Ten Minutes to Improving Teaching and Learning
Overview and Goals

• Explore formative assessment as used in the FOSS program

• Experience a 10- to 15-minute technique for increasing student achievement that you can try in your own classroom tomorrow.

• Experience embedded assessments as learners. Analyze embedded assessments as teachers.
Why Focus on Formative Assessment?

ASK/FAST Development Study
--Kennedy, Long, and Camins, 2008

ASK-It Development Study
--Kennedy, Ferguson, and Long, 2010

ASK/FOSS Efficacy Study
--WestEd and CRESST, 2013
Assumptions…

• No matter how good the curriculum or how good the teacher, there will be students who do not learn what we teach.

• Every student can learn; every student can improve. ~focus on a growth mindset

• Assessment bridges the gap between teaching and learning—and can help develop a culture of continuous improvement.
Foundations

- National and California Frameworks
- FOSS Conceptual Frameworks
- Student Progress Levels
- NGSS Performance Expectations
How can we change the motion of wheels rolling down ramps?
Wheel-and-Axle Systems

Build some different systems and observe their motion.

Record your designs in your notebooks.

What happens if you

- use wheels the same size?
- use a small wheel and a large wheel?
- put the axle in different wheel holes?
- use two axles?
- put axles on the outside indentations of the wheels?
- put a third wheel in the middle?
Investigation 2, Part 2: Predicting Motion of New Systems
Focus Question

Wheels are not the only things that roll.

What do you predict the motion of this cup will be if I were to let it roll down a ramp?

What rules help predict where a rolling cup will end up?
Rolling Cups

Explore how paper cups roll on ramps.

Materials (per pair)
1 ramp
4 clothespins
2 paper cups
Investigation 2, Part 2

Rolling Cups

Explore how paper cups roll on ramps.

Materials (per pair)
1 ramp
4 clothespins
2 paper cups

Why did the cup roll in a curve instead of straight?

What determines which direction the cup will roll?

What else did you discover about rolling cups from your investigations?

How does a rolling cup compare to a wheel-and-axle system?
More Paper Cup Challenges

Try these challenges. You may get any additional materials you think you need from the materials station.

1. Pretend your cup is a car and the ramp is a parking garage. Roll the cup off the ramp so that it ends up parked under the ramp.

2. Modify your paper-cup system so that it rolls down the ramp in a straight line.

3. Add weight to your paper-cup system. What happens?

Record your designs and observations in your notebooks.
Response Sheet A—Investigation 2

A student in another class invented a game. In order to win the game, you have to pick three objects and roll each one off the ramp in a different place. First you have to roll an object onto the area marked 1. Then, roll a second object onto the area marked 2. Finally, roll a third object onto the area marked 3. You must let go of all objects at the place marked “START POSITION.”

Ramp top

START POSITION

Ramp bottom

1

2

3

Response Sheet B—Investigation 2

Now it’s your turn to play the game. Look at the objects at the bottom of the page. On a blank notebook page, answer these questions.

1. Which objects could you choose to land at position 1? Explain why those objects would work.

2. Which objects could you choose to land at position 2? Explain why you chose those objects.

3. Choose one object to land at position 3. Explain how you will use that object to land in position 3.

[Images of objects: funnel, bottle, potato, pencil, vase]

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Reflective Assessment Practice

1. **Anticipate**
   Plan for investigation part per IG and determine embedded assessment.

2. **Teach**
   Teach the lesson per IG and collect student notebooks.

3. **Review**
   Review student work (10 minutes)
   Use “What to Look For.”

4. **Reflect**
   Note trends and patterns you see in student understanding.

5. **Adjust**
   Plan next instructional steps based on assessment reflection.
   Make notes for next year.

FOR EACH PART
Before Instruction Begins........Anticipate

• “If you don't know where you are going, you'll end up someplace else.”  ~Yogi Berra
Anticipate

13. Assess progress: response sheet
Distribute a copy of notebook sheets 6 and 7, Response Sheet A and B—Investigation 2, to each student. Collect the science notebooks after class, and review students’ responses. Plan to spend time discussing the sheets with students after you review them.

What to Look For

- **Students choose an object with different-sized ends to roll off the ramp at position 1; the smaller end of the object should start closest to side 1.**
- **Students choose an object with equal-sized ends to roll off the ramp at position 2; e.g. the pencil or the vase with the wide opening.**
- **Students choose an object with different-sized ends to roll off the ramp at position 1; the smaller end of the object should start closest to side 3.**

CROSSCUTTING CONCEPTS
Patterns

TEACHING NOTE
Students should use the rule they have developed: if the ends are equal sized, the roller will go straight; if the ends are different sizes, it will roll in a curved path, rolling toward the smaller end.

Anticipating what we want students to learn helps us make sure our instruction guides students towards conceptual understanding.
## Embedded Assessment Notes

<table>
<thead>
<tr>
<th>Investigation ___, Part ___</th>
<th>Date</th>
</tr>
</thead>
</table>

### Got it!
- Tally for each student that has “got” both concepts.

### Record “what to look for”
- Choose 1 concept.
- Write names of students that need help with concept.

### (Emerging trends)

### Reflections/Next Steps
- Record patterns and next step self-assessment strategy if one is needed. Adjustments for next year?
## Reflective Assessment Practice

Recording the Concepts

<table>
<thead>
<tr>
<th>Embedded Assessment Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
</tr>
<tr>
<td><strong>Investigation__2, Part__2</strong></td>
</tr>
<tr>
<td>Got it!</td>
</tr>
<tr>
<td><strong>Concept</strong></td>
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</tr>
<tr>
<td>Reflections/Next Steps</td>
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Reflective Assessment Practice

1. **Anticipate**
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   Teach the lesson per IG and collect student notebooks.

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FOR EACH PART
Reflective Assessment Practice

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3. **Review**
   Review student work (10 minutes) Use “What to Look For.”

4. **Reflect**
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**FOR EACH PART**
### Embedded Assessment Notes

**Energy**

| Investigation _2_, Part _2_ | Date _3/10/18_
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Got it!</td>
<td></td>
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</table>

**Concept**

- Objects with different-sized ends roll to the left or right.

**Concept**

- If you see a trend emerging, add it here.

**Reflections/Next Steps**

Reflective Assessment Practice
Reviewing the Work

Student B
I think the pencil will land at position 2 because the pencil has a tip but the tip does not touch the ground so it rolls straight to the number 2.

I think that the funnel will go to number 1 because the small tip and big tip do not go together so it will roll side ways to the number 1.

I think the drum stike will go to number 3 because it has a ball on one side and just a stink on the other side, so it will roll to the right.
Reflective Assessment Practice
Recording the Concepts

### Embedded Assessment Notes

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Part</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>3/10/18</td>
</tr>
</tbody>
</table>

- **Got it!**
- **Concept**
  - Objects will different-sized ends roll to the left or right.

- **Concept**

- **Reflections/Next Steps**
Student E
I think the potato will land in to 2 position because it is kind of bumpie.
I think the little juice bottle will land in 3 position because it can roll.
I think the funnel will go in 1 position because it can rool straight.
<table>
<thead>
<tr>
<th>Investigation 2, Part 2</th>
<th>3/10/18</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Got it! /</td>
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<td></td>
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<td>Concept</td>
<td>Objects with different-sized ends roll to the left or right.</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concept</td>
<td>Objects with same-sized ends roll straight.</td>
<td></td>
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<tr>
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Reflective Assessment Practice
Recording the Concepts

Your turn!

1. There is a folder of student work for every 2 participants.
2. Share the student work with your partner. Split the papers into two groups. After you read a paper, pass it on to your partner.
3. You’ll have ten minutes to read and record notes for as many papers as you can.
Reflective Assessment Practice

For Each Part

1. Anticipate
   Plan for investigation part per IG and determine embedded assessment.

2. Teach
   Teach the lesson per IG and collect student notebooks.

3. Review
   Review student work (10 minutes)
   Use "What to Look For."

4. Reflect
   Note trends and patterns you see in student understanding.

5. Adjust
   Plan next instructional steps based on assessment reflection.
   Make notes for next year.
Reflective Assessment Practice
Recording the Concepts

**Concept:** Objects with different-sized ends roll to the left or right.
- B, C, F, G, I, K

**Concept:** Objects with same-sized ends roll straight.
- B, D, E, J, L, O

**Reflections/Next Steps**
Many students used the ‘rule’ in one place, but not consistently. Certain shapes, such as the potato, students didn’t know where the parts would touch the ramp.
Next Step Strategy- Line of Learning

- Look at your own notebook Wheel-and-Axle entry.
- What words can you use to describe the pattern of motion ‘rules’? What was the cause? What was the effect?
- With your A/B partner.
  A – describe your ‘rules’.
  B- Paraphrase- “So you are saying….”
SWITCH
Next Step Strategy- Line of Learning

• Draw a line of learning…

• Underneath your line of learning describe the pattern of motion ‘rules’.
• Did you use your ’rules’ to predict the three objects?
Student E
I think the potato will land in to 2 position because it is kind of bumpie.

I think the little juice bottle will land in 3 position because it can roll.

I think the funnel will go in 1 position because it can roll straight.

L.O.L
If the edges are the same, it will roll straight. The potato will roll straight

If the edges are different, it will turn. The funnel and bottle.
Next Step Strategies

1. Anticipate
   Plan for investigation part per IG and determine embedded assessment.

2. Teach
   Teach the lesson per IG and collect student notebooks.

3. Review
   Review student work (10 minutes)
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4. Reflect
   Note trends and patterns you see in student understanding.

5. Adjust
   Plan next instructional steps based on assessment reflection.

FOR EACH PART

- Refer to the hand out
- What Next Step Strategy might you try if this was your class?
Thinking about the RAP…..

• We just experienced all of the parts of the Reflective Assessment Practice.

• With your partner….  
• FIRST - restate all the steps of the process in your own words.
• SECOND – share one important thing you want to remember when you do this process on your own.
Reflecting on the RAP

• What was it like for you to do the RAP independently under the time constraints?

• What did you learn about patterns of students’ thinking and understanding?
Looking at Student Work

What seems like a misconception is often, and perhaps usually, a perfectly good conception in the wrong place…The key insight here is that children are active in the construction of their own knowledge…Teachers must acknowledge that what their students learn is not necessarily what they intended, and this is inevitable because of the unpredictability of teaching [and learning].
When teachers listen [read] student responses, many focus more on the correctness of the answers than what they can learn about the student’s understanding.

…If we listen [or read] interpretively there is often information about how to teach something better in what students say—and thus how to adjust the instruction.

(adapted from Embedded Formative Assessment, Dylan Wiliam)
TIME FOR QUESTIONS
Why the FOSS Assessment System is Better than Traditional Systems

<table>
<thead>
<tr>
<th>Traditional Assessment</th>
<th>FOSS Assessment</th>
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</thead>
<tbody>
<tr>
<td>Designed to evaluate minimum mastery.</td>
<td>Designed to provide diagnostic information about learning.</td>
</tr>
<tr>
<td>Students receive feedback as percentage correct.</td>
<td>Students receive feedback explaining what they know or need to work on. (Butler 1988; comments only produce higher achievement.)</td>
</tr>
<tr>
<td>Once students view their grade, they’re done.</td>
<td>Students continue to build content understanding through self-assessment activities.</td>
</tr>
<tr>
<td>Students hate taking tests (students often feel inadequate and perseverance is not supported).</td>
<td>Students ask when they get to take the next test (develops growth mindset; we learn from mistakes).</td>
</tr>
</tbody>
</table>
Why Assess?

Assessment occupies a central position in good teaching because we cannot predict what students will learn, no matter how we design our teaching.

Assessment bridges the gap between teaching and learning—and can help develop a culture of continuous improvement.