



# Preparing for EC 200x

## Session 2

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# Workshop Presenters

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  - Project Director, Foundation Coalition
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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 II: Life-long Learning

- Introduction to lifelong learning
- The Biggs Study Process Questionnaire (SPQ)
- The Learning and Study Skills Inventory (LASSI)
- Attitude Surveys
- Self-assessment of metacognitive processing
- Behavioral checklist
- Self-efficacy



# Life-long Learning Indicators

Students should:

- **Be proficient in the use of a variety of informational and educational media such as traditional textbooks, scientific and technical journals, the library system as a whole, the World Wide Web, and educational software.**
- **Have an understanding of and exposure to the breadth and structure of the professional and technical support system that will be available to the students upon graduation; this includes professional and technical societies, the continuing education needed to maintain professional relevance, and professional registration systems.**
- **Have an awareness of the dynamic, evolving nature of science, engineering, technology, and industry, and an understanding that learning does not end with the B.S. degree.**
- **Have the ability to learn on their own.**



# Biggs Study Process Questionnaire

- The Biggs Study Process Questionnaire (SPQ) is a 42-item questionnaire.
- The SPQ is a diagnostic tool to identify the learning approaches of the students.
- The SPQ provides feedback on the learning approaches in the three domains:
  - the surface approaches
  - the deep approaches
  - the achieving approaches



# Biggs SPQ: Surface Approaches

- **Surface motives are extrinsic such as:**
  - Fear of failing
- **Surface strategies include:**
  - Reproduction
  - Rote learning
  - "minimalistic" learning
- **Surface learning is just enough to meet the course demands.**
- **Surface approaches often leads to poor academic performance.**



# Biggs SPQ: Deep Approaches

- **The deep approaches are about:**
  - Seeking to understand
  - Relating understanding to other subjects and
  - Developing personal meaning for subject material.
- **However, a deep learner may sometimes wander off-track and not follow course syllabi and outlines.**
- **Academic performance, especially in a more structured system, may also be adversely affected.**



# Biggs SPQ: Achieving Approaches

- **An achieving approach is about:**
  - Maximizing performance while optimizing efforts to achieve it.
- **These are strategic learners who may use surface or deep approaches; whichever that can help them to get high marks.**



# Biggs SPQ: Examples

Please mark your immediate reaction to the following statements. (*5=always or almost always true, 4=frequently true, 3=true about half the time, 2=sometimes true, 1=never or only rarely true*)

- I chose my present courses largely with a view to the job situation when I graduate rather than out of their intrinsic interest to me.
- I find that at times studying gives me a feeling of deep personal satisfaction.
- I want top grades in most or all of my courses so that I will be able to select from among the best positions available when I graduate.
- I think browsing around is a waste of time, so I only study seriously what's given out in class or in the course outlines.



# Learning and Study Skills Inventory (LASSI)

- The Learning and Strategies Inventory (LASSI), is a computer-based program designed as a self-assessment tool.
- Students are given questions regarding:
  - their personal study habits
  - information processing skills
  - time-management
  - various other areas of concern related to attaining academic success
- The purpose of this self-assessment is to help students recognize their strengths and weaknesses.



# Learning and Study Skills Inventory (LASSI)

[http://www.hhpublishing.com/\\_assessments/LASSI/index.html](http://www.hhpublishing.com/_assessments/LASSI/index.html)

- **Skill Component of Strategic Learning**
  - Information Processing
  - Selecting Main Ideas
  - Test Strategies
- **Will Component of Strategic Learning**
  - Attitude
  - Motivation
  - Anxiety
- **Self-regulation Component of Strategic Learning**
  - Concentration
  - Time Management
  - Self-Testing
  - Study Aids



# Learning and Study Skills Inventory (LASSI)

*Choose the response that most closely matches your feeling about the statement. (SD=Strongly, Disagree, D=Disagree, A=Agree, SA=Strongly Agree)*

- 1. I take rest periods when I study.**
- 2. Roommates, family, or friends distract me while I study.**
- 3. I study for at least an hour without being distracted**
- 4. Listening and staying focused on lectures in my classes is a problem for me.**
- 5. I find it difficult to pay attention in lectures.**
- 6. During a lecture, I doodle in my notebook or sketch pictures unrelated to the course**



# Attitude Surveys

- An attitude survey:
  - will point to what you can do practically to develop positive attitudes.
  - can supply key information to fuel the decision-making and planning processes.
  - Will identify ways in which student support, commitment, morale and performance can be improved.
- An attitude survey gives feedback that :
  - is essential to facilitating development and organizational change
  - allows focus on program needs and leverages its strengths
  - informs program on which actions will create problems
  - provides positive and negative on the program
  - measures the impact of current programs, policies and procedures
  - can be used to motivate students and improve satisfaction



# Attitude Surveys

Attitude Surveys may be used to assess:

- Creativity
- Innovation
- Satisfaction
- Interpersonal Relations
- Ability to listen
- Communication
- Leadership
- Obtaining results
- Analytical Thinking
- Mentoring
- Strategic Leadership
- Teamwork
- Adaptability



# Examples of Attitude Survey Questions

*For each question, indicate the way you feel today about the statement below: (SCALE:1- Strongly Agree; 2- Agree; 3- Neutral; 4- Disagree; 5- Strongly Disagree )*

- 1. College courses are most of the formal study I will need for the future.*
- 2. Adult's don't learn much after college.*
- 3. There is a little reason to continue to study topics that are not job-related after college.*
- 4. I enjoy learning new things, even if they are not career-related.*



# Lifelong Learning: UMassD

- For measuring **lifelong learning**, three different approaches are included in the survey system.
  - **Metacognitive processes**: Research in the acquisition of expertise suggests that people who develop high levels of expertise “work smart.” This research has uncovered several specific metacognitive processes that experts use (and that most college students do not use).
  - **Behavioral check list**: This scale measures the extent to which students participated in desirable, engineering-related behaviors, such as joining a student engineering society or reading an engineering article for fun.
  - **Self-efficacy**: Research in education and psychology has demonstrated that a sense of self-efficacy (that one can succeed – in learning, in sports) is a good predictor of success.



# Self-assessment of Metacognitive Processing

- Encouraging metacognitive strategies helps students to understand, monitor, and direct their learning processes.
- Metacognitive questions such as:
  - "What do you notice about your thinking?"
  - "How did you remember that information?"

help students develop internal conversations and reflection about the learning process.

- When students have opportunities to reflect on their learning they begin to develop self-assessment skills and take more responsibility for shaping and directing their own learning experiences.



# Self-assessment of Metacognitive Processing

- **Effectiveness of self-assessment and self-management of learning has been shown to improve with:**
  - age, experience, intelligence, academic achievement and the quality of instruction.
- **Student self-assessment:**
  - is fundamental to the development of intrinsic motivation and autonomous learning.
  - assists students to "learn how to learn".
- **As students' metacognitive abilities develop so does their ability for self-reflection and self-regulation of learning.**



# Self-assessment of Metacognitive Processing

- Write down the two most important things you have learned during the past month.
- What is the biggest worry affecting your work in class at this moment?
- *On a scale of 1-5 , 1 being very well and 5 being very poorly, answer the following questions.*
  - How well do I compare information?
  - How well do I classify information?
  - How well do I make inductions?
  - How well do I make deductions?
  - How well do I analyze errors?



# Self-assessment of Metacognitive Processing

*Please Answer the following statements in terms of the following answers  
"Don't do, " "Sort of do," and "Usually do".*

- a. I think through a plan of action before I start working on the assignment.
- b. I consciously consider several different approaches before tackling a problem.
- c. I identify aspects of the assignment that I do not understand and figure out what to do about it—ask the instructor or classmate, reread the text, find another reference, etc.
- d. While working on the assignment I ask myself questions about how the information fits into what else I know.
- e. When I get stumped, I spend time thinking through what else I know that might help me understand.



# Self-assessment of Metacognitive Processing

*Comment on the following statements in terms of : Never do, Occasionally do, Sometimes do, Usually do, Always do.*

- **I think through a plan of action before I start working on the assignment.**
- **I consciously consider several different approaches before tackling a problem.**
- **I identify aspects of the assignment that I don't understand and figure out what to do about it - ask the instructor or classmate, reread the text, find another reference, etc.**
- **While working on the assignment I ask myself questions about how the information fits into what else I know.**



# UMassD Metacognitive Practices

## Sample Questions

- I think through a plan of action before I start working on the assignment.
- I consciously consider several different approaches before tackling a problem.
- I identify aspects of the assignment that I don't understand and figure out what to do about it - ask the instructor or classmate, reread the text, find another reference, etc.
- While working on the assignment I ask myself questions about how the information fits into what else I know.
- When I get stumped, I spend time thinking through what else I know that might help me understand.
- When solving a problem, I sometimes stop to make sure I am on the right track.
- After I finish an assignment, I think about what I did well and what I did poorly and make plans to change the way I do things in the future.



# Review: Assessment of Metacognitive Practices

- **Indirect Approach: Asking students to answer questions about their perceptions of their metacognitive behavior**
- **Direct Approach: Asking for demonstrations of metacognitive behavior**
- **Direct Approach: Observe student behavior (naturalistic observation)**



# Participant Activity

- **Construct three or more test questions (time limited) through which students could demonstrate the ability to perform metacognitive processes. (Direct approach to assessment of metacognitive processes, number 2)**



# Participant Activity

- Give a code segment (with or without errors) and identify all the errors in the code segment.
- Alternative: describe most of the processes through which errors could be found.
- Electroplating copper: What fields of chemistry are related to electroplating copper? Explain how these fields are related to electroplating.
- If you were to design an airplane that flies like a bird, what physical principles would be applicable? Recorder in an interdisciplinary team would take notes showing what comments were made, how links were made, etc.
- Videotape of manufacturing facility. Describe how you would recognize problems in the manufacturing processes. Either team or individual. Answer from first-year and senior students should be different.
- How do you go from giving directions in a city on a two-dimensional square grid to writing directions in three dimensions? Knowledge of three-dimensional representations would be required.
- Give two statements that contain true facts and descriptions along with incorrect facts and descriptions. Ask students to find the errors, why they are errors, and how the statements might be corrected.



# Behavioral Checklist

- A goal of **behavioral checklists** is to help identify conditions which merit attention
- **BC**: one can easily check off items in order to provide a quick, convenient, and yet reasonably thorough assessment of areas in which help is needed.



## Examples of “Classic” Behavioral Checklist

Have you noticed these signs in your dog? .

*Check when you have seen these symptoms in terms of: Signs you see today; Signs you have seen for 30 days; Signs you have seen for 60 days.*

- House soiling, “accidents”
- Does not ask to go outside
- No longer greets family members
- Does not seek petting/attention
- Does not recognize familiar places or faces
- Sleeps more during the day or less at night
- Appears lost or confused in yard/ house
- Wanders aimlessly or paces



## Examples of “Classic” Behavioral Checklist

*Please rate the severity of each problem listed. Please add comments below. (0 =none, 1=slight, 2=moderate, 3=major)*

- Trouble attending to work that child understands well \_\_\_\_\_
- Trouble attending to work that child understands poorly \_\_\_\_\_
- Requires one-to-one attention to get work done \_\_\_\_\_
- Impulsive (trouble waiting turn, blurts out answers) \_\_\_\_\_
- Hyperactive (fidgety, trouble staying seated) \_\_\_\_\_
- Inconsistent work and effort \_\_\_\_\_



# Lifelong Learning: Examples of Educational Behavioral Checklist

*Please answer the following statements in terms of "Yes," "No," or "I don't know."*

- a. In the last year I have attended at least one lecture in the field of engineering.
- b. I have had a job related to engineering.
- c. I am a member of a student engineering society in my area.
- d. I have browsed the internet for engineering information that was not related to my classes.
- e. I have told a non-engineering friend or relative about my engineering activities.
- f. In engineering assignments I went beyond the assignment just because it interested me.



# UMassD Behavioral Checklist

## Sample Questions

- I have attended at least one lecture outside of class related to engineering.
- I have had a job related to engineering.
- I am a member of a student engineering society in my area.
- I have searched the internet for engineering information that was not related to my class.
- I have told a non-engineering friend or relative about my engineering activities.
- In engineering assignments I went beyond what was needed just because it interested me.
- I read an engineering article for fun.



# Lifelong Learning: Self-Efficacy

Albert Bandura defined self-efficacy as:

- a judgment of one's capability to accomplish a certain level of performance
- "perceived self-efficacy is a significant determinant of performance that operates partially independently of underlying skills".
- Self-efficacy is commonly understood as being very specific:
  - one can have more or less firm self-beliefs in particular situations of functioning.
  - Researchers have also conceptualized a **generalized sense of self-efficacy**.



# Self-efficacy Measurement

- **The general self-efficacy scale aims at a broad & stable sense of personal competence to deal efficiently with a variety of stressful situations**



# Examples of Self-efficacy Questions

*Rate your agreement with the statements below on a scale of 1-4. (1 =really agree, 2 = kind of agree, 3 =kind of disagree, 4 =really disagree)*

- 1. I work hard in school.**
- 2. I could get the best grades in class if I tried enough.**
- 3. Most of my classmates like to do math because it is easy.**
- 4. I would get better grades if my teacher liked me better.**
- 5. Most of my classmates work harder on their homework than I do.**
- 6. I am a good science student.**



# Examples of Self-efficacy Questions

*Rate your agreement with these statements on a scale of 1 to 5, 1= I really don't agree, 2= I don't agree, 3= neutral, 4 = I agree, 5 = I really agree*

- a. I feel very proud of my skills and ability to do engineering.**
- b. I seek out new intellectual experiences.**
- c. I feel uncomfortable learning new concepts on my own.**
- d. I have all the skills to succeed in engineering.**
- e. I avoid areas of knowledge that are unfamiliar to me.**
- f. I frequently participate in experiences that contribute to my personal development.**
- g. I seek out activities related to my future profession.**



# UMassD Self-Efficacy Sample Questions

- I feel proud of my skills and ability to do engineering.
- I seek out new intellectual experiences.
- I feel uncomfortable learning new concepts on my own (reversed).
- I have all the skills to succeed in engineering.
- I avoid areas of knowledge that are unfamiliar to me (reversed).
- I frequently participate in experiences that contribute to my personal development.
- I seek out activities related to my future profession.
- Most people can solve engineering problems better than I
- I am very good at solving engineering problems.



# Session II: Life-long Learning

- Biggs Study Process Questionnaire (SPQ)
- The Learning and Study Skills Inventory (LASSI)
- Attitude Surveys
- Self-assessment of metacognitive processing
- Behavioral checklist
- Self-efficacy



# Team Activity: Data Fusion

- Start with a program outcome is lifelong learning.
- Select a limited number (2-3) of instruments from the previous list to be used to collect data for evaluating your outcome.
- Decide when and how each instrument will be administered to collect data.
- Describe how the data gathered from your collection of instruments will be used to determine the degree to which students are achieving the learning outcome.



# Summary: Session 2

- **Student Outcome (i): Lifelong learning**
- **Possible instruments**
  - Biggs Study Process Questionnaire (SPQ)
  - The Learning and Study Skills Inventory (LASSI)
  - Attitude Surveys
  - Self-assessment of metacognitive processing
  - Behavioral checklist
  - Self-efficacy
- **Preparing a plan to evaluate outcome (i)**