Adapting Academic System & Curriculum
to
Outcome-Based Education (OBE)

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ADAPTING THE CURRICULUM TO OBE

- REVIEW OF ACADEMIC SYSTEM TO ALLOW PROPER PLANNING, IMPLEMENTATION, ASSESSMENT AND EVAUATION, AND FINALLY FOR CONTINUAL QUALITY IMPROVEMENT.

- THE INVOLVEMENT OF STAKEHOLDERS

- IMPLEMENTATION OF PROPER DOCUMENTATION APPROACH AND SYSTEM

- IMPLEMENTATION OF PROPER COURSE MATERIAL DELIVERY

- IMPLEMENTATION OF APPROPRIATE ASSESSMENT (MUST MATCH THE OUTCOME AND TIMELY)

- IMPLEMENTATION OF APPROPRIATE EVALUATION OF PERFORMANCE CRITERIA ATTAINMENTS

- IMPLEMENTATION OF CQI

ADAPTING THE CURRICULUM TO OBE

- ► SYSTEM: WORK THE WAY DOWN FROM MACRO TO MICRO – IMPORTANT SO THAT THE WHOLE SYSTEM SUPPORTS THE OBE IMPLEMENTATION AND NO LOOPHOLES

- ► IMPLEMENTATION: BOTTOM UP – IMPORTANT SO THAT THE ROOT OF THE PROBLEM CAN BE IDENTIFIED EASILY

- ► WHEN START THE PLAN:
  - ► SEE THE BIGGER PICTURE
  - ► PLAN TO COLLECT DATA THAT MEANS SOMETHING (RELATED TO THE OUTCOMES)
  - ► DO NOT BE TOO FOCUSED ON TOO MUCH OF THE TINIEST DETAILS
  - ► DO NOT COLLECT TOO MUCH DATA
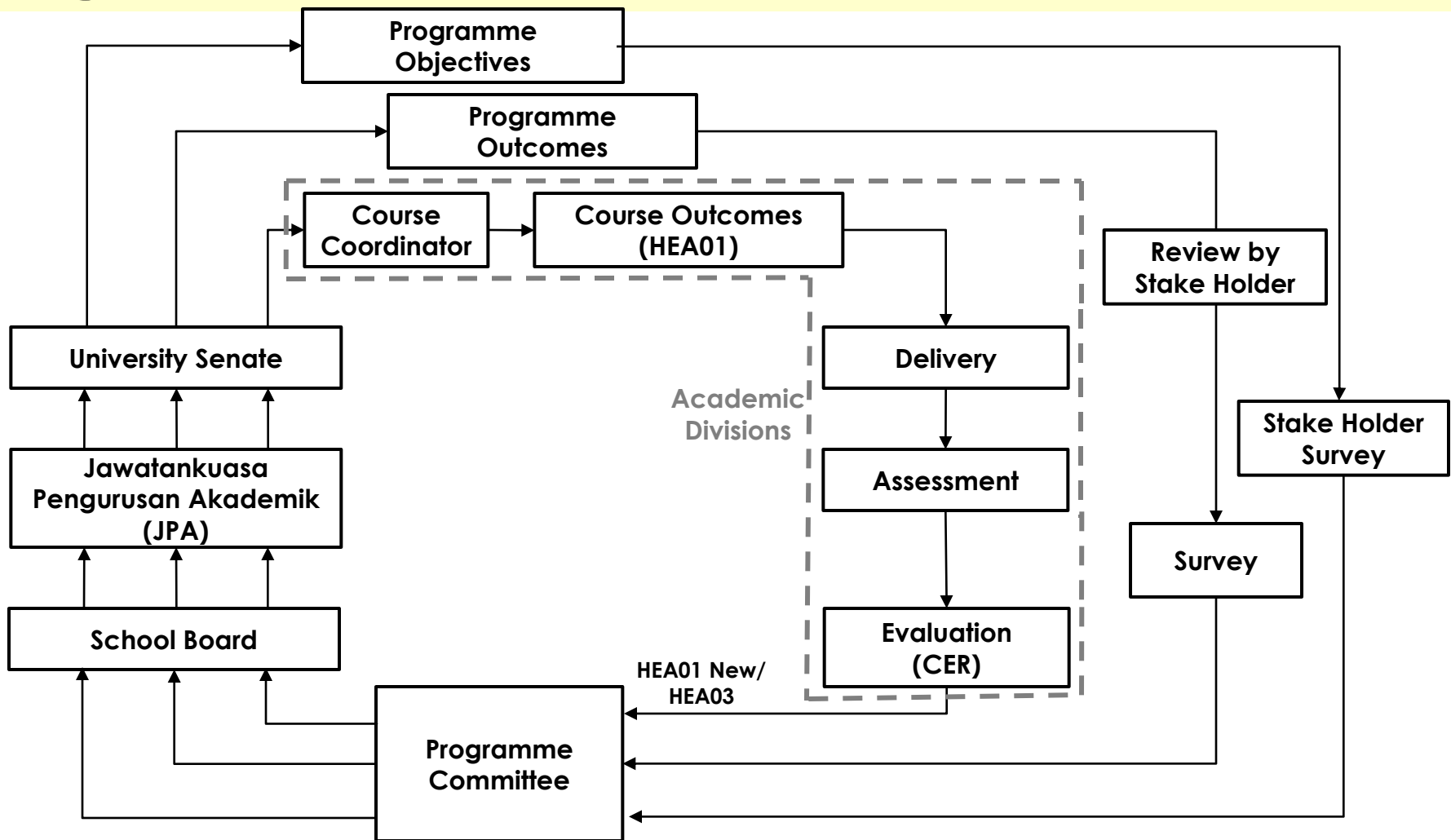 - ► MUST BE PRACTICAL / IMPLEMENTABLE

ADAPTING THE CURRICULUM TO OBE

- IT IS OK IF IT DOES NOT WORK THE FIRST TIME AROUND. THAT IS WHY CQI MUST BE IN PLACE

- SYSTEM MUST ALLOW FOR THE CQI TO HAPPEN / BE IMPLEMENTED

ACADEMIC SYSTEM: OBE Implementation

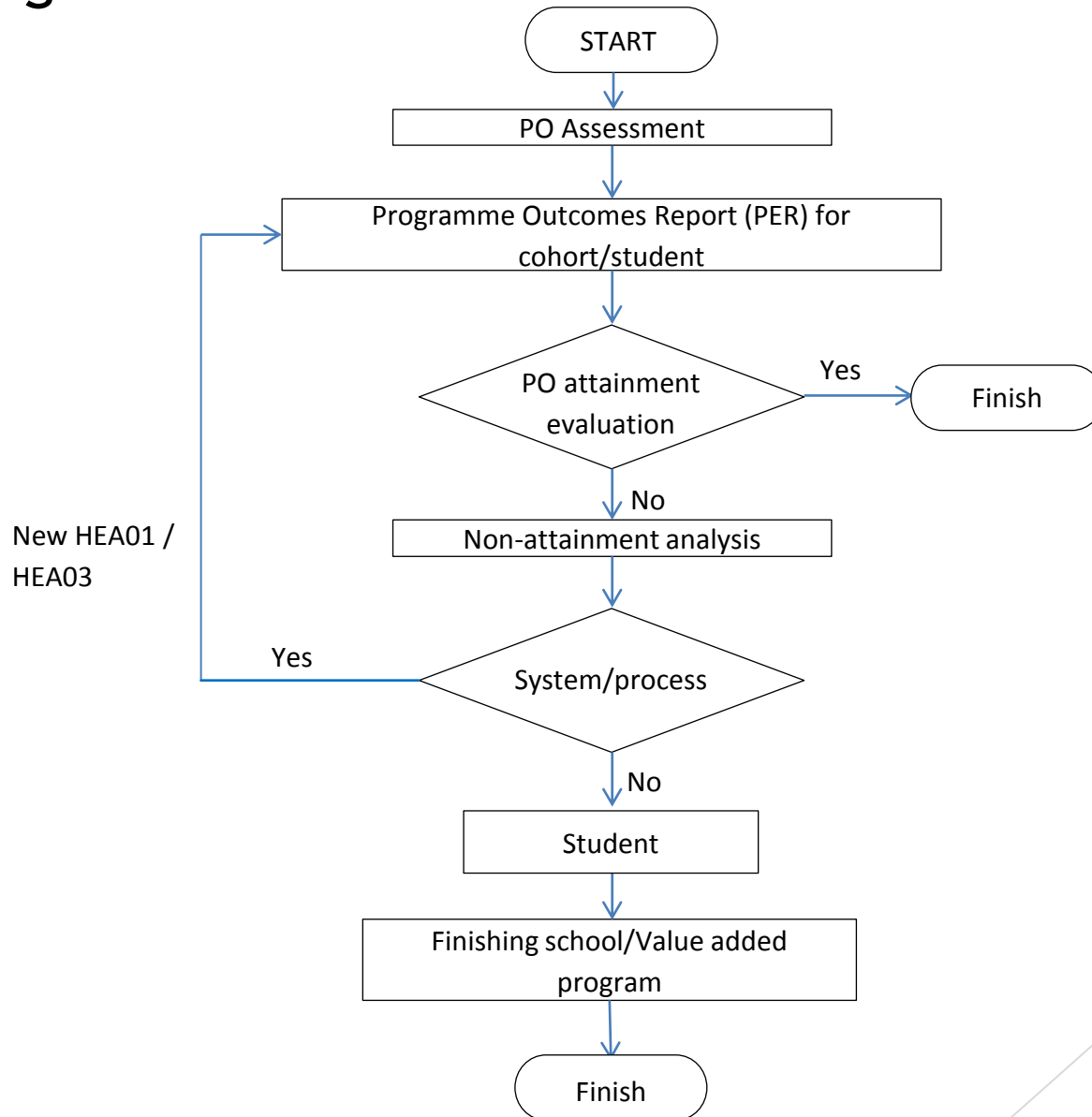# Evaluation Process of Programme Objectives, Programme Outcomes and Course Outcomes

OBE implementation at School of Mechatronic Engineering showing the planning, implementation, assessments and evaluations, as well as the CQI process in closing the loop.

CQI process for non-attainment of Programme Outcomes

```
                    ┌─────────────┐
                    │    START    │
                    └──────┬──────┘
                           ↓
                  ┌─────────────────┐
                  │  PO Assessment  │
                  └────────┬────────┘
                           ↓
              ┌─────────────────────────────┐
   ┌─────────→│ Programme Outcomes Report   │
   │          │ (PER) for cohort/student    │
   │          └──────────────┬──────────────┘
   │                         ↓
   │                    ◇─────────◇            Yes     ╭──────────╮
   │                   ╱  PO        ╲─────────────────→│  Finish  │
   │                   ╲ attainment ╱                  ╰──────────╯
   │                    ◇ evaluation◇
   │                         │ No
   │                         ↓
New HEA01 /         ┌─────────────────────┐
HEA03               │ Non-attainment      │
   │                │ analysis            │
   │                └──────────┬──────────┘
   │                           ↓
   │      Yes          ◇───────────────◇
   └──────────────────╱  System/process ╲
                      ◇─────────┬────────◇
                                │ No
                                ↓
                       ┌─────────────────┐
                       │     Student     │
                       └────────┬────────┘
                                ↓
                   ┌───────────────────────────┐
                   │ Finishing school/Value     │
                   │ added program              │
                   └─────────────┬─────────────┘
                                 ↓
                          ╭──────────╮
                          │  Finish  │
                          ╰──────────╯
```

Course outcomes (CO)

- *Learning outcomes are statements of what a learner is expected to know, understand and/or be able to demonstrate after completion of a process of learning.*

- Complexity level as guide – using Bloom Taxonomy / SOLO Taxonomy

- The taxonomy provides a framework in which one can build upon prior learning to develop more complex levels of understanding.

- There are three domain of learning;

  - Cognitive

  - Psychomotor

  - Affective

Domains of Interests

- ▶ COGNITIVE
- ▶ PSYCOMOTOR
- ▶ AFFECTIVE

Objectives vs Outcomes

Objectives	Outcomes
Objectives describe WHAT A TEACHER NEEDS TO DO TO TEACH, AND WHAT NEEDS TO BE PLANNED TO TEACH.	Outcomes describes WHATSTUDENTS SHOULD KNOW,UNDERSTAND AND CAN DO UPON THE COMPLETION OF A STUDY PERIOD.
Objectives require the use of BASIC THINKING SKILLS SUCH AS KNOWLEDGE, COMPREHENSION, AND APPLICATION.	Outcomes require the use of HIGHER THINKING SKILLS SUCH AS ANALYSIS, SYNTHESIS, AND EVALUATION (as described in Bloom's Taxonomy)
Objectives DO NOT NECESSARILY RESULT IN A PRODUCT.	Outcomes result in a PRODUCT THAT CAN BE MEASURED AND ASSESSED.

Writing Course outcomes (CO)

▶ The use of the correct verbs is the key to the successful writing of learning outcomes.

▶ Refer publication; Writing and Using Learning Outcomes: a Practical Guide by Declan Kennedy, Aine Hyland and Norma Ryan

▶ Well written verbs must be SMART.

Writing Course outcomes (CO)

Table C 3.4-1-1   Examples of verbs used in writing aims and learning outcomes. (Fry et al., 2000 p. 51)

Aims	Outcomes
Know	Distinguish between
Understand	Choose
Determine	Assemble
Appreciate	Adjust
Grasp	Identify
Become familiar	Solve, apply, list

Guidelines in writing Course outcomes (CO)

▶ Begin each learning outcome with an **action verb**, followed by the **object of the verb** followed by a **phrase that gives the context**.

▶ Use only **one verb** per learning outcome.

▶ **Avoid vague terms** like know, understand, learn, be familiar with, be exposed to, be acquainted with, and be aware of. These terms are associated with teaching objectives rather than learning outcomes.

▶ **Avoid complicated sentences**. If necessary use more one than one sentence to ensure clarity.

Guidelines in writing Course outcomes (CO)

- ▶ Ensure that the learning outcomes of the module relate to the **overall outcomes** of the programme.

- ▶ The learning outcomes must be **observable** and **measurable**.

- ▶ Ensure that the earning outcomes are capable of being **assessed**.

- ▶ When writing learning outcomes, bear in mind the **timescale** within which the outcomes are to be achieved. There is always the danger that one can be over-ambitious when writing learning outcomes. Ask yourself if it is realistic to achieve the learning outcomes within the time and resources available

► As you work on writing the learning outcomes, bear the mind how these **outcomes will be assessed**, i.e. how will you know if the student has achieved these learning outcomes? If the learning outcomes are very broad, they may be difficult to assess effectively. If the learning outcomes are very narrow, the list of learning outcomes may be too long and detailed.

► When writing learning outcomes, for students at levels beyond first year, try to **avoid overloading the list with learning outcomes** which are drawn from the bottom of Bloom's taxonomy (e.g. Knowledge and Comprehension in the cognitive domain). Try to challenge the students to use what they have learned by including some learning outcomes drawn from the higher categories (e.g. Application, Analysis, Synthesis and Evaluation)

Linking CO, learning activities and assessments

Learning outcomes		Teaching and Learning Activities	Assessment
Cognitive		Lectures	End of module exam
	Demonstrate knowledge	Tutorials	Multiple choice tests
	Comprehension		
	Application	Discussions	Essays
	Analysis		
	Synthesis	Laboratory work	Practical assessment.
	Evaluation		
Affective		Clinical work	Fieldwork
		Group work	Clinical practice
	Integration of beliefs, ideas and attitudes	Seminar	Presentation
		Peer group presentation	Project work
Psychomotor	Acquisition of physical skills		

TIEING EVERYTHING TOGETHER

Example of Course to Program Outcomes (PO) Matrix

NO	CODE	COURSE	EMPHASIS TO THE PROGRAM OUTCOMES												
			1	2	3	4	5	6	7	8	9	10	11	12	13
18	ENT257	Fluid Mechanics	3	3	2	2	2	1	2	2					1
19	ENT258	Numerical Analysis	3	3	2	3	2	1	2	2		2		3	2
20	ENT364	Control System	3	2	3	3	3	1	2	2	1			2	2
21	ENT355	Heat Transfer	3	3	2	3	2	1	2	2		2		3	2
22	ENT353	Mechanical Design II	2	2		3	1			2				3	2
23	ENT352	Computer Aided Engineering Design	3	2	2	2	2	1		3	1		1	1	2
24	EIT300	Industrial Training	2	1	2	2	2	1	1	2	1	1	1	1	
25	ENT451	Vibrations	3	2	1	3	2	1	1	2		1		2	2
26	EUT440	Engineer In Society			1	1	1	3	3	2	3	3	3	3	
27	ENT444	Final Year Project	3	2	2	2	3			2		1		2	2
		Elective I													
28	ENT483	Turbomachinery	2	2	1	2	2	2		2				2	2
29	ENT485	Finite Element Analysis	3	2	2	2	2	1		3	1		1	2	2
		Elective II													
30	ENT487	Fracture Mechanic	2	2		2	3		1	1				2	3
31	ENT481	Renewable Energy	2	2	1		2		2	1	2	2		2	2
		Elective III													
32	ENT488	Operational Research	3	2	1	3	3		2	2				3	2
33	ENT489	Numerical Analysis	2	2		3	1		1	1				3	2
		Elective IV													
34	ENT 452	Rapid Engineering	2	2		3	1		1	1				3	2

Course Outcomes vs. Programme Outcomes Matrix

Course Outcomes	Domain & Taxonomy Levels	PO 1 C	PO 2 C P	PO 3 CS P	PO 4 P C	PO 5 C P CTPS	PO 6 EM	PO 7 LL C	PO 8 LS TS	PO 9 EM	PO 10 ES C	PO 11 LL	PO 12 C	PO 13 P C
CO1: Ability to **analyze** concepts and problems in general measurement systems and error analysis in a system.	**C4** P2 A2:CS, CTPS	3	3	1	-	3	-	-	-	-	-	-	-	3
CO2: Ability to **analyze** concepts and problems in signal characteristics, signal conditioning and basic of DAQ system.	**C4** P2 A2:CS, CTPS	3	3	1	-	3	-	-	-	-	-	-	-	3
CO3: Ability to **analyze** concepts and problems in sensor & transducers, and the voltage & current measurement.	**C4** P2 A2:CS, CTPS	3	3	1	-	3	-	-	-	-	-	-	-	3
CO4: Ability to **analyze** concepts and problems in mechanical properties using sensors for temperature measurements, position, velocity & acceleration measurements, force & torque measurements, stress & strain measurement, pressure measurement and flow measurements.	**C4** P2 A2:CS, CTPS	3	3	1	-	3	-	-	-	-	-	-	-	3
Average		**3**	**3**	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

Course Outcomes vs Assessment components

Course Outcome	Assessments				
	Taxonomy Levels	Final Exam	Mid-term Tests	Lab Report and/or Oral Presentation	Assignment Report and/or Oral Presentation
CO1: Able to describe the concept of dynamics.	Knowledge Comprehension Analysis.	Q1	Q1& Q2	Lab 1	
CO2: Able to describe kinetic and kinematics for particle and rigid body.	Knowledge Comprehension Analysis.	Q2&Q3	Q3	Lab 3	Assignment No 1
CO3: Able to solve motion problem (rectilinear, curvilinear, motion of projectile and relative motion) using basic of dynamic.	Knowledge Comprehension Analysis.	Q4		Lab 2 & Lab 4	Assignment No 2 & Quiz
CO4: Able to describe application of dynamics by using concept of kinetic of particle and concept of kinematics of a rigid body.	Knowledge Comprehension Analysis.	Q5&Q6		Lab 5	

REFERENCES

The Language of Assessment: Humpty Dumpty Had a Great Fall . . .

Assessment Tips With Gloria Rogers

In Lewis Carroll's *Alice's Adventures in Wonderland*, Alice and Humpty Dumpty have an interesting conversation:

"I don't know what you mean by 'glory,'" Alice said.

Humpty Dumpty smiled contemptuously. "Of course you don't – till I tell

Faculty should represent a *discourse community*. A discourse community is a group of people who have a particular way of talking to one another. This implies the ability to communicate freely and clearly about issues that matter most – especially student learning. A discourse community builds knowledge together and represents a knowledge community. Community members develop a particular way they talk about what they know. This knowledge can only be constructed through a common language and understanding of what that language represents. Assessment and evaluation professionals have the same

Death by Assessment: How Much Data Are Too Much?

Assessment Tips With Gloria Rogers

The movement of accreditation – both regional and specialized – toward outcomes assessment is creating positive changes in academe. It is also, however, requiring iterative processes and procedures that, while necessary to ensure continuous program improvement, might be overwhelming if we don't go about them in an effective way. One such process is data collec-

the fifteenth student? Do all 2,357 alumni from your program need to be surveyed to find out what you need to know about your program? Do you need 30,000 ABET-aligned data points? Could alumni surveys be made much shorter by asking sub-sets of questions to different segments of the alumni pool? This will not only increase the response rate (fewer questions) but also present an opportunity to ask questions at the performance criteria level for each outcome.

Understanding and using good sampling techniques can greatly

Assessment101

Assessment Tips with Gloria Rogers, Ph.D.

When Is Enough Enough?

Will the focus on outcomes — which are designed to understand, document, and improve student learning — collapse under its own weight? Data collection activities must be examined in light of good program assessment practice, efficiency, and reasonableness, and we must ask ourselves the question "When is enough enough?" This question can be answered through a self-examination of current processes related to program assessment and data collection. The following questions can help guide the process:

1) Why? Is there a clear vision of why specific data are being collected? If you have not defined each of your outcomes into a few measurable performance criteria[1] that clearly identify the most important indicators of student achievement for your outcomes, then you probably don't have a focused data collection process. This is probably **the** most signifi-

3) How often? Data do not need to be collected from every student on every outcome during every year. It is important to pace yourself and strategize for efficiency without sacrificing quality. Do data need to be gathered from every class or activity in which students demonstrate the criteria? Do they need to be collected every year? How many data are enough? The answer to these questions will vary with the size of the program and the analysis of the data previously collected.

If data suggests that students are not at a level of proficiency appropriate for graduates of the program for a specific outcome, measurements may be taken more often. Consider developing a three-year plan for data collection. A three-year plan will provide two cycles of refinement on each outcome prior to any given ABET visit (assuming a six-year cycle). Do not try to do everything all at once. Concentrate on a few student learning outcomes a year (depending on the program's total number of outcomes) and plan to complete the cycle of all learning outcomes within

Assessment Tips with Gloria Rogers, Ph.D.

Direct and Indirect Assessments: What Are They Good For?

There has been a lot of discussion (and confusion) in the ABET community about direct and indirect assessments: What are they? Do you have to use both when measuring student learning?

Direct assessments (measures) are most familiar to faculty. Direct assessments provide for the direct examination or observation of student knowledge or skills against measurable learning outcomes. Faculty conduct direct assessments of student learning throughout a course using such techniques as exams, quizzes, demonstrations, and reports. These techniques provide a sampling of what students know and/or can do and provide strong evidence of student learning.

However, not all learning can be measured in a direct way. For example, a desired out-

However, as evidence of student learning, indirect measures are not as strong as direct measures because assumptions must be made about what exactly the self-report means. If students report that they have attained a particular learning outcome, how can that report be validated? An indirect assessment is useful in that it can be used to measure certain implicit qualities of student learning, such as values, perceptions, and attitudes, from a variety of perspectives. However, in the absence of direct evidence, assumptions must be made about how well perceptions match the reality of actual achievement of student learning.

It is important to remember that all assessment methods have their limitations and contain some bias. A meaningful assessment program would use both direct and indirect assessments from a variety of sources (students, alumni, faculty, employers, etc.). This use of multiple assessment methods

Using Course or Test Grades for Program Assessment

Grades represent the extent to which a student has successfully met an individual faculty member's requirements and expectations for a unit or course. **Because many factors contribute to an assigned grade, it is almost impossible to make inferences about what a student knows or can do solely by looking at that grade.**

In outcomes assessment at the program level, the primary question that needs to be answered is "To what extent do students demonstrate the anticipated learning outcomes?"
The focus of program assessment is on providing evidence that students can demonstrate knowledge or a skill that is directly linked to specific performance criteria* that define the program outcomes. Grades per se are relative measures and generally do not represent specific aspects of learning. More often, they reflect performance on multiple concepts.

For program assessment, a numeric score that is **directly** linked to students' performance on specific performance criteria can be used as evidence of program learning outcomes. For example, for the outcome "students have an understanding of ethical responsibility," one of the performance criteria could be "students will demonstrate the ability to evaluate the ethical dimensions of a problem in their discipline."

Faculty could develop a rubric to score student performance. Each performance level
is described and assigned a numeric score (e.g., 1=no evidence, 2=developing, 3=good,
and 4=exemplary).

The student work related to the specific performance can be scored as a part of the course work and may even contribute to the course grade. Reporting the percent of students who score at each of the performance levels provides meaningful data that are linked directly to the anticipated performance and focus the evaluation and strategies for improvement.

Grades will continue to be an important part of the higher education culture and should be understood for what they represent. However, the measure used to assess the outcomes should be used consistently among faculty, reflect specific student knowledge or skills, and be directly linked to specific performance criteria. It is important to remember that the focus is not a score but the specific student knowledge or skill that the score represents.

Holistic Rubric Example

4-Exceeds Criteria	3 – Meets Criteria	2- Progressing to Criteria	1 – Below Expectations
• Provides ample supporting detail to support solution/ argument. • Organizational pattern is logical and conveys completeness. • Uses effective language; makes engaging, appropriate word choices for audience and purpose. • Consistently follows the rules of standard English.	• Provides adequate supporting detail to support solution/ argument. • Organizational pattern is logical & conveys completeness & wholeness with few lapses. • Uses effective language & appropriate word choices for intended audience & purpose. • Generally follows the rules for standard English.	• Includes some details, but may include extraneous or loosely related material. • Achieves little completeness & wholeness though organization attempted. • Limited & predictable vocabulary, perhaps not appropriate for intended audience & purpose. • Generally does not follow the rules of standard English.	• Includes inconsistent or few details which may interfere with the meaning of the text Little evidence of organization or any sense of wholeness & completeness. • Has a limited or inappropriate vocabulary for the intended audience & purpose. • Does not follow the rules of standard English.

USEFUL RESOURCE FROM ABET

https://www.abet.org/assessment/assessment-planning-resources/

https://www.abet.org/assessment/assessment-planning-resources/assessment-reading-list/

THANK YOU