Linking Assessment & Instruction in the Mathematics Classroom

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Based on work done in the BIFOCAL Project with Valerie Mills, Charalambos Charalambous, Jenny Sealy, Dana Gosen, Hala Ghousseini & others
What comes to mind when you hear the word Assessing?
The Meaning of “Assessing”

- “To determine the value, significance, or extent of; to appraise” (The American Heritage® Dictionary of the English Language: Fourth Edition, 2000)
  - the “proving” function of assessment

- From Latin assidere: “to sit beside” (and thus to assist a judge in fixing the estimated amount of a fine or tax; to provide guidance and feedback) (The Online Etymology Dictionary)
  - the “improving” function of assessment
Assessment: Common Beliefs and Perceptions

- Assessment is distinct from and is usually an interruption of teaching and learning.
- Its purpose is to evaluate and “prove” student learning so that grades can be assigned, promotion/retention decisions can be made, a school’s AYP can be determined, and …
The NCTM Assessment Principle

- “Assessment should be more than merely a test at the end of instruction to see how students perform under special conditions; rather, it should be an integral part of instruction that informs and guides teachers as they make instructional decisions. Assessment should not merely be done to students; rather it should also be done for students, to guide and enhance learning” (NCTM, 2000, p. 22)

- “Assessment and instruction must be integrated so that assessment becomes a routine part of the ongoing classroom activity rather than an interruption” (NCTM, 2000, p. 23).
A Common Approach to Formative Assessment

- What information about student learning should the teacher collect?
- How should this information be collected?
- How can a teacher reconcile different sources of information?

Instruction is in the background, treated as if it were not problematic
The BIFOCAL Approach

Mathematical Tasks

Assessment

Instruction
Focus on Instruction

- First two years of the project (2003-2005)
- Emphasis on mathematical tasks and the work around them: The Mathematical Tasks Framework (MTF)
Focus on Instruction

Some MTF-related instructional issues during the first two years:

- Selecting and using cognitively demanding, mathematically rich tasks
- Anticipating plausible student solution approaches
- Using tasks that have multiple entry points and lend themselves to multiple approaches
- Selecting which student solution approaches to share and orchestrating the sharing
- Handling incorrect solutions
- Asking questions to support/challenge student thinking rather than replace it
Focus on Instruction

- Tools used to support teachers’ work:
  - Narrative cases
  - Modified Lesson Study - Collaborative Lesson Planning
  - Thinking Through a Lesson Protocol (TTLP)
**Focus on Assessment**

- Third year of the project (2005-2006)
- Emphasis shifted to analyzing assessment tasks and students’ work on these tasks to capture student learning and inform instructional decisions
Focus on Assessment

Some third-year activities:

- Analyze local or state assessments:
  - Task analysis
    - The potential of tasks to reveal student learning and misconceptions
    - Connecting tasks to GLCEs (state standards)
    - Content coverage
  - Analysis of student work to make inferences about student learning and instruction
    - Analyzing student work as a whole
    - Analyzing student work in specific tasks
      - Identifying correct and incorrect solution strategies
      - Identifying difficult tasks; postulating about the causes of their difficulty (concept, wording, etc)
  - Consideration of possible instructional decisions based on analyses of tasks and student performance
Focus on Assessment

- Tools used to support teachers’ work:
  - Narrative cases on Assessment
  - The “Assessment for Learning” (AFL) Protocol
**The AFL protocol**

### Looking at the summary data:
- Identify the tasks on which students struggled and did particularly well.

### Looking at the tasks:
- Identify the math concepts and/or skills assessed for each task selected, as well as the GLCE(s)/Standard(s) associated with the task.

### Looking at correct and incorrect student responses and reflecting on practice:
- What do you think students might (not) understand?
- What solution strategies are students using? Can these be improved?
- Are these conclusions consistent with other sources of evidence such as classroom observations?

### Modifying/reinforcing instructional decisions:
- Where does the mathematics appear in your curriculum materials?
- How was the mathematics originally taught and what might be done differently to deepen the students’ understanding of the concepts?
- Will there be future opportunities for students to learn this concept and/or does this concept need to be re-taught?
Focus on Assessment

A glimpse at our work in year 3

Teacher reflections
A glimpse at our Work in Year 3

The MEAP Task

Student Results on the Task

Using the AFL to Analyze the Task
31 Four experimental cars, A, B, C, and D, are competing in a 500-mile race. Each car starts the course at a different time. Race officials record each car’s distance from the starting line each hour. The following graph shows the location of each car from 3 p.m. to 5 p.m.

Which car was traveling at the greatest speed during the times observed?

A  Car A
B  Car B
C  Car C
D  Car D
### State Student Results

#### Released Multiple Choice

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<tr>
<th>STRAND Domain</th>
<th>Released Item Number</th>
<th>GLCE Code</th>
<th>Item Type</th>
<th>PERCENT RESPONDING</th>
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Using the AFL to Analyze Student Results
Reflections

How was our work on the AFL protocol different from the way you typically “go over test results” in your classroom?

- “I usually just go over test with an answer key on the overhead. I think I will show more student work. I would also give a couple of examples to each group to look over and be the ‘teacher’.”

- “Usually I just notice a common missed question and remember to go over it the next day. Using this format, I tend to come up with more than one way to revisit a task.”

- “This protocol will help me see holes in my own teaching or let me see misunderstanding among students.”
Shifts in Beliefs and Practices

- Considering assessment an integral part of instruction and not an interruption of it
- Capitalizing on student work to inform next instructional decisions
The **BIFOCAL** Approach

**Mathematical Tasks**

**Instruction**
(MTF, cases, modified lesson planning, TTLP, scaffolding strategies list)

**Assessment**
(analyzing tasks, analyzing students' work, AFL)
Discussion

- TASKS as they appear in curricular materials
- TASKS as set up by teachers
- TASKS as enacted with students

STUDENT LEARNING