Developing an Effective Assessment Plan

Colorado School of Mines
Prof. Ronald Miller

www.mines.edu/academic/chemeng/assess

Prepared by

Dr. Aiman El-Maleh

King Fahd University of Petroleum & Minerals,
Dept. of Computer Eng., Saudi Arabia

Outline

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- Aligning program-level outcomes with course-level outcomes
- Some assessment Do's and Don'ts
- Observations about assessment
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Components of a Successful Assessment Plan

- Program objectives and program outcomes
- Performance criteria
- Implementation strategy
- Evaluation methods
- Timeline/logistics
- Feedback loop

Program Objectives & Outcomes

- **Program Objectives**
  - What are the overall goals of the program?
  - What are the expected accomplishments of program graduates in the first few years after graduation?
  - How do the program goals complement institional and accreditation expectations
- **Program Outcomes**
  - What should your students know and should be able by time of graduation?
  - Are you using measurable verbs to describe the outcomes?

Performance Criteria & Implementation Strategy

- **Performance Criteria**
  - How will you know the outcomes have been achieved?
  - What level of student performance will indicate students posses the outcome?
  - Criteria must be related to the method(s) used for assessing each outcome
- **Implementation Strategy**
  - How will the outcomes e met?
  - What program activities (curricular and co-curricular) help your students meet each outcome?

Evaluation Methods & Logistics

- **Evaluation Methods**
  - What assessment methods will you use to collect data?
  - How will you interpret and evaluate the data?
- **Logistics**
  - When will you measure?
  - How often will you measure?
  - Who will collect and interpret the data and report the results?

Feedback

- **Who needs to know the results?**
- **How can you convince them the outcomes were met?**
- **How can you improve your program and your assessment process?**
- **Discrepancies between performance criteria and student outcome results form the basis for program improvement.**

Aligning Program-level Outcomes with Course-level Outcomes

- **Once program objectives and outcomes are established, course-level outcomes should be prepared.**
- **Map the course-level outcomes onto the program-level outcomes to be sure coverage is complete and students are given enough opportunity to meet each outcome.**
- **Each course is given a score to indicate its coverage of the outcome**
  - 1: little emphasis
  - 2: some emphasis
  - 3: significant emphasis

Some Assessment Do's and Don'ts

- **Don't start collecting data before developing clear objectives, outcomes, and a process.**
- **Do promote stakeholder buy-in by involving as many constituencies in the process as possible.**
- **Do involve as many faculty members as possible; balance day-to-day assessment tasks (one person?) with periodic input from program faculty.**
- **Don't forget to look for campus resources to help supplement program assessment efforts.**

Some Assessment Do's and Don'ts

- **Don't forget that quality of results is more important than quantity .**
- **Not every outcome needs to be measured for every student every semester.**
- **Do collect and interpret data that will be of most value in improving learning and teaching.**

Observations about Assessment

- **There will always be more than one way to measure any outcome.**
- **There is no “magic bullet” that will measure all student abilities.**
- **There is a consistently inverse correlation between quality of measurement methods and their expediency**
  - The best methods usually take longer and cost more

Triangulation

- **Use of multiple assessment methods to assess and evaluate an outcome.**
- **Improves reliability (repeatability) and validity (accuracy) of assessment data.**
- **Recommendations for program improvement are more credible.**

Rubrics

- **A detailed guide to scoring student work products or performances**
  - Analytic: scores individual components or characteristics of a work product
  - Holistic: scores work product as a whole
- **Can be used for assigning grades to individual students or for overall program assessment**

Creating a Rubric

- Determine what learning outcomes to assess
- Determine what student work will be assessed
- Determine an appropriate rating scale
- Draft the rubric using sample work
- Test the rubric on student work with several evaluators
- Revise rubric language until inter-rater reliability meets expectations

Sustaining the Effort

- **How will your program and institution sustain the assessment efforts you design and implement?**
  - Issues of faculty time and effort?
  - Faculty rewards and recognition?
  - Will programs and the institution be willing to improve ased on assessment results?
  - How can you make the process more efficient?

Focus on Efficiency

- **Assessment is designed to provide data to improve the program, not certify students for gradation**
- **This implies**
  - Sampling of student work and other assessment data collection
  - Less frequent assessment of some outcomes
- **Consider use of scoring rubrics as a mechanism for rapid, holistic scoring of student work products**
- **Select student work products that ca be used to assess more than one outcome**

Focus on Efficiency

- Don’t measure an outcome if you don’t want to know the results
- Don’t collect data that won’t be used
- Develop a long-range plan to measure outcomes periodically but not necessarily every semester
- Focus on key data that will help make program improvements

Program Objectives

Objective 1	Our graduates will enter the workforce with a high-quality basic education in chemical engineering fundamentals.
Objective 2	Our graduates will possess the knowledge and skills required to apply engineering fundamentals to the analysis, synthesis, and evaluation of chemical engineering processes and systems.
Objective 3	Our graduates will develop personally to ensure a lifetime of professional success and an appreciation for the ethical and social responsibilities of chemical engineering and world citizen.

Program Outcomes: Objective 1

Outcome	Description	ABET Student Criterion 3 Reference
1.1	Our graduates will be able to apply knowledge of math, chemistry, and physics to identify, formulate, and solve chemical engineering problems.	a, e
1.2	Our graduates will be able to apply knowledge of rate and equilibrium processes to identify, formulate, and solve chemical engineering problems.	a, e
1.3	Our graduates will be able to apply knowledge of unit operations to identify, formulate, and solve chemical engineering problems.	a, e
1.4	Our graduates will demonstrate an ability to use the computational tools necessary for chemical engineering practice.	k
1.5	Our graduates will be able to analyze the economic profitability of chemical engineering processes or systems.	---

Program Outcomes: Objective 2

Outcome	Description	ABET Criterion 3 Reference
2.1	Our graduates will be able to design and conduct experiments of chemical engineering processes and systems.	b
2.2	Our graduates will be able to analyze and interpret experimental data from chemical engineering experiments.	b
2.3	Our graduates will be able to design a process or system to meet desired needs.	c
2.4	Our graduates will be able to function effectively on a multi-disciplinary team.	d

Program Outcomes: Objective 3

Outcome	Description	ABET Criterion 3 Reference
3.1	Our graduates will demonstrate an awareness of professional and ethical responsibility.	f
3.2	Our graduates will demonstrate an ability to communicate in oral and written formats.	g
3.3	Our graduates will demonstrate an awareness of the impact of engineering solutions in a global and societal context.	h
3.4	Our graduates will demonstrate an ability to engage in life-long learning and self-education.	i
3.5	Our graduates will demonstrate an awareness of contemporary issues in chemical engineering.	j

Program Assessment and Evaluation Plan Example

Objective #1: Instill in our students a high-quality basic education in chemical engineering fundamentals

Program Outcomes	Performance Criteria	Implementation Plan	Evaluation Methods	Logistics	Feedback
What are the program objectives? What should our students know and be able to do?	How will we know the objectives have been met? What level of performance meets each objective?	How will the objectives be met? What program activities (curricular and co-curricular) help students meet each objective?	What assessment methods will we use to collect data? How will we interpret and evaluate the data?	When will we measure? How often? Who will collect and interpret the data and report the results?	Who needs to know the results? How can we convince them the objectives were met? How can we improve our program and assessment process?
1.1) ChEN graduates will be able to apply knowledge of math, chemistry, and physics to identify, formulate, and solve Chemical engineering problems (ref. ABET Criteria 3a and 3e)	100% of assessed ChEN students will be rated at 2 (apprentice) or above and 50% will be rated at 3 (proficient) or above on applications of math, chemistry, and physics in the following work products: ChEN 357, 375 and 418 final exams and ChEN 308 projects. Of our students taking the FE exam each year, collectively they will score at or above the national average in 75% of math and science topics on the Fundamentals of Engineering (FE) exam and the overall pass rate of ChE students will exceed the national average.	Core courses in mathematics, chemistry, and physics.	Portfolio samples of student final exams (ChEN 357, 375, and 418) and projects (ChEN 308) will be assessed using scoring rubrics developed by ChEN faculty. FE exam results will be obtained from the Colorado State Board of Registration for Professional Engineers.	Final exams and projects will be collected at the end of each semester courses are taught and assessed/ interpreted by ChEN assessment committee. FE exam results for the previous academic year will be collected and assessed/ interpreted by the ChEN assessment committee each spring semester.	Results will be shared with math, Chemistry, and physics faculty via the CSM Assessment Committee to help improve learning and instruction in core courses and to determine how well department and CSM goals and ABET outcomes are being met. Results will also be shared with ChEN students via the AICHE student chapter to help them understand how the quality of math, science, and engineering education is monitored and improved and to encourage them to take the FE exam prior to graduation.

Assessment Metrics Matrix

Measure / Outcome	ChEN 357, 375, and 418 final exams (rubric)	ChEN 308 project (rubric)	ChEN312/313 U.O. lab written reports (rubric)	ChEN312/313 U.O. lab and ChEN402 senior design oral reports (rubric)	ChEN402 Senior design final reports (rubric)	FE exam results	Senior exit survey	Alumni survey	Recruiter survey	Teamwork evaluation forms (peer and prof.)
1.1 – math, chemistry, physics	X	X				X	X	X	X	
1.2 – rate/equilibrium processes	X	X				X	X	X	X	
1.3 – unit operations			X				X	X	X	
1.4 – computational tools		X					X	X	X	
1.5 – engineering economics					X	X	X	X	X	

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2.1 – design/conduct experiments			X				X	X	X	
2.2 – analyze/interpret experimental data			X				X	X	X	
2.3 – design process/ system					X		X	X	X	
2.4 – multidisciplinary teams							X	X	X	X

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3.1 – professional/ ethical responsibility							X	X	X	
3.2 – oral/written communications			X	X	X		X	X	X	
3.3 – global/societal impact							X	X	X	
3.4 – self-education and life-long learning							X	X	X	
3.5 – contemporary issues							X	X	X	

Oral Presentation Assessment Rubric

	Needs Improvement	Meets Expectations	Exceeds Expectations
Quality of Content • **Audiene awareness** (interacts with audience: e.g. stepping toward audience and speaking to them, not at them) • **Focus**: goal, evidence, conclusion (gives audience a roadmap and follows it) • **Transistions** (phrases smoothly link one part to next • **Use of visual aids** (to tell the story and enhnce the quality of the presentation	• Does not interact with audience • Does not give audience an adequate road map of goal, evidence and conclusion • Abruptly transitions from one phase to the next • Does not use visual aids effectively to tell the story; too much dependency on visual aids	• Some interaction with audience • Gives audience an adequate road map of goal, evidence and conclusion • Transitions are generally smooth • Overall, uses visual aids effectively to tell the story; visual aids add to presentation	• Interacts with audience throughout presentation • Gives audience very clear road map of goal, evidence and conclusion • Very smooth Transitions • Uses visual aids very effectively to tell the story; visual aids enhance presentation

Oral Presentation Assessment Rubric

	Needs Improvement	Meets Expectations	Exceeds Expectations
Mechanics • **Body position** (e.g., facing audience or screen)) • **Eye contact** (e.g., scanning entire audience) • **Body movement** (e.g. hand gestures, stepping back) • **Visual aids** (e.g., clear, not too busy, readable size font) • **Delivery** (e.g., fluency, pace, voice projection, um's, uh's)	Does not effectively use (e.g.'s): • Body position (faces screen) • Eye contact (not enough, looking down a lot) • Body movement (lack of gestures, glued to overhead) • Visual Aids (too busy, blurry) • Delivery (too fast, too many um's, not projecting voice, lack of enthusiasm)	Effectively uses (e.g.'s): • Body position (faces audience most of the time) • Eye contact (some scanning of audience, looking at people) • Body movement (some hand gestures, steps back f/ OH)) • Visual Aids (can read clearly, usually not too much material) • Delivery (good pace, usually projects voice, some enthusiasm)	Very effectively uses (e.g.'s): • Body position (always facing audience) • Eye contact (excellent scanning of audience, looking at people) • Body movement (good use of hand gestures, steps back) • Visual Aids (clear, right amount on each slide) • Delivery (excellent pace, projects voice, great enthusiasm)

Oral Presentation Assessment Rubric

	Needs Improvement	**Meets Expectations**	**Exceeds Expectations**
Questions • **Asks audience for questions** • **Answers questions effectively and smoothly**	• Does not ask for questions • Does not answer questions adequately	• Asks for questions • Answers questions adequately	• Effectively opens ("I'd be happy to answer questions") • Answers questions effectively and smoothly