Preparing for EC 200x

Session 4

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Workshop Presenters

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Overview

I 8:30 – 10:00 AM • Overview • Concept Inventories for Engineering Science • Surveys of Self-Reported Mastery *Time – 90 minutes*	III 1:00 – 2:30 PM • Soft Skills Assessment • Communication • Teaming *Time – 90 minutes*
II 10:30 – 12:00 Noon • Soft Skills Assessment • Lifelong Learning *Time – 90 minutes*	IV 3:00 – 5:30 PM • Rubrics for Open-Ended Assessment • Design • Problem Solving *Time – 150 minutes*

Workshop Features

- Background information about assessment instruments and methods for selected ABET “a – k” criteria
- Instruments developed or adopted by FC institutions
- Hands-on practice using instruments or methods
- Information about developing and adapting instruments and methods for tailored application

EC 200x Program Outcomes

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(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

(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 an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Session IV: 3:00 – 5:30 PM

- Rubrics for Open-Ended Assessment
  - Engineering design: process, teaming & communication
  - Problem solving & lifelong learning
  - Teaming
- Open-ended Activities & Assessment
  - "Natural" demonstrations of competencies

Bloom's Taxonomy of Cognitive Learning

- Knowledge: defines, recalls, matches, reproduces
- Comprehension: explains, gives examples
- Application: discovering, assessing, computing
- Analysis: breaking down, organizing, inferring
- Synthesis: creating, putting together
- Evaluation: appraising, judging, selecting

TAMU-TIDEE Design Assessment

- **Assessment instruments for outcomes related to**
  - Part A: Engineering design
  - Part B: Teamwork
  - Part C: Communication
- **Transferable Integrated Design in Engineering Education (TIDEE)**
- **Texas A&M University (TAMU)**

Design Process
Open Ended Question (TAMU-TIDEE)

From the TAMU-TIDEE Design Knowledge Assessment Tool

In a general sense, a process is an ordered set of activities to accomplish a goal. In the space provided, describe your understanding of the engineering design process in diagram or flowchart form, in sentences, or in list form.

Participant Activity

- Write your answer to the preceding question
- Trade papers with a partner
- Rate the paper you receive from 1 to 5 (5 highest) for completeness and depth of knowledge expressed in the answer

Design Process
Scoring Rubric Criteria (TAMU-TIDEE)

Engineering design process scoring criteria:

- **Information gathering** (understanding problem)
- Problem definition (understanding problem requirements)
- **Idea generation** (brain storming, creative ideas to improve the design products)
- **Evaluation and decision making** (analyzing ideas)
- **Implementation** (product delivered on time , product satisfy requirements)
- **Process development** (reviewed for improvement)

Design Process
Scoring Rubric Scale (TAMU-TIDEE)

- 5 Points – **Student's response shows good knowledge of, and interrelationships among, most (5-6 of 6) of the listed elements of the engineering design process necessary to produce design products.**
- 4 Points – **Student's response shows moderate knowledge, if include 4 elements (listed here) of the engineering design process.**
- 3 Point – **Student's response shows little knowledge, if include 3 elements of the engineering design process necessary to produce design products.**
- 2 Point – **Student's response shows very little knowledge, if include 2 elements of the engineering design process.**
- 1 Point – **Student's response indicates an effort made to describe the engineering design process but lacks coherent organization. (one element indicated).**
- 0 Point – **Student did not make any effort to define the engineering design process and shows no knowledge of any of the elements listed.**

Participant Activity

- Rate the paper you received in the previous exercise using the preceding scoring rubric
- Compare the two scores

Communications
Open Ended Questions (TAMU-TIDEE)

From the TAMU-TIDEE Design Knowledge Assessment Tool

- **What are the component characteristics of good communication with regards to the quality of information communicated and with regards to receiving and presenting information? List as many component qualities as possible.**

Communication
Scoring Rubric: CRITERIA & SCALE (TAMU-TIDEE)

Five specific elements articulated by students.

- **Structure** (i.e. organization, highly understandable, flow of thoughts)
- **Content** (i.e. details, key points, clarity of ideas, complete and accurate information)
- **Relevance to audience** (i.e. communicated well and understandable to audience)
- **Team attitude** (i.e. co-operation, listening)
- **Involvement** (i.e. planning meetings, interaction)

5 points total: 1 point given for each characteristic that relates to the five elements for communication within the team.

5 points total: 1 point given for each characteristic that relates to the five elements for communication outside of the team.

5 points total

- 2.5 points for more explanations of communication within the team
- 2.5 points for more explanations of communication outside the team

Grand Total of 15 Points for Section

Instrument: Daina Briedis, Michigan State

- **Assessment instrument for outcomes related to**
  - Open-ended problem solving
  - Lifelong learning

Instrument: Daina Briedis, Michigan State

- **Students conducted independent research, in which the concepts learned in class were applied to the technical analysis of a device or system.**
  - Students were observed by professors during the project
  - Student teams presented their results in a written report and as an oral presentation.
- **Student presentations were graded during class using the grading sheet**
- **Based on project-long observations, students were rated on life-long learning and other competencies at end of project**

Instrument: Daina Briedis, Michigan State

For each Problem Solving and/or Lifelong Learning item the faculty member marked a level of achievement (scale of 1 to 5) directly on the grading sheet.

Problem Solving: *Scoring Rubric*

(Daina Briedis, Michigan State)

Technical Content

a. Explanation (relationship to fluid flow/heat transfer)

- Takes new information and effectively integrates it with previous knowledge
- Demonstrates understanding of how various pieces of the problem relate to each other and to the whole
- Is able to understand, interpret, and apply learned materials and concepts in a format different from that taught in class

b. Technical analysis

- Uses appropriate equations, constants, and estimates
- Includes necessary references to technical resources (handbooks, texts, etc.)
- Goes beyond what is required in completing an assignment and brings information from outside sources into assignments

Lifelong Learning: Scoring Rubric

(Daina Briedis, Michigan State)

Rate from 1-5 (5 = mastery) Student . . .

1. **Demonstrates ability to learn independently**
2. **Goes beyond what is required in completing an assignment and brings information from outside sources into assignments**
3. **Learns from mistakes and practices continuous improvement**
4. **Demonstrates capability to think for one's self**
5. **Demonstrates responsibility for creating one's own learning opportunities**
6. **Is able to understand, interpret, and apply learned materials and concepts in a format different from that taught in class (e.g. different nomenclature, understand equation from different textbook)**
7. **Participates and takes a leadership role in professional and technical societies available to the student body**

Lifelong Learning: Scoring Rubric

(Daina Briedis, Michigan State)

Rate from 1-5 (5 = mastery) Student . . .

8. **Requires guidance as to expected outcome of task or project**
9. **Completes only what is required**
10. **Sometimes is able to avoid repeating the same mistakes**
11. **Does not always take responsibility for own learning**
12. **Seldom brings information from outside sources to assignments**
13. **Has some trouble using materials and concepts that are in a different format from that taught in class**
14. **Occasionally participates in the activities of local professional and technical societies**

Lifelong Learning: Scoring Rubric

(Daina Briedis, Michigan State)

Rate from 1-5 (5 = mastery) Student . . .

15. **Requires detailed or step-by-step instructions to complete a task**
16. **Shows little or no interest in outside learning resources**
17. **Assumes that all learning takes place within the confines of the class**
18. **Cannot use materials outside of what is explained in class**
19. **Unable to recognize own shortcomings or deficiencies**
20. **Does not show any interest in professional and/or technical societies**

Soft Skills Assessment Inventory

- Soft Skills Assessment Inventory (SSAI)
  - "Naturalistic" Assessment Rubric
- Advantages
  - Students may be retroactively assessed on various "soft skill" competencies by raters familiar with them as pupils
- **Drawbacks**
  - All raters may not be equally familiar with all of the competencies rated
  - Opportunity for cross-contamination of opinions over time among raters

SSAI: Teamwork

For each student listed, please refer to the following response scale and assign a score for that student.

(1= Poor, 2= Below Average, 3= Average, 4 = Above Average, 5 = Excellent)

When in a group, student:

- **Poor 1, MARK THIS IF A STUDENT:**
  - **Doesn't listen, Speaks out of turn ,Has his/her own agenda**
- **Average 3, MARK THIS IF A STUDENT:**
  - **Listens, Speaks at appropriate times, Supports team goals**
- **Excellent 5, MARK THIS IF A STUDENT:**
  - **Listens and paraphrases speaker's thoughts, Speaks clearly and concisely at appropriate time, Sacrifices personal goals to accomplish team goals**

Participant Activity

- Use handout SSAI assessment instrument to assess **individually** a student or colleague that everyone one in your team knows.

Participant Activity

- **Compare ratings among your different team members.**

Team Activity: Data Fusion

- Select either teamwork or communications as your program outcome.
- Select a limited number (2-4) sources of data for your program outcome. You may use instruments covered in this workshop and any additional sources of data that you may identify.
- Decide when and how you will collect the data.
- Describe how you will assemble and process the data to reach decisions on the degree to which your program outcome is being achieved.

Summary: Session 4

- **Student Outcome (c): Design**
- **Student Outcome (e): Solve engineering problems**
- **Rubrics for scoring open-ended answers**
  - Design process knowledge (TAMU-TIDEE)
  - Communication knowledge (TAMU-TIDEE)
  - Problem solving and lifelong (Mich. St.)
  - Soft Skills Assessment Inventory (Alabama)