness.")

What does this mean?

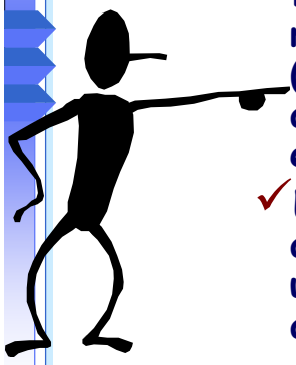
An educational program CQI process should involve:

1. a clear understanding of its mission, constituents, and objectives (what one is trying to achieve),
2. learning outcomes (the desired learning that needs to take place to meet the objectives),
3. integrated processes (internal practices designed to achieve the outcome),
4. facts (purposeful data collection),
5. evaluation (interpretation of facts),
6. and action (feedback to support decision making and improve processes).

New Challenges

- Overcoming traditional view that inputs equal quality of learning outcomes
- Providing meaningful mental models that can be used to bring focus on outcomes as evidence of program quality
- Moving from micro assessment in the classroom to macro assessment of the program

Foundational Truths



- ✓ Programs are at different places in the maturity of their assessment processes
- ✓ Programs have different resources available to them (e.g., number of faculty, availability of assessment expertise, time)
- ✓ Each program has faculty who are at different places in their understanding of good assessment practice

What comes into the system?

What are we doing with the inputs?

How many?

What is the effect?

Input	Processes	Outputs	Outcomes
Student Background	Programs & services offered; populations served	Student grades; graduation rates; employment statistics	What have students learned; what skills have they gained; attitudes developed?
Faculty Background	Faculty teaching loads/class size	Publication numbers/Faculty development activities; Credit hrs delivered	Faculty publication citations data; faculty devlpmt
Educational Resources	Policies, procedures, governance	Statistics on resource availability, participation rates	Student learning and growth

Input	Processes
Student Background	Programs & services offered; populations served
Faculty Background	Faculty teaching loads/class size
Educational Resources	Policies, procedures, governance

- ✓ **Assessment of inputs and process only establishes the capability or capacity of a program (how many courses and what is "covered", background of faculty, nature of facilities, etc.)**

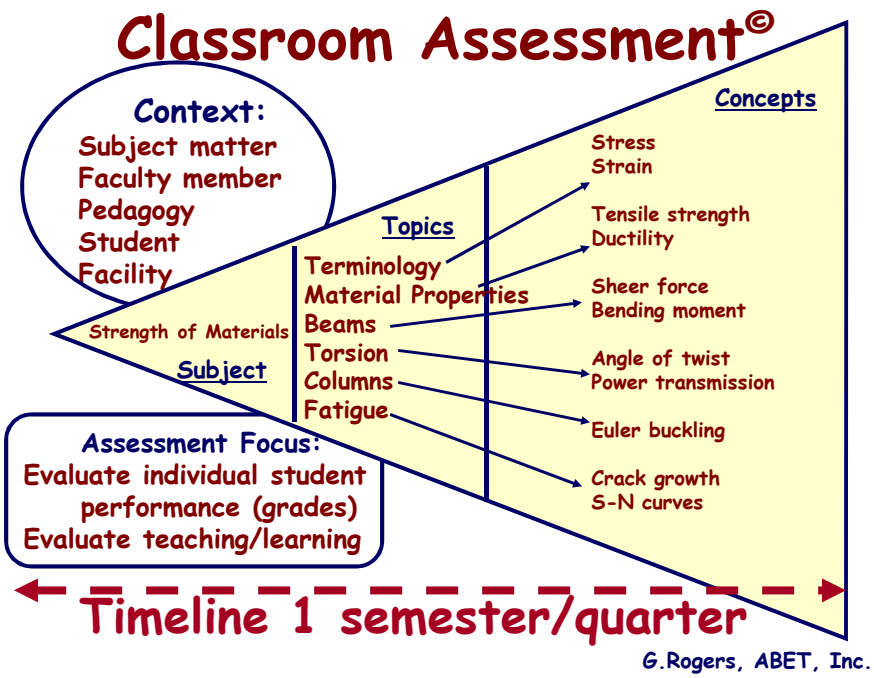
- Assessment of **outputs** serve as indirect measures or proxies for effectiveness—they provide general indicators of achievement.

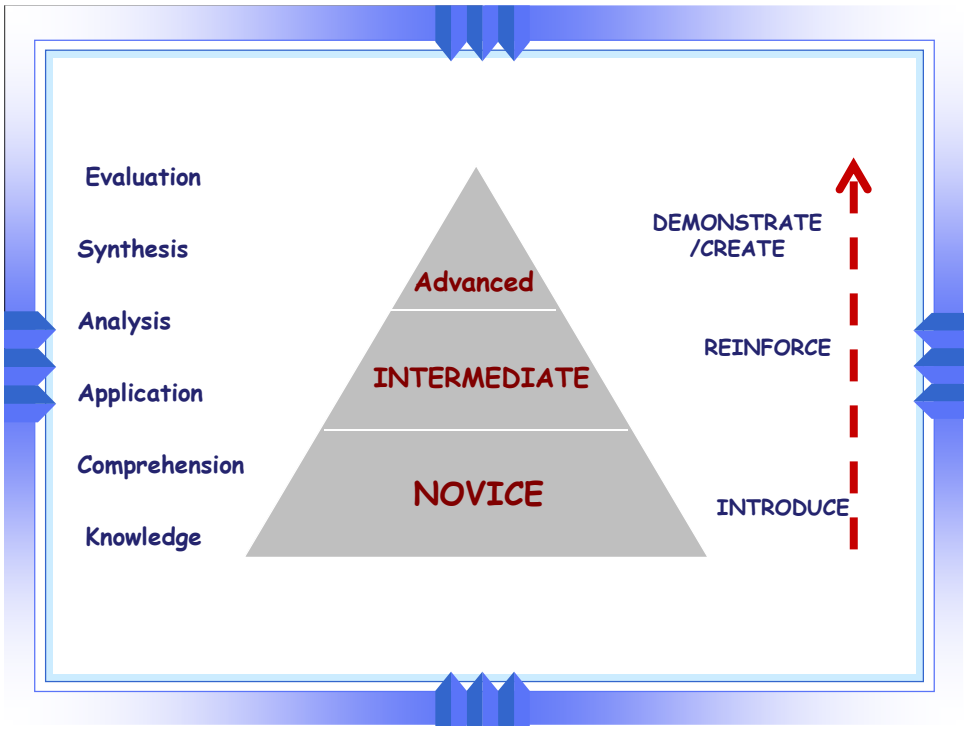
Outputs
Student grades; graduation rates; employment statistics
Publication numbers/Faculty development activities; Credit hrs delivered
Statistics on resource availability, participation rates

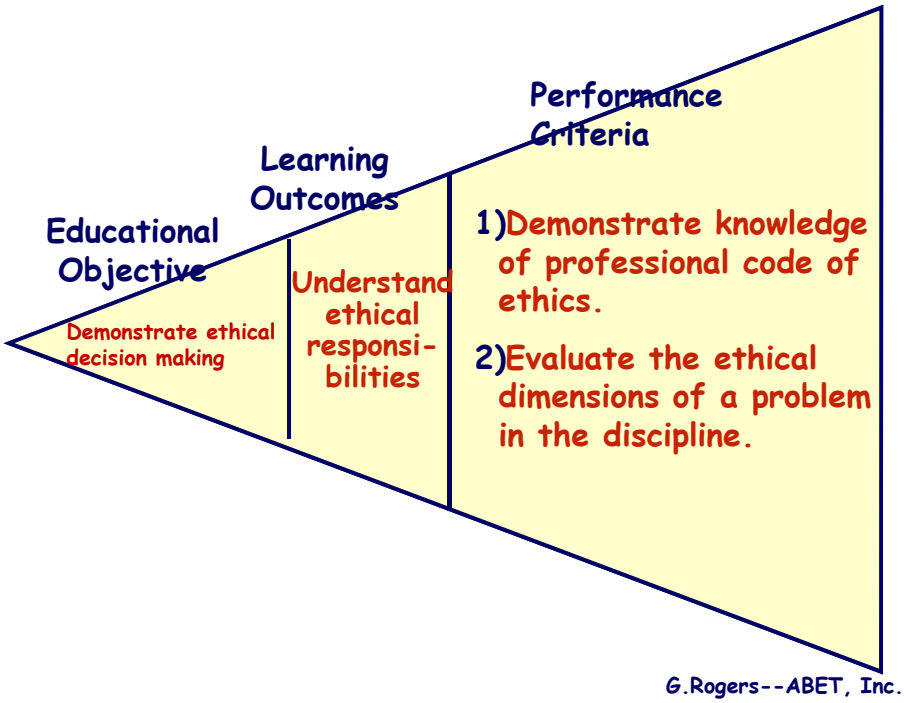
- Assessment of **outcomes** provides for direct measures of the effectiveness of what has been done with that capability/ capacity related to individual learning and growth.

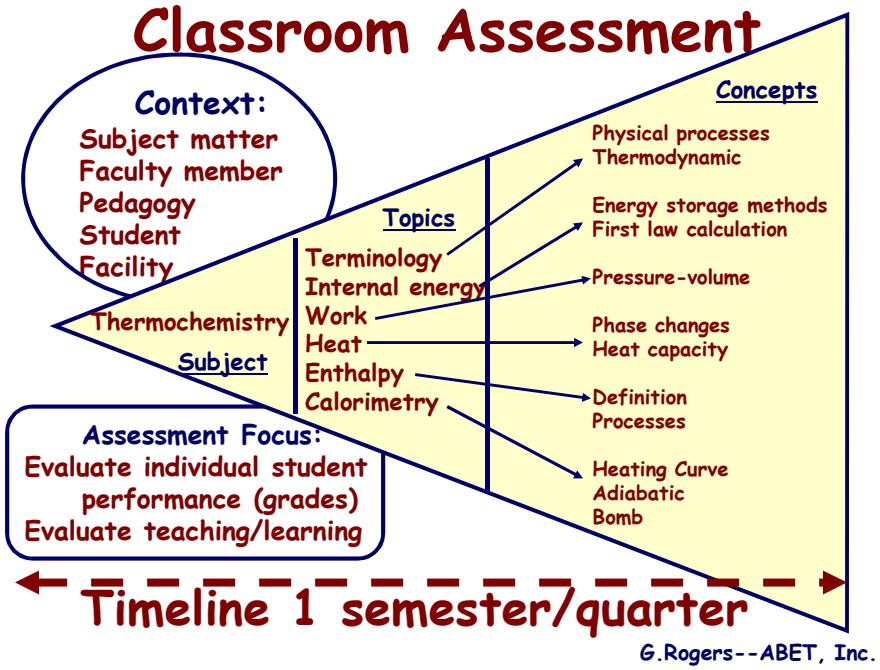
Outcomes
What have students learned; what skills have they gained; attitudes developed?
Faculty publication citations data; faculty devlpmt
Student learning and growth

Terms	Definition	Some other terms for same concept
Objectives	Broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.	Goals, outcomes, purpose, etc.
Outcomes	Statements that describe what students are expected to know and able to do by the time of graduation.	Objectives, standards, etc.
Performance Criteria	Specific, measurable statements identifying the performance(s) required to meet the outcome; confirmable through evidence.	Standards, rubrics, specifications, metrics, outcomes, etc.
Assessment	Processes that identify, collect, use and prepare data that can be used to evaluate achievement.	Evaluation
Evaluation	Process of reviewing the results of data collection and analysis and making a determination of the value of findings and action to be taken.	Assessment



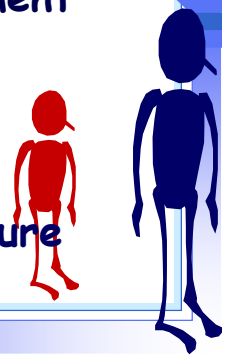


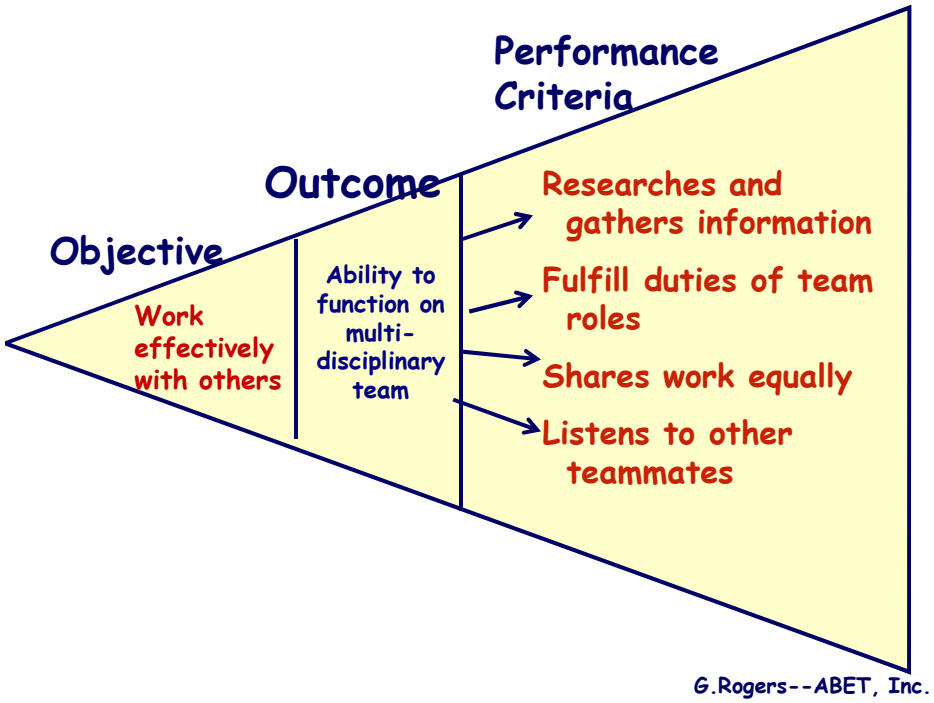




Differences between classroom and program assessment

- ✓Degree of complexity
- ✓Time span
- ✓Accountability for the assessment process
- ✓Cost
- ✓Level of faculty buy-in
- ✓Level of precision of the measure





Please rate each member of the team on the following scale:

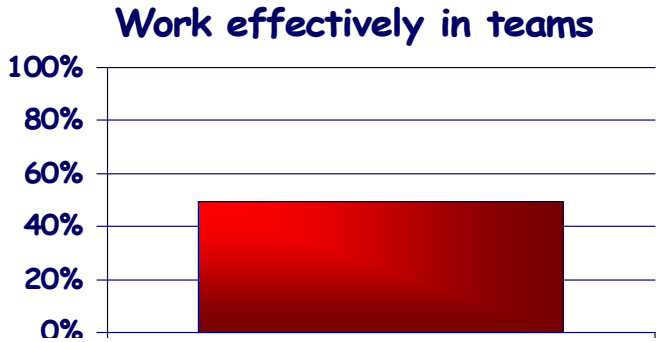
Unsatisfactory 1 | Developing 2 | Satisfactory 3 | Exemplary 4

Name	Attribute	1	2	3	4	Ave Score
	Researched and gathered information					
	Fulfilled team role's duties as assigned					
	Shared the work equally					
	Listened to other teammates points of view					
	Researched and gathered information					
	Fulfilled team role's duties as assigned					
	Shared the work equally					
	Listened to other teammates points of view					
	Researched and gathered information					
	Fulfilled team role's duties as assigned					
	Shared the work equally					
	Listened to other teammates points of view					
	Researched and gathered information					
	Fulfilled team role's duties as assigned					
	Shared the work equally					
	Listened to other teammates points of view					

Work Effectively in Teams

	Unsatisfactory 1	Developing 2	Satisfactory 3	Exemplary 4	Score
Research & Gather Information	Does not collect any information that relates to the topic.	Collects very little information--some relates to the topic.	Collects some basic information--most relates to the topic.	Collects a great deal of information--all relates to the topic.	
Fulfill Team Role's Duties	Does not perform any duties of assigned team role.	Performs very little duties.	Performs nearly all duties.	Performs all duties of assigned team role.	
Share Equally	Always relies on others to do the work.	Rarely does the assigned work--often needs reminding.	Usually does the assigned work--rarely needs reminding.	Always does the assigned work without having to be reminded.	
Listen to Other Teammates	Is always talking--never allows anyone else to speak.	Usually doing most of the talking--rarely allows others to speak.	Listens, but sometimes talks too much.	Listens and speaks a fair amount.	
				Average	

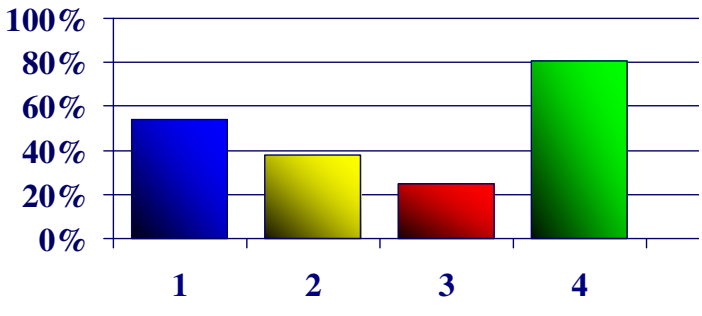
Example of Results



At a level expected for a student who will graduate?

Example of Results

Teaming Skills



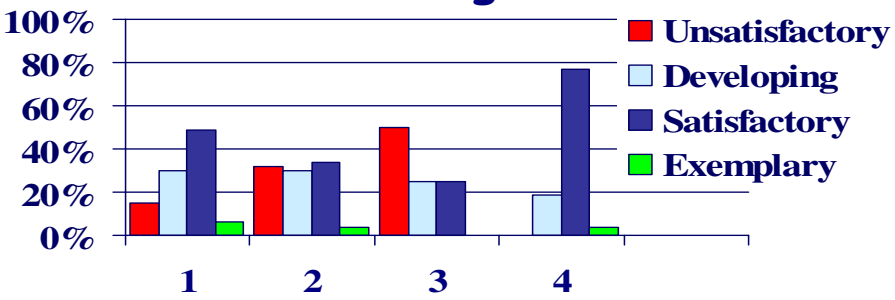
Performance Criterion #

1. Research & gather information
2. Fulfill team role's duties
3. Shares equally
4. Listens to teammates

Example of Results

Teaming Skills

Percent meeting criterion

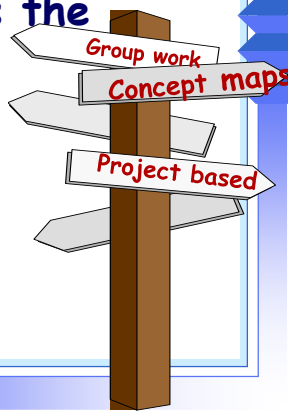


Performance Criterion #

1. Research & gather information
2. Fulfill team role's duties
3. Shares equally
4. Listens to teammates

Importance of Curriculum Mapping

- Align teaching strategies with anticipated outcomes
- Where do you give students the opportunity to:
  - Learn
  - Practice
  - Develop
  - Demonstrate



Linking results to Practice

- ✓ Development of Curriculum Map
- ✓ Linking curriculum content/pedagogy to knowledge, practice and demonstration of learning outcomes

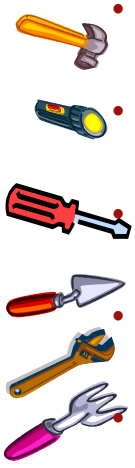
Performance Criterion is Explicit. This performance criteria is explicitly stated as being a learning outcome for this course.
Demonstrate Competence. Students are asked to demonstrate their competence on this performance criteria through homework, projects, tests, etc.
Formal Feedback. Students are given formal feedback on their performance on this performance criteria.
Not covered. This performance criterion is not addressed in these ways in this course.
Note: Clicking on the link 'view rubric' will show you the scoring rubric for the particular performance criteria related to the outcome.

Performance Criteria	Criterion Explicit	Demonstrate Competence	Formal Feedback	Not Covered
Recognition of ethical and professional responsibilities.				
1. Demonstrate knowledge of professional codes of ethics. View rubric or make a comment (optional)	☐ Yes	☐ Yes	☐ Yes	☐
2. Evaluate the ethical dimensions of professional engineering, mathematical, and scientific practices. View rubric or make a comment (optional)	☐ Yes	☐ Yes	☐ Yes	☐
An ability to work effectively in team				
1. Share responsibilities and duties, and take on different roles when applicable View rubric or make a comment (optional)	☐ Yes	☐ Yes	☐ Yes	☐
2. Analyze ideas objectively to discern feasible solutions by building consensus View rubric or make a comment (optional)	☐ Yes	☐ Yes	☐ Yes	☐
3. Develop a strategy for action. View rubric or make a comment (optional)	☐ Yes	☐ Yes	☐ Yes	☐
An ability to communicate effectively in oral, written, graphical, and visual forms				
1. Identify the readers/audience, assess their previous knowledge and information needs, and organize/design information to meet those needs. View rubric or make a comment (optional)	☐ Yes	☐ Yes	☐ Yes	☐
2. Provide content that is factually correct, supported with evidence, explained with sufficient detail, and properly documented. View rubric or make a comment (optional)	☐ Yes	☐ Yes	☐ Yes	☐
3. Test readers/audience response to determine how well ideas have been relayed. View rubric or make a comment (optional)	☐ Yes	☐ Yes	☐ Yes	☐
4. Submit work with a minimum of errors in spelling, punctuation, grammar, and usage. View rubric or make a comment (optional)	☐ Yes	☐ Yes	☐ Yes	☐

Chemical engineering curriculum map for Communication Skills

	1st Year			2nd Year			3rd Year			4th Year		
FALL	CM 111	Chem I	4	CH 01	Cons Principles	4	CH 414	Heat Transfer	4	CH 400	Career P III	0
	EM 100	Life Skills	1	CM 251	O Chem I	4	CH 415	Materials	4	CH 401	Mass II	4
	EM 104	Graph Comm	2	MA 221	DE I	4	CM 225	A Chem I	4	CH 403	Lab II	2
	RH 131	Fresh Comp	4	HSS	Elective	4	CH 304	Thermo II	4	CH 404	Kinetics	4
	MA 111	Calc 1	5	CH 200	Career P I	0					Elective	4
WINTER	CM 113	Chem II	4	CH 202	Che Proc Calc	4	CH 300	Career P II	0	CH 406	Design I	4
	PH 111	Physics I	4	CM 252	O Chem II	4	CM 360	P Chem	4	CH 408	Lab III	2
	HSS	Elective	4	MA 222	DE II	4	CH 305	Mass I	4	CH 440	P Control	4
	MA1 12	Calc II	5	EM 101	Statics I	2	MA 227	Statistics	4	HSS	Elective	4
	MS 120	M.History	1				Hss	Elective	4		Elective	4
SPRING	CM 115	Chem III	4	CH 301	Fluids	4	EE 206	EEE	4	CH 407	Design II	4
	CS 100	Program.	2		Elective	4	CH 402	ChE Lab I	1	CH 409	Prof Prac	1
	EM 103	Int Design	2	HSS	Elective	4		Elective	4	HSS	Elective	4
	MA 113	Calc III	5	CH 303	Thermo I	4		Elective	4		Elective (Des)	4
	PH 112	Physics II	4				HSS	Elective	4		Elective (free)	4

Assessment Methods



- Written surveys and questionnaires
- Exit and other interviews
- Standardized exams
- Locally developed exams
- Archival records
- Focus groups

- Portfolios
- Simulations
- Performance Appraisal
- External examiner
- Oral exams
- Behavioral observations

Direct Measures

Direct measures provide for the direct examination or observation of student knowledge or skills against measurable learning outcomes.

Indirect Measures

Indirect measures are those that ascertain the opinion or self-report of the extent or value of learning experiences.

Direct

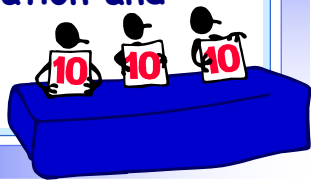
- ✓ Exit and other interviews
- ✓ Standardized exams
- ✓ Locally developed exams
- ✓ Portfolios
- ✓ Simulations
- ✓ Performance Appraisal
- ✓ External examiner
- ✓ Oral exams
- ✓ Behavioral observations

Indirect

- ✓ Written surveys and questionnaires
- ✓ Exit and other interviews
- ✓ Archival records
- ✓ Focus groups

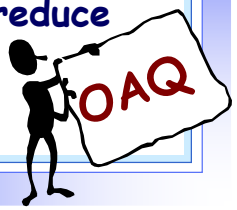
Validity

- relevance - the assessment option measures the educational outcome as *directly* as possible
- accuracy - the option measures the educational outcome as *precisely* as possible
- utility - the option provides formative and summative results with *clear implications* for educational program evaluation and improvement



Assessment Methods

- ✓ All assessment options have advantages and disadvantages
- ✓ "Ideal" method means those that are best fit between program needs, satisfactory validity, and affordability (time, effort, and money)
- ✓ Crucial to use multi-method/multi-source approach to maximize validity and reduce bias of any one approach

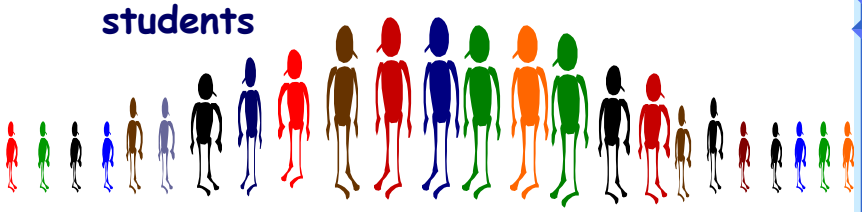


Assessment Method Truisms

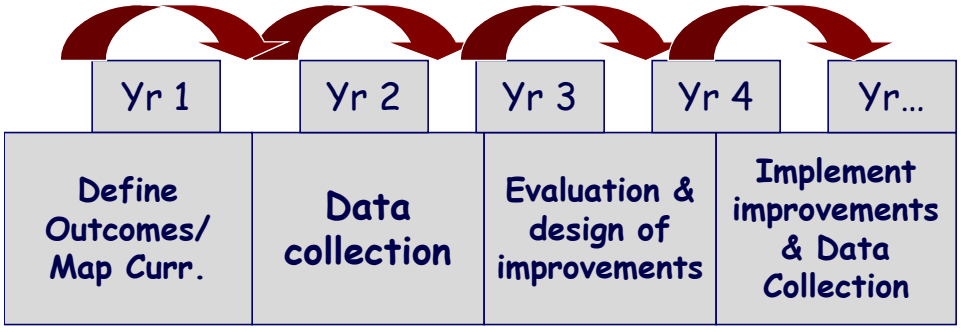
- ✓ There will always be more than one way to measure any learning outcome
- ✓ No single method is good for measuring a wide variety of different student abilities
- ✓ There is generally an inverse relationship between the quality of measurement methods and their expediency
- ✓ It is important to pilot test to see if a method is appropriate for your program

Sampling

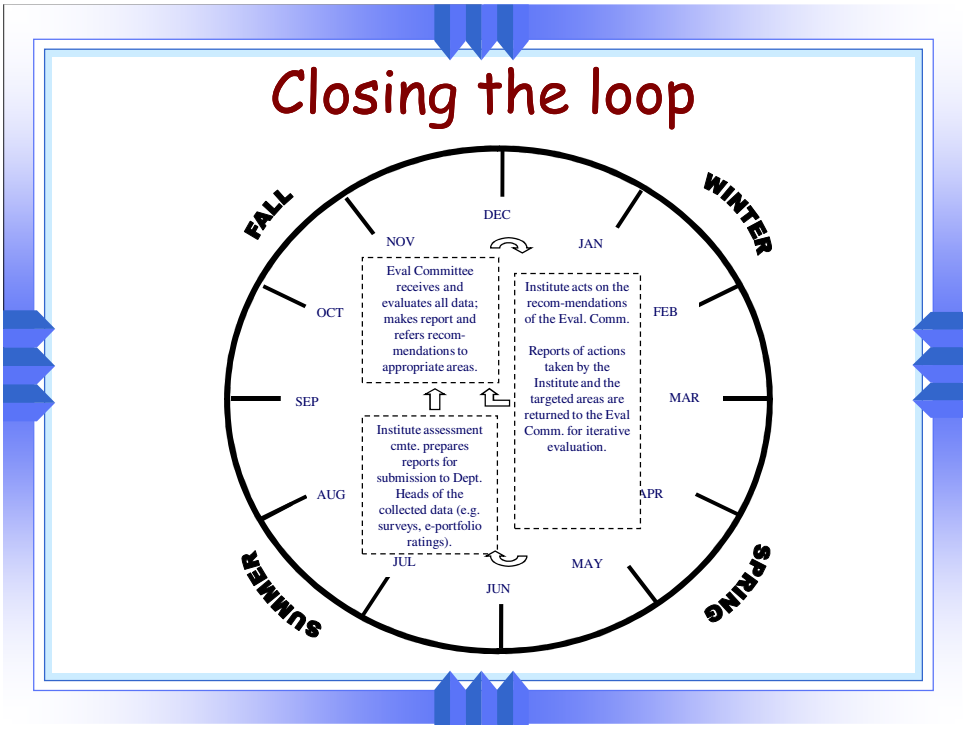
- For program assessment, sampling is acceptable and even desirable for programs of sufficient size.
  - Sample is representative of all students



Data collection



Learning Outcomes related to:	07-08	08-09	09-10	10-11	11-12	12-13
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,	✦		✦		✦	



Student Learning Outcomes at the PROGRAM level©

Learning Outcome _____

Performance Criteria	Strategies	Assessment Method(s)	Context for Assessment	Time of data collection	Assessment Coordinator	Evaluation of Results

Results _____ (date):

Actions _____(date):

Second-Cycle Results ____(date):

grogers@abet.org

Checklist

- ☑ Constituents involved in the development and assessment of objectives
- ☑ Outcomes are defined and number of performance criteria are manageable
- ☑ Data are efficiently and systematically collected
- ☑ Assessment methods are appropriate to program context
- ☑ Results are evaluated
  - ☑ Evaluation is more than looking at the results of learning outcomes
- ☑ Action is appropriate

Things I wish I had known:

- ✓Capitalize on what you are already doing
- ✓One size does not fit all
- ✓You don't have to measure everything all the time
- ✓More data are not always better
- ✓Pick your battles
- ✓Take advantage of local resources
- ✓Don't wait for perfection
- ✓Go for the early win
- ✓Decouple from faculty evaluation

http://www.abet.org

by

Gloria Rogers
grogers@abet.org