Using Classroom Formative Assessment and Tasks to Improve Student Learning

*Used with skill, assessment can motivate the reluctant, revive the discouraged, and thereby increase, not simply measure, achievement.*

### Formative Assessment
Formal and informal processes teachers and students use to gather evidence for the purpose of improving learning.

### Summative Assessment
Assessment information used to provide evidence of student achievement for the purpose of making a judgment about student competence or program effectiveness.

### What Does Research Say the Benefits of Formative Assessment Are
Formative assessment is any assessment task designed to promote students’ learning. These tasks give both teachers and students feedback, so that teaching and learning activities can be altered according to the results. Formative assessment is different from summative assessment, the goal of which is to measure mastery. Research indicates the following conclusions:

- Formative assessment produces greater increases in student achievement and is cheaper than other efforts to boost achievement, including reducing class sizes and increasing Teachers’ content knowledge.
- Formative assessment that occurs within and between instructional units (medium-cycle assessment) as well as within and between lessons (short-cycle assessment) has been shown to improve students’ achievement. Formative assessment across marking periods, quarters, semesters, or years (intervals of four weeks to one year) has not been shown to improve students’ achievement.
- In classrooms where medium and short-cycle formative assessment was used, teachers reported greater professional satisfaction and increased student engagement.

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What strategies contribute to effective formative assessment?

Looking separately at the roles of the teacher, the students, and the students’ peers, we find that research suggest that effective assessment can be based on the following five “key strategies”:

1. Clarifying, sharing, and understanding what students are expected to know. (Learning Progressions)
2. Creating effective classroom discussions, questions, activities, and tasks that offer the right type Evidence of how students are progressing to the espoused learning goals
3. Providing feedback that moves learning forward
4. Encouraging students to take ownership of their own learning
5. Using students as learning resources for one another.

Based on *What Does Research Say the Benefits of Formative Assessments Are?*  
The National Council of Teachers of Mathematics (NCTM)

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### Aspects of Assessment for Learning

<table>
<thead>
<tr>
<th></th>
<th>Where the learner is going</th>
<th>Where the learner is right now</th>
<th>How to get there</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teacher</strong></td>
<td>Clarifying &amp; Sharing learning intentions &amp; criteria for success</td>
<td>Engineering effective classroom discussions, questions, activities, &amp; tasks that elicit evidence of learning</td>
<td>Providing feedback that moves learners forward</td>
</tr>
<tr>
<td><strong>Peer</strong></td>
<td>Understanding &amp; sharing learning intentions &amp; criteria for success</td>
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<tr>
<td><strong>Learner</strong></td>
<td>Understanding learning intentions &amp; criteria for success</td>
<td>Activating students as the owners of their own learning</td>
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## Cognitive Demand and Standards for Mathematical Practice

<table>
<thead>
<tr>
<th>Bloom’s Taxonomy Revised</th>
<th>Webb’s Depth of Knowledge</th>
<th>Cognitive Demand in Mathematics</th>
<th>Standards for Mathematical Practice</th>
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<tbody>
<tr>
<td>Remembering</td>
<td>Level One Recall and Reproduction</td>
<td>Level One Memorize Facts, Definitions, &amp; Formulas.</td>
<td>1. Make sense of problems and persevere in solving them.</td>
</tr>
<tr>
<td>Understanding</td>
<td>Level Two Skills and Concepts</td>
<td>Level Two Perform Procedures</td>
<td>2. Reason abstractly and quantitatively.</td>
</tr>
<tr>
<td>Applying</td>
<td>Level Two Skills and Concepts</td>
<td>Level Three Demonstrate Understanding of Mathematics</td>
<td>3. Construct viable arguments and critique the reasoning of others.</td>
</tr>
<tr>
<td>Analyzing</td>
<td>Level Three Strategic Thinking</td>
<td>Level Four Conjecture, Analyze, Generalize, Prove</td>
<td>4. Model with mathematics</td>
</tr>
<tr>
<td>Evaluating</td>
<td>Level Four Extended Thinking</td>
<td>Level Five Solve Non-Routine Problems, Make Connections</td>
<td>5. Use appropriate tools strategically.</td>
</tr>
<tr>
<td>Creating</td>
<td>Level Four Extended Thinking</td>
<td>Level Five Solve Non-Routine Problems, Make Connections</td>
<td>6. Attend to precision.</td>
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<tr>
<td></td>
<td></td>
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<td>7. Look for and make use of structure.</td>
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<td></td>
<td></td>
<td>8. Look for and express regularity in repeated reasoning.</td>
</tr>
</tbody>
</table>

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Provide students with a clear and understandable vision of the learning target.

Use examples and models of strong and weak work.

Offer regular descriptive feedback.

Teach students to set goals.

Teach students focused revision.

Design lessons to focus on one learning target at a time.

Teach students to self-assess and set goals.

Engage students in self-reflection, and let them keep track of and share their progress.

Where am I going?

How can I close the gap?

Where am I now?

Where am I going?

Seven Strategies of Assessment for Learning
Strategies to Turn Assessment into Instruction

- Get one, give one
- Explain your answer/reasoning
- Try a different answer
- Add to/extend the problem
- Connect concepts
- Logical eliminations
- Understand the problem
- Error analysis

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### Common Core State Standards, Mathematics Practices

#### Questions for Planning & Observation

**Make sense of problem and persevere in solving.**

- Do students:
  - Unpack the problem?
  - What is the story?
  - What are the given quantities?
  - What needs to be found out?
  - Use strategies to enter the problem?
    - Previous similar or simpler problems.
    - Knows representations/models that work.
    - Language needed to understand problem.
  - Recognize relationships in the problem? Relationships needed to find a solution?
    - Knows representations/models that work.
    - Previous similar or simpler problems.
    - Use strategies to enter the problem?
      - When needs to be found out?
      - What are the given quantities?
      - What is the story?
  - Look for patterns, trends?
  - Look for regularities, trends?
  - Make conjectures?
  - What mathematics should be evident in all solutions? How will students see the same mathematics in each representation and solution?
  - Make sense of problem and persevere in solving? Make sense of problem and persevere in solving?

**Reason abstractly and quantitatively.**

- Do students:
  - Mathematize the problem?
    - What are the given quantities?
    - How do they relate to each other?
  - Represent the problem symbolically?
    - Can students explain what symbols mean and how relate to quantities, other symbols?
    - Can students explain why they are choosing a particular strategy?
  - What properties and reasoning will support solutions? How can the problem be decomposed and recomposed?
    - What are the units needed while solving and reporting answer?
    - What properties and reasoning will support solutions? How can the problem be explained? The context of problem? What are the units needed while solving and reporting answer?
    - Do strategies and results make sense?
    - What are the given quantities?
    - How do they relate to each other?
    - What are the given quantities?
    - How do they relate to each other?

**Construct viable arguments and critique the reasoning of others.**

- Do students:
  - Make conjectures?
    - Explore the problem to support or disprove their conjecture?
    - Refine or change their conjecture?
  - Construct their justification? Use objects? Drawings? Diagrams? Examples and counterexamples?
    - Are the given quantities?
    - Which objects provide evidence of their conjecture?
    - What is the story?
  - Have opportunities to explain their conclusions and communicate their reasoning with others? What language is needed?
    - What is the story?
    - What is the story?
  - Have opportunities to ask useful questions to seek clarity? Follow the arguments of others looking for flaws and explaining them?
### Model with Mathematics

**Do students:**

- Apply the mathematics to the problems?
- Make and recognize assumptions and approximations?
- Understand they may need to make revisions?
- Identify important quantities and the relationships between them?
- Interpret the mathematics in the context of the problem?
- Reflect on the results?
- Evaluate the reasonableness of the results?
- Maintain oversight of process & attend to details?
- Look for and express regularity in repeated reasoning?
- Notice if calculations repeat themselves?

### Use Appropriate Tools Strategically

**Do students:**

- Choose appropriate tools to explore and deepen understanding?
- Recognize usefulness and limitations of tools?
- Choose tools to fit the problem and know how to use them?
- Use technological tools to explore and deepen understanding?
- Examine their claims and check reasoning?
- Calculate accurately and precisely?
- Do they use clear definitions?
- Do they use clear definitions?
- Communicate precisely to others?

### Attend to Precision

**Do students:**

- Communicate precisely to others?
- Do they use clear definitions?
- State the meaning of the symbols they use?
- Calculate accurately and precisely?
- Recognize the structure of problem?
- Patterns (e.g., rectangles have 4 sides).
- Definitions (e.g., rectangles have 4 sides).
- Utilize properties.
- Decompose & recognize the numbers and expressions?
- Recognize the structure of problem?

### Look for and Express Regularity in Repeated Reasoning

**Do students:**

- Notice if calculations repeat themselves?
- Look for general methods? Shortcuts?
- Maintain oversight of process & attend to details?
- Look for and express regularity in repeated reasoning?
- Notice if calculations repeat themselves?
- Make sense of solutions?
- Reflect on the results?
- Identify important quantities and the relationships between them?
- Make and recognize assumptions and approximations?
- Evaluate the reasonableness of the results?
- Maintain oversight of process & attend to details?
- Look for and express regularity in repeated reasoning?
- Notice if calculations repeat themselves?
- Make sense of solutions?
- Reflect on the results?
Useful Formative Assessment Websites

- http://www.michigan.gov/mde/0,4615,7-140-22709_55936----00.html
- http://wvde.state.wv.us/teach21/FormativeAssessment.html

Learning Progression
http://ime.math.arizona.edu/progressions/

Illustrative Math Project
http://illustrativemathematics.org/standards/k8

Sample SBAC Items 3-HS (Math and ELA) organized by Missouri
http://dese.mo.gov/divimprove/assess/sbac.html#sbacsample

MARS – Secondary Lessons, Tasks, and Assessment examples
http://map.mathshell.org/materials/index.php

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