THE CDIO APPROACH TO ENGINEERING EDUCATION: 5. Assessing Student Learning

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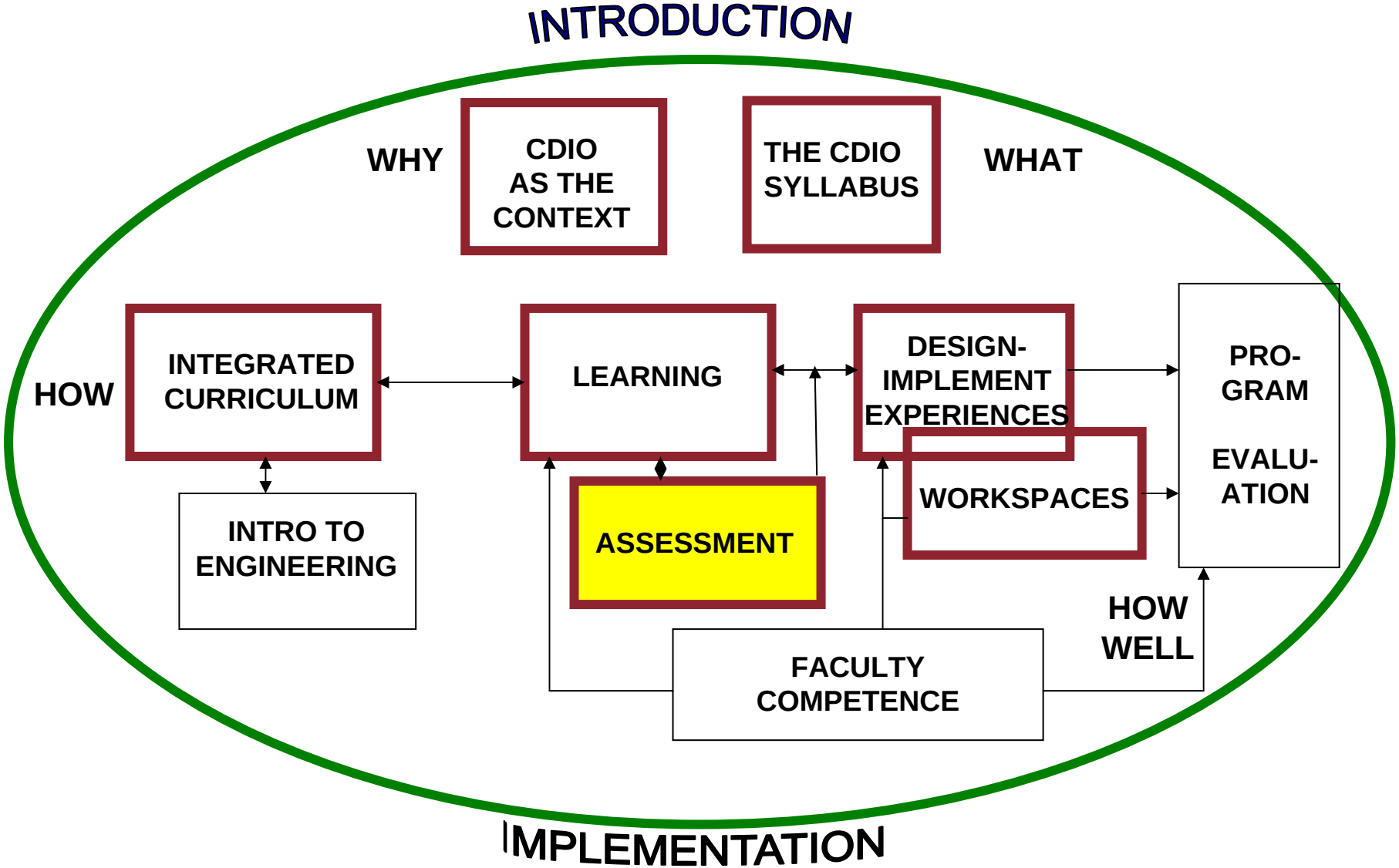
SESSION FIVE



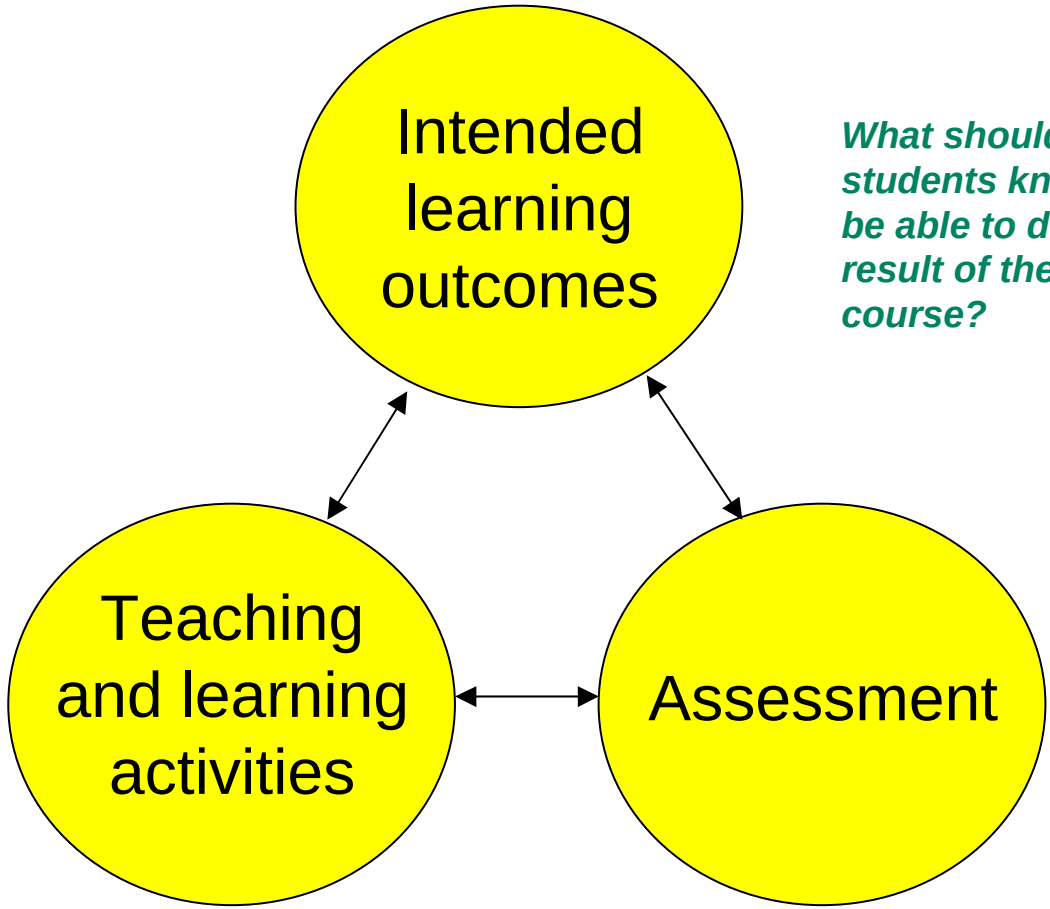
SESSION FIVE OBJECTIVES

Recognize the importance of aligning curriculum, teaching, learning, and assessment

Give examples of a variety of methods to assess learning

Participate in one or more learning assessment methods

CONSTRUCTIVE ALIGNMENT



What should students know or be able to do as a result of the course?

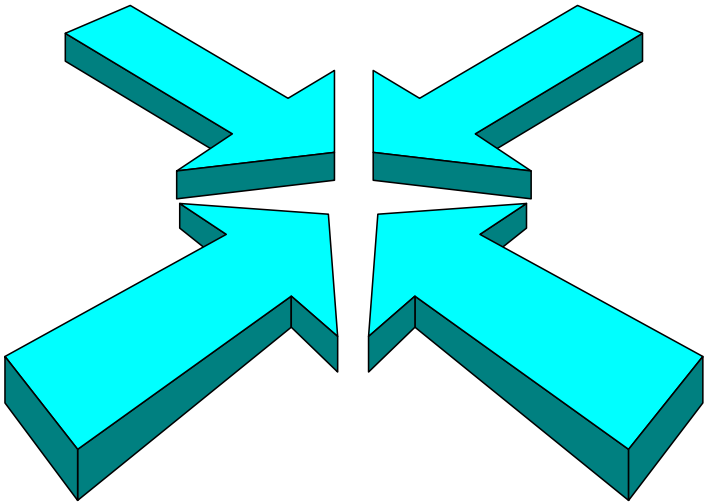
What activities are appropriate for students in order to reach the intended learning outcomes?

How can students demonstrate that they have reached the intended learning outcomes?

BASIC ASSESSMENT PRINCIPLES

1. **Assessment requires attention to outcomes and to the experiences that lead to those outcomes.**
2. **Different types of learning objectives require different methods of assessment.**
3. **Teaching and assessment are intertwined.**
4. **Any assessment is only a sample.**
5. **Assessment works best when it is regular and ongoing, and not just a final measure.**
6. **There are trade-offs between authenticity and efficiency, *i.e.,* the closer the tasks are to real-world experiences, the more time and resources they require.**

ACTIVITY: DISCUSSION



Divide into groups with each group taking one assessment principle.

In your own words, explain the meaning of the assessment principle as it relates to your courses. Give examples, if possible.

Choose someone to report to the whole group.

BEST PRACTICE

CDIO Standard 11 - Learning Assessment

Assessment of student learning in personal and interpersonal skills, and product, process, and system building skills, as well as in disciplinary knowledge

- Measure of the extent to which a student has achieved specified learning outcomes
- Faculty usually conduct this assessment within their respective courses
- Uses a variety of methods matched appropriately to learning outcomes

(See Handbook, p. 13)

Bloom's Taxonomy (Cognitive Domain)

	Level	Type of Performance
	6. Creating	▪ Designing, generating, planning, producing.
HIGHER-ORDER THINKING	5. Evaluating	▪ Checking, critiquing, jugding, testing
	4. Analysing	▪ Differentiating, organizing, attributing.
	3. Applying	▪ Executing, implementing, carrying out.
LOWER-ORDER THINKING	2. Understanding	▪ Interpreting, exemplifying, classifying, summarizing, inferring, comparing, explaining.
	1. Remembering	▪ Recognizing, Recalling.

Table 1 Correspondence between the assessment instruments and Bloom's taxonomic levels - Cognitive domain

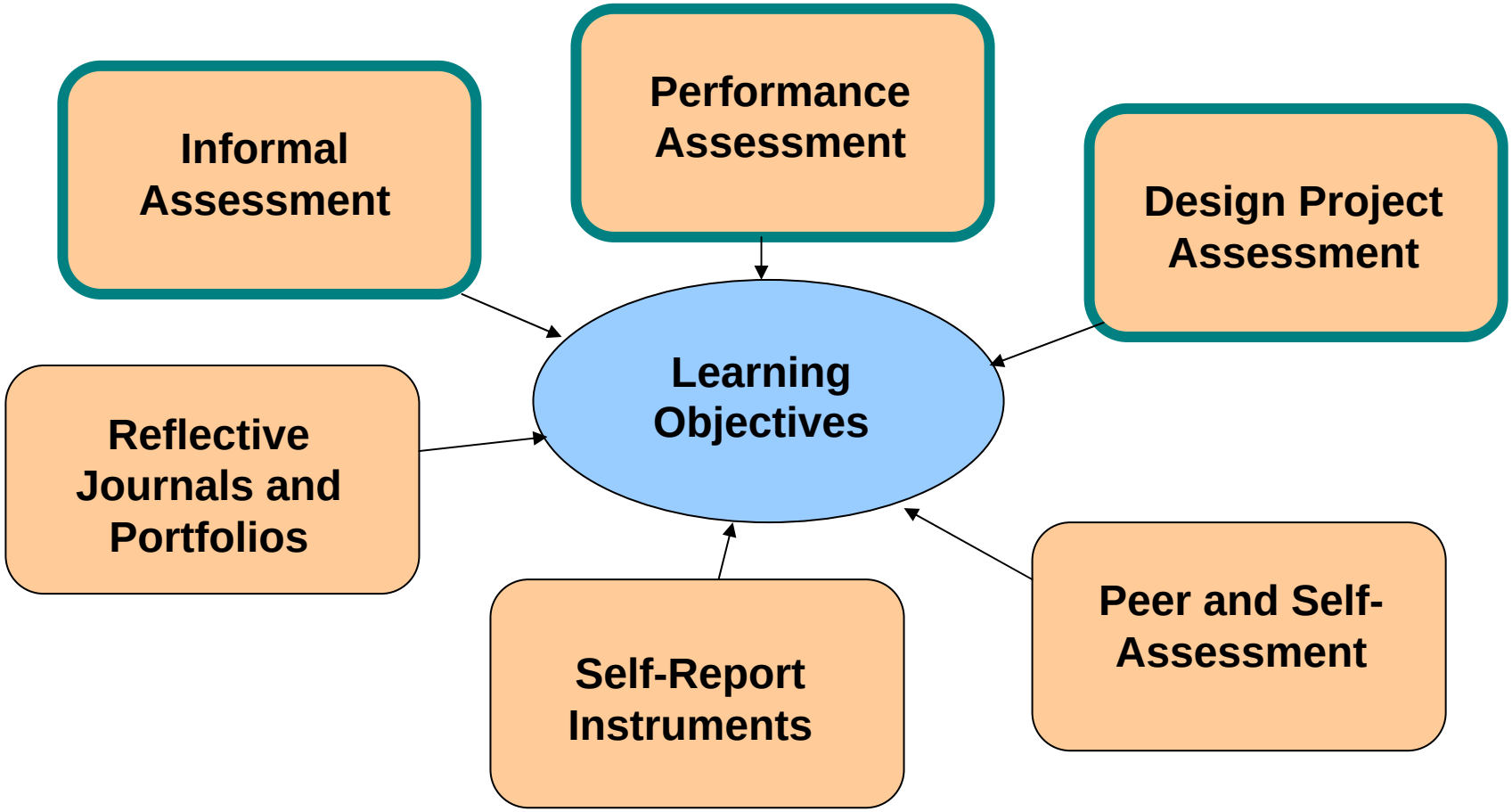
Assessment Instruments	Taxonomic levels					
	1	2	3	4	5	6
WRITTEN TESTS						
short answer	X	X	X			
multiple choice	X	X	X			
true or false	X	X				
sentence completion	X	X				
ORAL TESTS	X	X	X	X	X	

1. Remembering
2. Understanding
3. Applying
4. Analysing
5. Evaluating
6. Creating

Table 1 Correspondence between the assessment instruments and Bloom's taxonomic levels - Cognitive domain

Assessment Instruments	Taxonomic levels					
	1	2	3	4	5	6
ASSIGNMENTS						
critical summary				X	X	X
literature review				X	X	
paper				X	X	X
case study				X	X	X
project			X	X	X	X
laboratory session			X	X	X	
presentation				X	X	
internship report					X	X
EXERCISES						
homework		X	X	X		
guided exercice		X	X	X		

SAMPLE ASSESSMENT METHODS



ACTIVITY: INFORMAL ASSESSMENT

- **What did you learn so far today?**
  - **What did you learn *about*?**
  - **What did you learn *how to do*?**
  - **What do you have more confidence about, or change your opinion about?**

- **Without looking at your notes, write three or four things you learned.**

ACTIVITY: NOMINAL GROUP TECHNIQUE

Procedure

- When everyone has finished writing at least three responses, ask the first person for *one* response from his/her list.
- Record the response so that everyone can see it. (Do not discuss; simply record.)
- Go to the next person, ask for a *different* response.
- A person who does not have any *different* responses to add to the common list simply *passes*.
- Continue around the group until all *different* ideas have been *named* (nominal) and listed.
- Summarize the responses.

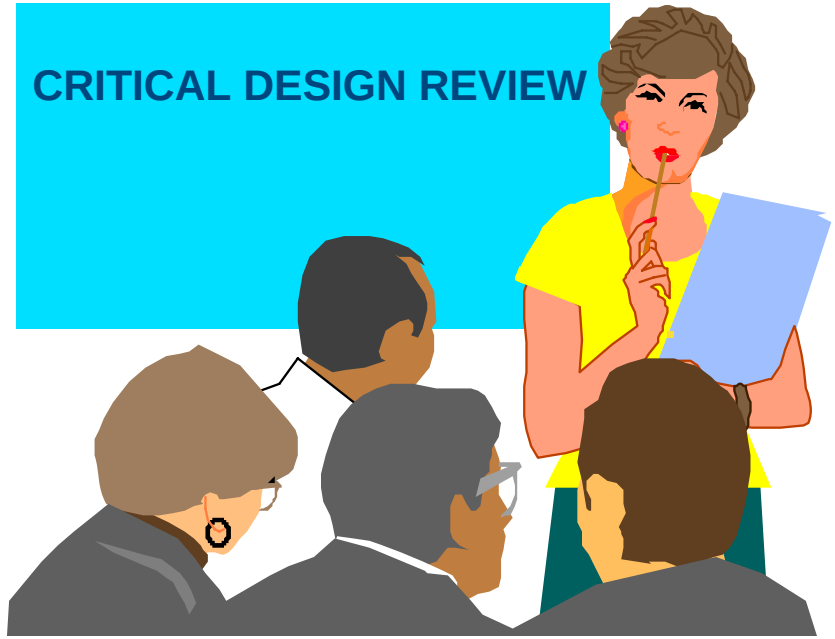
NOTES

PERFORMANCE ASSESSMENT

Students prepare and present a **performance** of a valued activity, *e.g.,* oral presentations and technical briefings, problem-solving, teamwork.

It is the **process** itself that is assessed.

Use **rating scales** that address specific criteria relevant to the process and scales with 3 to 5 levels of mastery.



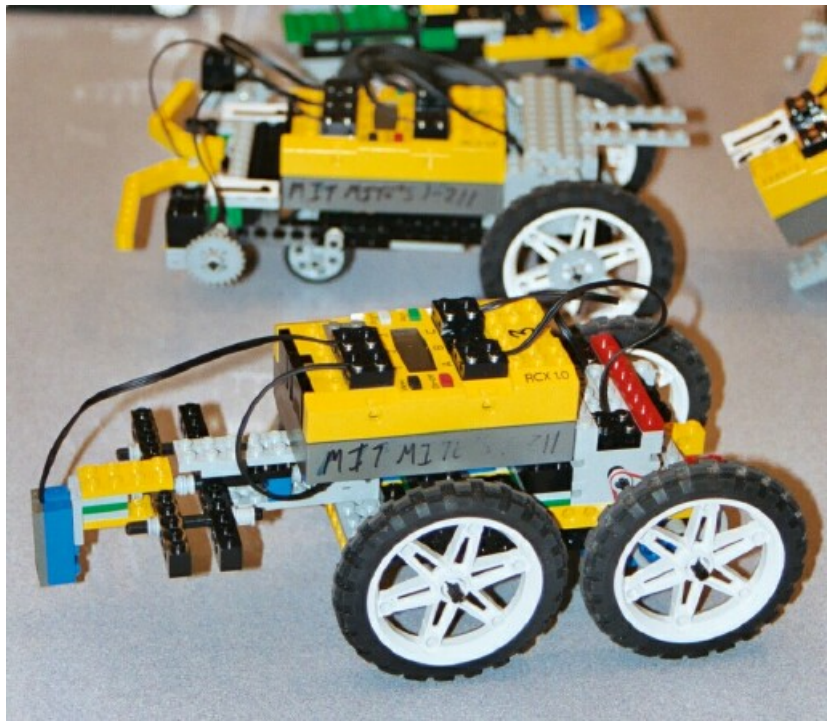
(See Handbook, p. 35)

DESIGN PROJECT ASSESSMENT

A project whose focus is on the development of a tangible **product.**

The **product** itself, the **process**, and quality of **reasoning** are all assessed.

Use **rating scales** that address specific criteria relevant to the product, process and quality of reasoning and scales with 3 to 5 levels of mastery



(See Handbook, p. 37-39)

SAMPLE DESIGN PROJECT ASSESSMENT

Formula Student Project

(Courtesy of Chalmers University of Technology)

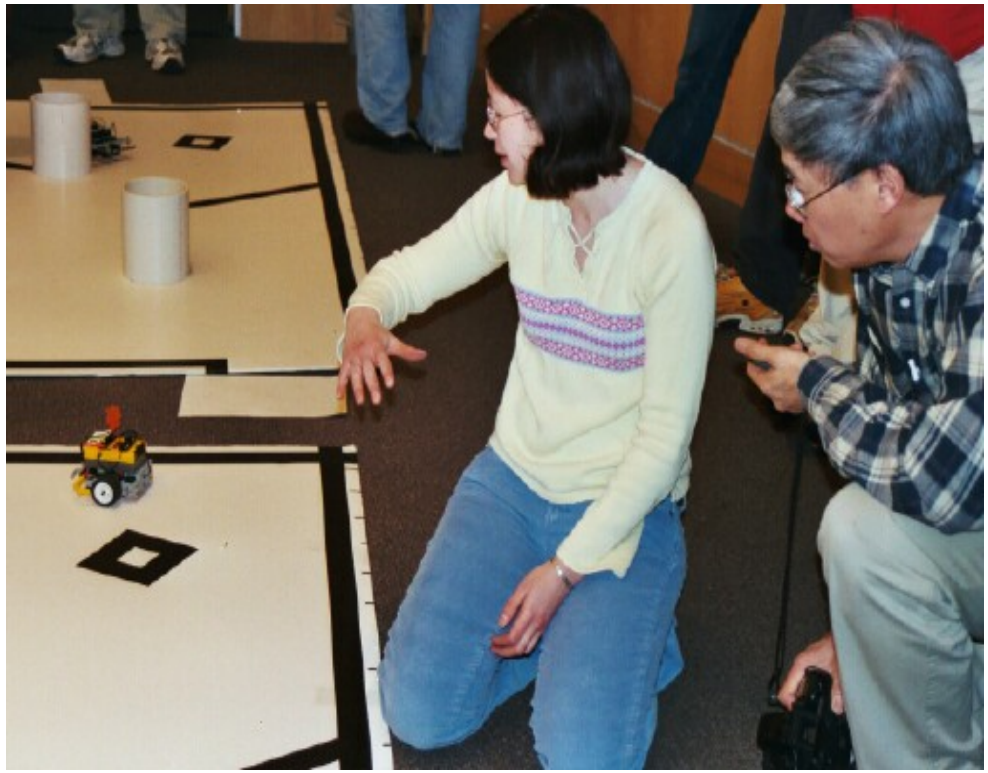
- Product Assessment
  - –Built to specification
  - –Time
- Team Collaboration
- Written Documentation
- Reflective Journal

What methods could you use to assess each component of the project?

SAMPLE DESIGN PROJECT ASSESSMENT

LEGO Robotics

- Product Assessment
  - –Built to specification
  - –Course completion
  - –Time
  - –Number of trials
- Team Collaboration
- Articulation of robot logic



(Courtesy of Massachusetts Institute of Technology)

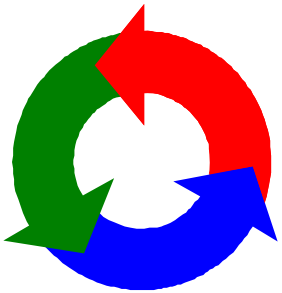
What methods could you use to assess each component of the project?

ASSESSING STUDENTS IN GROUPS

Agree or Disagree?

1. Assess students individually when each student's contribution to the group can be clearly identified.
2. When successful teamwork is an important criterion, assess the final results (product), and give the same grade to all team members.
3. You can use an oral exam to determine each student's conceptual understanding of the group project
4. Use a single assessment method in a project-based course to make assessment clearer to students
5. Be sure the grading criteria and assessment measures are clear to students from the start

USING RESULTS TO IMPROVE LEARNING



"Providing feedback on students' work is one of the most expensive components of their education, but it is often not an effective investment simply because it happens too slowly." **(Gibbs, 1999)**

Provide frequent feedback throughout the term and be prompt in returning assignments and exams

Make feedback as specific as possible so that students know how to improve

Correct errors, but avoid sarcasm and condescending comments

ACTIVITY:
MUDDIEST-PART-OF-THE-LECTURE CARD

What is still “clear as mud” to you?

What learning assessment methods can you introduce or improve in your courses?