



Preparing for EC 200x

Southern University

Jeff Froyd, Texas A&M University



Workshop Questions

- How might you prepare a self-study report?
- What are various methods for assessment data collection and reporting?
- How might you choose assessment data for program evaluation and enhancement?
- How might you select and implement assessment processes?
- How might you gather, process, and report assessment results?
- How might you use assessment data to close the loop in an engineering program?



Introduction: Team Formation

- **Self-Organize into groups of four people**
 - Try working with people from the same department
 - Introduce yourselves within the group



Agenda

- 8:00-8:30 AM Introduction
- 8:30-9:00 AM Question No. 1 – Self-study Report
- 9:00-10:15 AM Question No. 2 – Assessment Methods
- 10:15-10:30 AM BREAK
- 10:30-12:00 Noon Question No. 2 – Assess. Meth. (cont'd)
- 12:00-1:00 PM LUNCH
- 1:00-1:45 PM Question No. 3 – Selecting Assessment Data
- 1:45-2:45 PM Question No. 4 – Implementing Processes
- 2:45-3:00 PM BREAK
- 3:00-3:45 PM Question No. 5 – Proc./Report. Results
- 3:45-5:00 PM Question No. 6 – Closing the Loop



Question No. 1

How might you prepare a self-study report?

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EC 200x General Criteria

- **Criterion 1: Students**
- **Criterion 2: Program Educational Objectives**
- **Criterion 3: Program Outcomes and Assessment**
- **Criterion 4: Professional Component**
- **Criterion 5: Faculty**
- **Criterion 6: Facilities**
- **Criterion 7: Institutional Support and Financial Resources**



Criterion 1: Students

- Program Requirements
 - Evaluate incoming students
 - Advise current students
 - Evaluate and enforce program requirements
 - Evaluate success in meeting program outcomes (see Criterion 3)
- Exceptional Cases
 - Check compliance with policies for the acceptance of transfer students
 - Check compliance with validation of courses taken for credit elsewhere.



Criterion 1. Students

- The quality and performance of the students and graduates are important considerations in the evaluation of an engineering program. The institution must evaluate, advise, and monitor students to determine its success in meeting program objectives.
- The institution must have and enforce policies for the acceptance of transfer students and for the validation of courses taken for credit elsewhere. The institution must also have and enforce procedures to assure that all students meet all program requirements.



Criterion 2. Program Educational Objectives

- Each engineering program must have:
 - (a) detailed **published** educational objectives
 - (b) a **process** that involves the program's various constituencies to determine and periodically evaluate the educational objectives
 - (c) a curriculum and processes that ensure the achievement of these objectives
 - (d) a system of ongoing evaluation that demonstrates achievement of these objectives and uses the results to improve the effectiveness of the program.



Criterion 2. Program Educational Objectives

- Each engineering program for which an institution seeks accreditation or reaccreditation must have in place:
 - **(a) detailed published educational objectives that are consistent with the mission of the institution and these criteria**
 - **(b) a process based on the needs of the program's various constituencies in which the objectives are determined and periodically evaluated**
 - **(c) a curriculum and processes that ensure the achievement of these objectives**
 - **(d) a system of ongoing evaluation that demonstrates achievement of these objectives and uses the results to improve the effectiveness of the program.**



Criterion 2. Program Educational Objectives

- **State program educational objectives**
- **Indicate where the educational objectives are published**
- **Describe program constituencies**
- **Describe the process through which the educational objectives were developed and how the various constituencies were involved**
- **Describe the process through which the educational objectives will be reviewed.**
- **For each educational objective describe the level of achievement and present a reasoned argument (with data) that supports the conclusion.**



Criterion 3. Program Outcomes and Assessment

- Student Outcomes: a-k
- Assessment Process
 - **Documented results**
- Continuous Improvement
 - **Evidence must be given that the results are applied to the further development and improvement of the program.**



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.



Criterion 3. Program Outcomes and Assessment

- Engineering programs must demonstrate that their graduates have:
 - **(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.**
- Each program must have an assessment process with documented results. Evidence must be given that the results are applied to the further development and improvement of the program. The assessment process must demonstrate that the outcomes important to the mission of the institution and the objectives of the program, including those listed above, are being measured. Evidence that may be used includes, but is not limited to the following: student portfolios, including design projects; nationally-normed subject content examinations; alumni surveys that document professional accomplishments and career development activities; employer surveys; and placement data of graduates.



Criterion 3. Program Outcomes and Assessment

- Describe your program (student) outcomes.
- Describe the process through which the program outcomes were developed. How were your constituencies involved?
- Describe the process through which the program outcomes are reviewed. How are your constituencies involved?



Criterion 3. Program Outcomes and Assessment

- For each program outcome
 - **Indicate which person or group of people is responsible**
 - **Indicate the expected level of achievement**
 - **Describe the process through which the outcome is being evaluated, that is, how do you decide the level to which an outcome is being achieved**
 - **Indicate the level to which the outcome is being achieved**
 - **Present a reasoned argument (with data) that supports your conclusion about the level of achievement**



Criterion 3. Program Outcomes and Assessment

- Continuous Improvement
 - At a particular point in time how do you identify which program outcomes have the highest priority in terms of improvement?
 - In preparing the visit report provide examples of program outcomes that had the highest priority in terms of improvement?
 - For each program outcome targeted for improvement, describe the changes which have been made to effect improvement?
 - For each program outcome, describe the results of the changes in terms of possible changes in the level of achievement



Criterion 3. Program Outcomes and Assessment

- Objective-Outcome Matrix
- Outcome-(a-k) Matrix
- Objective-Course Matrix
- Outcome-Course Matrix
- Process Diagrams



Criterion 4. Professional Component

- Major design experience
 - **Based on the knowledge and skills acquired in earlier course work**
 - **Incorporates most of the following considerations: economic; environmental; sustainability; manufacturability; ethical; health and safety; social; and political.**
- Course requirements:
 - **(a) one year of college level mathematics and basic sciences**
 - **(b) one and one-half years of engineering topics, that is, engineering sciences and engineering design**
 - **(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.**



Criterion 4. Professional Component

- The professional component requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The engineering faculty must assure that the program curriculum devotes adequate attention and time to each component, consistent with the objectives of the program and institution. Students must be prepared for engineering practice through the curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating engineering standards and realistic constraints that include most of the following considerations: economic; environmental; sustainability; manufacturability; ethical; health and safety; social; and political. The professional component must include:
 - **(a) one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline**
 - **(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study**
 - **(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.**



Criterion 4. Professional Component

- **Major Design Experience**
 - Overall description
 - Describe how most of the factors are incorporated into the major design experience
 - Provide examples of student work that show design process, quality outcomes, and understanding of different factors
- **Course Requirements**
 - Transcript analysis



Criterion 5. Faculty

- Sufficient number
 - **Student-faculty interaction**
 - **Student advising and counseling**
 - **University service**
 - **Professional development**
 - **Interactions with practitioners**
- Breath of competence to cover all of the curricular areas of the program.
 - **Education**
 - **Experience: engineering, Professional Engineers, teaching, professional societies, etc.**
 - **Activity in curricular/pedagogical initiatives**
 - **Research activity**



Criterion 5. Faculty

- The faculty is the heart of any educational program. The faculty must be of sufficient number; and must have the competencies to cover all of the curricular areas of the program. There must be sufficient faculty to accommodate adequate levels of student-faculty interaction, student advising and counseling, university service activities, professional development, and interactions with industrial and professional practitioners, as well as employers of students.
- The program faculty must have appropriate qualifications and must have and demonstrate sufficient authority to ensure the proper guidance of the program and to develop and implement processes for the evaluation, assessment, and continuing improvement of the program, its educational objectives and outcomes. The overall competence of the faculty may be judged by such factors as education, diversity of backgrounds, engineering experience, teaching experience, ability to communicate, enthusiasm for developing more effective programs, level of scholarship, participation in professional societies, and registration as Professional Engineers.



Criterion 5. Faculty

- Complete the faculty worksheet
- Include a brief paragraph on each faculty member in the self-study.



Criterion 6. Facilities

- Classrooms
 - **Number and size**
- Laboratories
 - **Number and size**
 - **Evidence of continued maintenance and improvement**
- Equipment, including computers
 - **Inventory**
 - **Evidence of continued maintenance and improvement**



Criterion 6. Facilities

- Classrooms, laboratories, and associated equipment must be adequate to accomplish the program objectives and provide an atmosphere conducive to learning. Appropriate facilities must be available to foster faculty-student interaction and to create a climate that encourages professional development and professional activities. Programs must provide opportunities for students to learn the use of modern engineering tools. Computing and information infrastructures must be in place to support the scholarly activities of the students and faculty and the educational objectives of the institution.



Criterion 6. Facilities

- Describe classrooms
- Describe each laboratory and how it has been updated
- Describe equipment and how it has been updated.



Criterion 7. Institutional Support and Financial Resources

- Financial resources
 - **Attract, retain, support well-qualified faculty**
 - **Acquire, maintain, operate facilities and equipment**
- Institutional support
 - **Adequate service personnel**
 - **Adequate institutional services**
- Constructive leadership



Criterion 7. Institutional Support and Financial Resources

- Institutional support, financial resources, and constructive leadership must be adequate to assure the quality and continuity of the engineering program. Resources must be sufficient to attract, retain, and provide for the continued professional development of a well-qualified faculty. Resources also must be sufficient to acquire, maintain, and operate facilities and equipment appropriate for the engineering program. In addition, support personnel and institutional services must be adequate to meet program needs.



Criterion 7. Institutional Support and Financial Resources

- Describe available financial resources and how they have been used
- Describe professional development opportunities
- Describe support personnel
- Describe institutional services
- Describe relationship with larger campus community



Question No. 2

What are various methods for assessment data collection and reporting?

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Assessment Methods

1. Commercial Norm-Referenced, Standardized Examinations
2. Locally Developed Examinations
3. Oral Examinations
4. Performance Appraisals
5. Simulations
6. Written Surveys and Questionnaires
7. Exit Interviews and Other Interviews
8. Third Party Reports
9. Behavioral Observations
10. External Examiners
11. Archival Records
12. Portfolios
13. Classroom Research
14. “Stone” Courses
15. Focus Groups

Prus, J., Johnson, R., (1994) *Assessment & Testing, Myths & Realities, New Directions for Community Colleges*, No. 88, Winter 1994



Jigsaw Exercise

- **Step 1: Break into expert teams. (2 minutes)**
- **Step 2: Each expert team will be assigned two or more methods to read. Each team will prepare a two-minute lesson on each method. (15 min.)**
- **Step 3: Experts will be distributed among learning teams so that each learning team has an expert on each method. (2 minutes)**
- **Step 4: Experts will share their lessons with other members of the learning team. (30 minutes)**



Jigsaw Exercise

- Form seven (7) teams.
- Team No. 1: Methods 1 and 2
- Team No. 2: Methods 3 and 4
- Team No. 3: Methods 5 and 6
- Team No. 4: Methods 7, 8, and 15
- Team No. 5: Methods 9 and 10
- Team No. 6: Methods 11 and 12
- Team No. 7: Method 13 and 14 (confusion in matching advantages, disadvantages, and reducing disadvantages)



BREAK

15 minutes



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.



Outcome (i): Lifelong Learning

- **Study Process Questionnaire (SPQ)**
- **Learning and Study Skills Inventory (LASSI)**
- **University of Massachusetts Dartmouth Survey**
 - Behavioral checklist
 - Self-assessment of metacognitive processing
 - Self-efficacy scale
- **Attitude Survey**



Study Process Questionnaire

- The 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



Surface Approaches

- **Surface motives are extrinsic such as:**
 - fear of failing
- **Surface strategies include:**
 - Reproductive
 - Rote learning
 - “Minimalistic” learning
- **Surface learning is just enough to meet the course demands. Such an approach often leads to poor academic performance.**



Deep Approaches

- **Deep approaches are about:**
 - seeking to understand
 - relate understanding to other subjects and to develop 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.**

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.**



Learning and Study Skills Inventory (LASSI)

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



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).
 - **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.
 - **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.



Sample Questions: Metacognitive Practices

- 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.



Sample Questions: Self-Efficacy

- 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.



Sample Questions: Behavioral Checklist

- 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.



Outcome (h): Societal and Global Context

- (h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
- **Suggestion: See how student teams address the societal and global context in their major design experience. See how students integrate their knowledge from humanities and social science courses into the context of their engineering solutions.**



Outcome (d): Multidisciplinary Teams

- **Team Exercise: List attributes that would be required to effectively participate on or lead multidisciplinary teams**
- ??



Outcome (d): Multidisciplinary Teams

- Peer assessment with carefully developed forms may be useful for monitoring AND assessment
- Example: Foundation Coalition team instrument used for peer assessment
- Example: Team Developer, Jack McGourty, commercially available



Generate Questions

- Form teams of four.
- Each team should generate two questions about assessment methods.
- ??



Question No. 3

How might you choose assessment data for program evaluation and enhancement?

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Major Design Experience

- **Extract lots of information from student work during major design experience**
- **Major design experience must address many factors relating to outcomes a-k**
 - Teams, social/global issues, ethical issues, may illustrate ability to perform research/lifelong learning
- **Major design experience is a cumulative learning experience and is well positioned to provide information on graduates**



Cooperative Programs?

- Design a careful program to collect feedback from employers



Sources of Data

- What are possible sources of data on the performance of your graduates with respect to your student outcomes?
- Volunteerism requirement
- Interview, exit or otherwise
- Feedback from recruiters
- FE (or mock) performance
- Departmental comprehensive examination
- Alumni feedback → Program objectives
- Alumni feedback from graduate school → Program objectives
- Videos of design presentations
- Grades ??????????



Grades

- **Course grades are composite scores. Using course grades as assessment data for one or more outcomes will raise questions.**
- **Course grades may be used as assessment data for outcomes in SPECIFIC cases, but be prepared to make the case why course grades are a relevant indicator for a specific outcome.**



Outcomes for Graduates

- **Criterion 3:** “Engineering programs must demonstrate that their graduates have ...”
- Since the purpose of the assessment is to demonstrate achievement of outcomes by graduates, proximity of the data collected to the time of graduation is important.
- Since time and energy are required to generate assessment data, prudent allocation of resources suggests that most data related to achievement of outcomes be collected near the time of graduation.



Generate Questions

- **Form teams of four.**
- **Each team should generate two questions about sources of assessment data.**
- **Is it reliable (repeatable)?**
- **Does one source have an advantage over another?**
- **Survey questions: Are they considered scientific?**
- **What resources are available to develop survey instruments?**
- **Are survey instruments valid?**



Question No. 4

How might you select and implement assessment processes?

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Team Exercise

- Break into departmental teams.
- Task: For each program outcome select the data sources that you will use and describe how you will gather and process the data to reach decisions about the level of achievement with respect to the program outcome.
- Time: 25 minutes



Share Plans

- **Assemble into teams with one departmental representative per team.**
- **Each representative will pick one interesting/challenging program outcome and share the potential solution. (3 minutes)**
- **Solicit suggestions to improve (5 minutes)**
- **Total Time: 25 minutes**



Generate Questions

- Form teams of four.
- Each team should generate two questions about selecting and implementing assessment processes
- ??





Question No. 5

How might you gather, process, and report assessment results?

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Generate Questions

- Form teams of four.
- Each team should generate two questions about processing and reporting assessment processes.
- ??



Question No. 6

How might you use assessment data to close the loop in a engineering program?

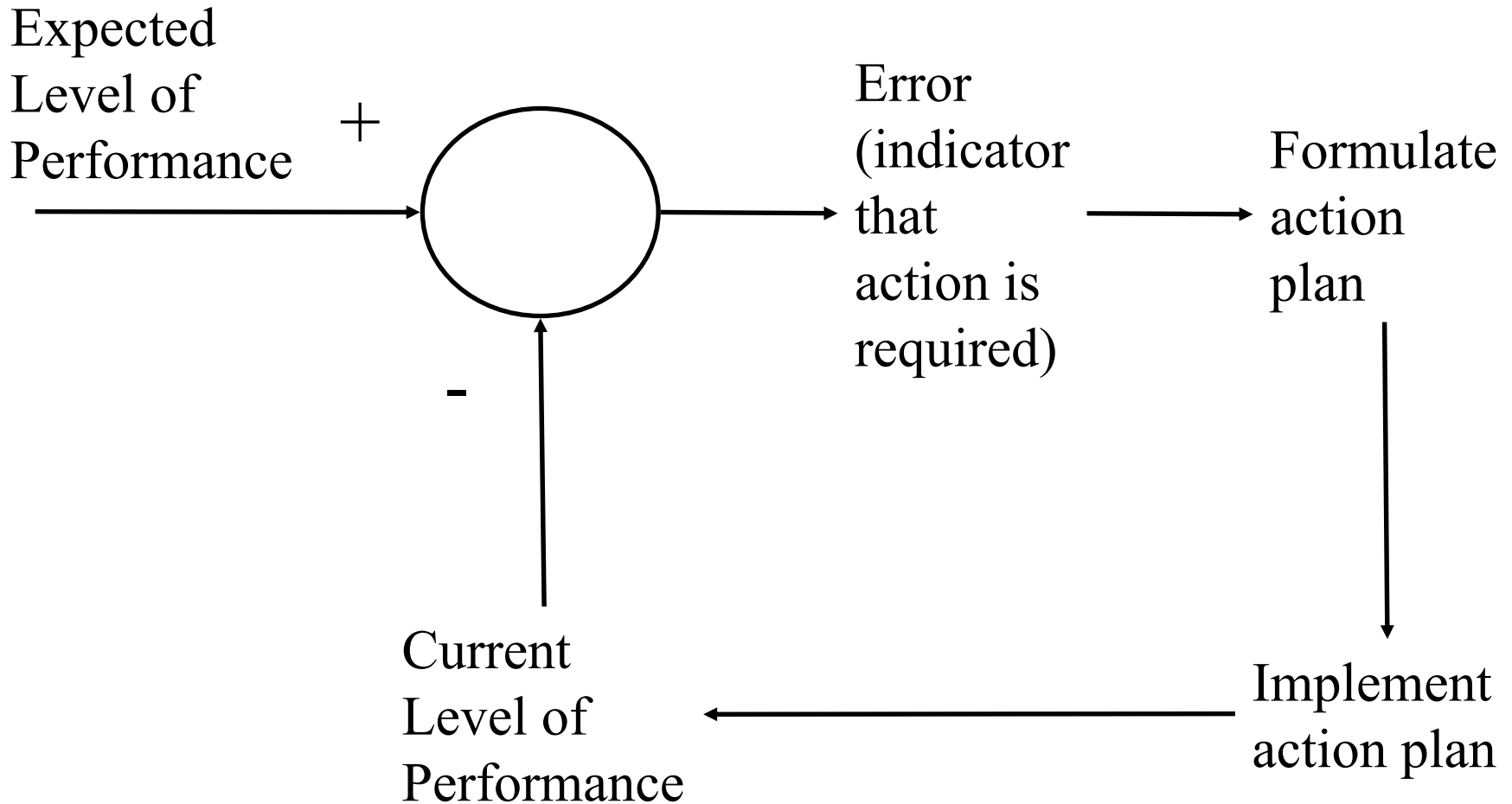
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General Idea

- **Step 1:** In generating each outcome, you will have established an expected level of achievement for the outcome.
- **Step 2:** After processing assessment data for each outcome, you will have constructed a current level of achievement for the outcome.
- **Step 3:** Program committee will review expect and current levels of achievement and decide which outcomes should receive attention.
- **Step 4:** For each outcome slated to receive attention, prepare a plan to improve student performance.
- **Step 5:** Implement plan
- **Step 6:** Use assessment process already in place to observe the effects of the changes.

General Idea



General Idea

- **Personal Opinion** (which has been reiterated by others): Failure to meet expected level of achievement **should** NOT lead to a weakness or deficiency that would require exceptional accreditation action.
- Failure to meet targeted goal **should** lead to action to improve performance.



Course Pre-Tests

- **One continuous improvement mechanism that has been used is course pre-tests.**
- **Idea: Almost every engineering course has course prerequisites.**
 - Ideally, students starting the course should have a set of knowledge and skills that raises the likelihood of success to a reasonably high level.
 - Design a local test that indicates the degree to which students starting the course have the required knowledge and skills.
 - Use data from course pre-test to assess the level of knowledge and skills and provide feedback to teachers in prerequisite courses about student performance



Generate Questions

- Form teams of four.
- Each team should generate two questions about closing the loop?
- ??