Introduction to Assessment in PBL

Courtesy of Sue Groh
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“Covering the Material”
A New Lesson Plan Is Needed
Active Learning?
Mission Accomplished?
Lesson Learned…
Defining Assessment

“An assessment is an activity, assigned by the professor, that yields comprehensive information for analyzing, discussing, and judging a learner’s performance of valued abilities and skills.”

- Huba and Freed, Learner-Centered Assessment on College Campuses: Shifting the Focus from Teaching to Learning, 2000

Assessment is more than assigning grades: it implies ongoing interaction and communication between instructor and student.
Assessment Decisions

Faculty Perspective:
“Learning drives everything.”
- Barbara Walvoord

Student Perspective:
“Grading drives everything.”
Key Questions

• What do I want my students to learn?
  ⇒ Learning objectives
  – Content knowledge
  – Process skills

• How will I know if they have learned it?
  ⇒ Assessment strategies
  – Summative
  – Formative

• How much do I value that learning?
  ⇒ Look at what counts towards the grade
Types of Assessment

• Summative assessment
  – Traditional grading for accountability
  – Usually formal, comprehensive
  – Judgmental

• Formative assessment
  – Feedback for improvement/development
  – Usually informal, narrow/specialized
  – Suggestive
Assessment and Learning Objectives

Bringing content and process together

- Content Knowledge
- Process Skills

Assessment
Bloom’s Cognitive Levels

**Evaluation** - make a judgment based on criteria

**Synthesis** - produce something *new* from component parts

**Analysis** - break material into parts to see interrelationships

**Application** - apply concept to a *new* situation

**Comprehension** - explain, interpret

**Knowledge** - remember facts, concepts, definitions
An Example: Probing Critical Thinking Skills in a Chem Exam

Goal: to design an exam question that:

• goes beyond simple knowledge or comprehension
• uses novel situation or “real world” context
• involves multiple concepts
• requires recognition of concepts involved (analysis), their roles here (application), and how several ideas come together (synthesis)
Chemical Solutions: Typical Questions

Calculate the vapor pressure of a solution of 5.8 g of NaCl in 100 g of water.
Bloom Level: Knowledge

Explain why a solution of NaCl will have a lower vapor pressure than pure water.
Bloom Level: Comprehension
A “Critical Thinking” Exam Question

The relative humidity inside a museum display case can be maintained at 75.3% by placing within the case a saturated solution of NaCl (containing excess solid NaCl). Explain, in molecular level terms, why the humidity remains constant - even when water-saturated air (100% humidity) diffuses into the case.
Design a solution-based system that could be used to maintain a constant humidity within a museum display case.

Explain in molecular-level terms why this would work.
## Assess at Several Bloom Levels

**Example: Chem exam**

<table>
<thead>
<tr>
<th>Level</th>
<th># of points</th>
<th>sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Comprehension</td>
<td>36</td>
<td>45 (D-)</td>
</tr>
<tr>
<td>Application</td>
<td>22</td>
<td>67 (C+)</td>
</tr>
<tr>
<td>Analysis</td>
<td>20</td>
<td>87 (A-)</td>
</tr>
<tr>
<td>Synthesis</td>
<td>9</td>
<td>96 (A)</td>
</tr>
<tr>
<td>Evaluation</td>
<td>4</td>
<td>100</td>
</tr>
</tbody>
</table>
Evaluating Learning through Rubrics

Rubric: a set of specific criteria against which a product is to be judged

• Criteria reflect learning objectives for that activity
• Several achievement levels are identified for each criterion
• Benchmark features indicating quality of work at each level are clearly described for each criterion

Rubrics can be used for both formative and summative assessment.
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Objective 1</th>
<th>Objective 2</th>
<th>Objective 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective 1</td>
<td>Accepted</td>
<td>Minor revision</td>
<td>Major revision</td>
</tr>
<tr>
<td>Objective 2</td>
<td>Expert</td>
<td>Advanced</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Objective 3</td>
<td>6-5</td>
<td>4-3</td>
<td>2-1</td>
</tr>
</tbody>
</table>
## Rubric Construction

### Achievement Levels

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Excellent</th>
<th>Good</th>
<th>Needs Work</th>
<th>Not acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>State an objective</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Describe characteristic features of each level of achievement</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Rubric for Planning of a Middle School Science Unit**

<table>
<thead>
<tr>
<th>Category</th>
<th>Excellent</th>
<th>Good</th>
<th>Average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>State &amp; national standards</td>
<td>Appropriate; listed for each lesson</td>
<td>Appropriate; listed for most lessons</td>
<td>Incomplete list/ some less appropriate</td>
<td>Few standards, inappropriately listed</td>
</tr>
<tr>
<td>Developmental level of lesson</td>
<td>Appropriate; misconceptions addressed in all lessons</td>
<td>Appropriate; misconceptions addressed in most lessons</td>
<td>Most lessons are appropriate; misconceptions addressed in few</td>
<td>Few lessons are appropriate misconceptions not addressed</td>
</tr>
<tr>
<td>Includes nature of science, inquiry in</td>
<td>all lessons</td>
<td>most lessons</td>
<td>many lessons</td>
<td>few lessons</td>
</tr>
<tr>
<td>Assessment</td>
<td>Variety of activities, well-integrated</td>
<td>Used in most areas but missed in some</td>
<td>Used but with little planning or integration</td>
<td>Little use of assessment throughout unit</td>
</tr>
</tbody>
</table>
Advantages of Rubric Use

• Clarifies expectations
• Efficient, specific feedback concerning areas of strength, weakness
• Convenient evaluation of both content and process learning objectives
• Encourages self-assessment: use as guideline
• Minimizes subjectivity in scoring
• Focal point for ongoing feedback for improvement
Other Ideas for Rubric Use

• Have students participate in setting criteria, performance descriptions
  – Use old student work as “data”
• Have students use rubric to rate own work; submit rating with assignment
• Others
Questions and Reflections