Formative Assessment
How can it improve teaching and learning?
Workshop Outline

• Assessing Students
• What is Formative Assessment?
• Five Formative Assessment Strategies:
  – Clarifying Learning Intentions
  – Eliciting Evidence of Student Learning
  – Giving Formative Feedback
  – Students as Learning Resources for One Another
  – Students Taking Ownership of Their Own Learning
• Reflections
Assessing Students
Assessment Methods

• How do we assess our students?

• Which assessment methods *improve* our teaching and students’ learning?
We assess our students for many reasons, for example, to:

1. **maintain records** so that teachers or parents can be informed of progress
2. **celebrate achievement**, rewarding effort and success
3. **select** learners for groups, courses, careers
4. **diagnose student difficulties** and so inform teaching
5. **motivate** learners by showing them what we value and what they still need to learn
6. **evaluate teaching methods** to see which work more effectively
What is Formative Assessment?
• What is ‘formative assessment’? – based on your experiences, readings, and understandings, how would you define/describe ‘formative assessment’?

• What about ‘formative assessment’ is challenging when used in the classroom?

• Take a couple of minutes, on your own, to think, and then discuss at your table with a partner. Be prepared to share with the whole group.
Summative & Formative Assessment

- **Summative** – evaluates student learning at the end of an instructional period, often generating a score that can be compared against a standard or benchmark.

- **Formative** – recognizes ongoing achievements and difficulties during an instructional period, without grading, allowing teachers and students to take appropriate action as the course progresses.
‘... all those activities undertaken by teachers, and by their students in assessing themselves, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged. Such assessment becomes ‘formative assessment’ when the evidence is actually used to adapt the teaching work to meet the needs’.

‘Practice in a classroom is formative to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have taken in the absence of the evidence that was elicited’.

What We Need to Know

Where the learner is going

How to get there

Where the learner is now
Five Formative Assessment Strategies
Five Formative Assessment Strategies

1. Clarifying and sharing learning intentions and criteria for success
2. Engineering effective classroom discussions, questions, and learning tasks that elicit evidence of learning
3. Providing feedback that moves learners forward
4. Activating students as instructional resources for one another
5. Activating students as the owners of their own learning

(Wiliam, D., & Thompson, M. (2007). Integrating assessment with learning: What will it take to make it work?)
### Instructional Processes Framework

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Where the learner is going</th>
<th>Where the learner is now</th>
<th>How to get there</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Clarifying, understanding, and sharing learning intentions</td>
<td>2. Eliciting evidence of student learning</td>
<td>3. Providing feedback that moves learners forward</td>
</tr>
<tr>
<td>Peer</td>
<td>4. Activating students as learning resources for one another</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learner</td>
<td>5. Activating students as owners of their own learning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adapted from Wiliam and Thompson (2007)
‘We checked many books and nine years' worth of more than 160 journals, and earlier reviews of research. This process yielded 580 articles or chapters to study. We prepared a review using material from 250 of these sources’.

‘All... studies show that... strengthening... formative assessment produces significant, and often substantial, learning gains. These studies range over ages, across several school subjects, and over several countries ...’ (Typical effect sizes 0.4 to 0.7)

<table>
<thead>
<tr>
<th></th>
<th>Where the learner is going</th>
<th>Where the learner is now</th>
<th>How to get there</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>1. Clarifying, understanding, and sharing learning intentions</td>
<td>2. Eliciting evidence of student learning</td>
<td>3. Providing feedback that moves learners forward</td>
</tr>
<tr>
<td>Peer</td>
<td>4. Activating students as learning resources for one another</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learner</td>
<td>5. Activating students as owners of their own learning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Clarifying Learning Intentions
Clarifying Learning Intentions

• Procedural Fluency
  – Carrying out procedures accurately and fluently

• Conceptual Understanding
  – The ability to describe and define a mathematical object, represent it in different ways, explain its properties, explain why a mathematical statement is true, or why a procedure works

• Problem Solving Strategies
  – The ability to make strategic decisions when solving problems, to reason, to prove and communicate results
Classroom Challenges

http://map.mathshell.org
Conceptual Understanding

Grade 8 lesson

Helps to identify students who:
- interpret distance–time graphs as pictures of situations
- have difficulty relating speeds to slopes of these graphs
<table>
<thead>
<tr>
<th></th>
<th>Where the learner is going</th>
<th>Where the learner is now</th>
<th>How to get there</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teacher</strong></td>
<td>1. Clarifying, understanding, and sharing learning intentions</td>
<td>2. Eliciting evidence of student learning</td>
<td>3. Providing feedback that moves learners forward</td>
</tr>
<tr>
<td><strong>Peer</strong></td>
<td>4. Activating students as learning resources for one another</td>
<td>3. Providing feedback that moves learners forward</td>
<td></td>
</tr>
<tr>
<td><strong>Learner</strong></td>
<td>5. Activating students as owners of their own learning</td>
<td>3. Providing feedback that moves learners forward</td>
<td></td>
</tr>
</tbody>
</table>

2. **Eliciting Evidence of Student Learning**
Classroom Challenge Structure

Before the lesson
• **Individual task**
  Students work unaided on an assessment task
  Teacher reviews work and prepares qualitative feedback

The lesson
• **Collaborative activity**
  After a whole class introduction, students work in small groups on
  a collaborative task
• **Small group discussion**
  Students compare their work with their peers
• **Whole class discussion**
  Students share as a whole class what has been learned

After the lesson
• **Individual reflection**
  Students reflect on their pre-assessment and use what they have
  learned to complete a post-assessment task
Classroom Challenge Structure

Before the lesson
- **Individual task**
  Students work unaided on an assessment task
  Teacher reviews work and prepares qualitative feedback

The lesson
- **Collaborative activity**
  After a whole class introduction, students work in small groups on a collaborative task
- **Small group discussion**
  Students compare their work with their peers
- **Whole class discussion**
  Students share as a whole class what has been learned

After the lesson
- **Individual reflection**
  Students reflect on their pre-assessment and use what they have learned to complete a post-assessment task
Before the lesson, students work on a task designed to reveal their current understandings and difficulties.

1. Describe what may have happened. You should include details like how fast he walked.

2. Are all sections of the graph realistic? Fully explain your answer.
Every morning Tom walks along a straight road from his home to a bus stop, a distance of 160 yards. The graph shows his journey on one particular day.

1. Describe what may have happened.
2. Is the graph realistic? Why?
### 3. Giving Formative Feedback

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Where the learner is going</th>
<th>Where the learner is now</th>
<th>How to get there</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Clarifying, understanding, and sharing learning intentions</td>
<td>2. Eliciting evidence of student learning</td>
<td>3. Providing feedback that moves learners forward</td>
</tr>
<tr>
<td>Peer</td>
<td></td>
<td></td>
<td>4. Activating students as learning resources for one another</td>
</tr>
<tr>
<td>Learner</td>
<td></td>
<td></td>
<td>5. Activating students as owners of their own learning</td>
</tr>
</tbody>
</table>
Classroom Challenge Structure

Before the lesson
• **Individual task**
  Students work unaided on an assessment task
  Teacher reviews work and prepares qualitative feedback

The lesson
• **Collaborative activity**
  After a whole class introduction, students work in small groups on a collaborative task
• **Small group discussion**
  Students compare their work with their peers
• **Whole class discussion**
  Students share as a whole class what has been learned

After the lesson
• **Individual reflection**
  Students reflect on their pre-assessment and use what they have learned to complete a post-assessment task
Handout 2 contains some examples of student work for the Journey to the Bus Stop task.

1. What does each student’s response tell you about his or her capacity to tackle the task?

2. If you were the teacher of these students, what formative feedback would you give them, to help them improve their understanding or methods?

Try to frame this feedback in the form of oral questions you could ask in the classroom.
‘Tom walked along a road for 100 yards. Instead of walking another 30 yards he took a short cut down an alleyway which took him 20 minutes. He walked very quickly then he caught the bus to his college which took about 50 minutes’.
Journey to the Bus Stop: Ben’s Response

‘When he get out he starts walking fast to the bus stop then he slows down then he picks up the speed again and then this speed goes constant’.
## Common Issues Table

<table>
<thead>
<tr>
<th>Common issue</th>
<th>Possible questions and prompts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Student interprets the graph as a picture</strong></td>
<td>• If a person walked at a steady speed up and down a hill, <em>directly away from home</em>, what would the graph look like?</td>
</tr>
<tr>
<td>E.g. as the graph goes up and down, Tom’s path goes up and down.</td>
<td></td>
</tr>
<tr>
<td><strong>Student interprets graph as speed–time</strong></td>
<td>• How can you tell if Tom is traveling away from or towards home?</td>
</tr>
<tr>
<td>E.g. The student has interpreted a positive slope as speeding up and a negative slope as slowing down.</td>
<td></td>
</tr>
<tr>
<td><strong>Student fails to mention distance or time</strong></td>
<td>• Can you provide more information about how far Tom has traveled during different sections of his journey?</td>
</tr>
<tr>
<td>E.g. The student has not worked out the speed of some/all sections of the journey.</td>
<td></td>
</tr>
<tr>
<td><strong>Student fails to calculate and represent speed</strong></td>
<td>• Can you provide information about Tom’s speed for all sections of his journey?</td>
</tr>
<tr>
<td><strong>Student adds little explanation as to why the graph is or is not realistic</strong></td>
<td>• Is Tom’s fastest speed realistic? Is Tom’s slowest speed realistic? Why?/Why not?</td>
</tr>
</tbody>
</table>
How could you estimate the number of trees of each type? Explain your method.
Use your method to estimate the number of old trees and young trees.
### 4. Students as Learning Resources for One Another

<table>
<thead>
<tr>
<th></th>
<th>Where the learner is going</th>
<th>Where the learner is now</th>
<th>How to get there</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teacher</strong></td>
<td>1. Clarifying, understanding, and sharing learning intentions</td>
<td>2. Eliciting evidence of student learning</td>
<td>3. Providing feedback that moves learners forward</td>
</tr>
<tr>
<td><strong>Peer</strong></td>
<td>4. Activating students as learning resources for one another</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Learner</strong></td>
<td>5. Activating students as owners of their own learning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Classroom Challenge Structure

#### Before the lesson
- **Individual task**
  - Students work unaided on an assessment task
  - Teacher reviews work and prepares qualitative feedback

#### The lesson
- **Collaborative activity**
  - After a whole class introduction, students work in small groups on a collaborative task
- **Small group discussion**
  - Students compare their work with their peers
- **Whole class discussion**
  - Students share as a whole class what has been learned

#### After the lesson
- **Individual reflection**
  - Students reflect on their pre-assessment and use what they have learned to complete a post-assessment task
A. Tom took his dog for a walk to the park. He set off slowly and then increased his pace. At the park Tom turned around and walked slowly back home.

B. Tom rode his bike east from his home up a steep hill. After a while the slope eased off. At the top he raced down the other side.

C. Tom went for a jog. At the end of his road he bumped into a friend and his pace slowed. When Tom left his friend he walked quickly back home.
Annotating the Graph

A graph may end up looking like this:

This is how students should annotate their graphs when working on the collaborative task.

Collaborative activity: matching Card sets A and B (20 minutes)

Ask students to work in small groups of two or three students. Give each group the Card Set A: Distance – Time Graphs, and Card Set B: Interpretations together with a large sheet of paper, and a glue stick for making a poster.

You are now going to continue exploring matching graphs with a story, but as a group. You will be given ten graph cards and ten story cards. In your group take a graph and find a story that matches it. Alternatively, you may want to take a story and find a graph that matches it.

Take turns at matching pairs of cards. Each time you do this, explain your thinking clearly and carefully. If you think there is no suitable card that matches, write one of your own.

Place your cards side by side on your large sheet of paper, not on top of one another, so that everyone can see them. Write your reasons for the match on the cards or the poster just as we did with the example in class.

Give explanations for each line segment. Make sure you leave plenty of space around the cards as, eventually, you will be adding another card to each matched pair.

The purpose of this structured group work is to encourage students to engage with each other’s explanations and take responsibility for each other’s understanding.

Slide P-3 of the projector resource summarizes these instructions.

- Line not too steep - this means Tom slows down.
- Furthest Tom gets from home.
- Negative slope means Tom is walking back to his home.
- Tom returns home.
<table>
<thead>
<tr>
<th>Column 1</th>
<th>Column 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Graph A" /></td>
<td><img src="image2.png" alt="Graph B" /></td>
</tr>
<tr>
<td><strong>1</strong> Tom ran from his home to the bus stop and waited. He realized that he had missed the bus so he walked home.</td>
<td></td>
</tr>
<tr>
<td><img src="image3.png" alt="Graph C" /></td>
<td><img src="image4.png" alt="Graph D" /></td>
</tr>
<tr>
<td><strong>2</strong> Opposite Tom’s home is a hill. Tom climbed slowly up the hill, walked across the top, and then ran quickly down the other side.</td>
<td></td>
</tr>
<tr>
<td><img src="image5.png" alt="Graph E" /></td>
<td><img src="image6.png" alt="Graph F" /></td>
</tr>
<tr>
<td><strong>3</strong> Tom skateboarded from his house, gradually building up speed. He slowed down to avoid some rough ground, but then speeded up again.</td>
<td></td>
</tr>
<tr>
<td><img src="image7.png" alt="Graph G" /></td>
<td><img src="image8.png" alt="Graph H" /></td>
</tr>
<tr>
<td><strong>4</strong> Tom walked slowly along the road, stopped to look at his watch, realized he was late, and then started running.</td>
<td></td>
</tr>
<tr>
<td><img src="image9.png" alt="Graph I" /></td>
<td><img src="image10.png" alt="Graph J" /></td>
</tr>
<tr>
<td><strong>5</strong> Tom left his home for a run, but he was unfit and gradually came to a stop!</td>
<td></td>
</tr>
<tr>
<td><img src="image11.png" alt="Graph K" /></td>
<td><img src="image12.png" alt="Graph L" /></td>
</tr>
<tr>
<td><strong>6</strong> Tom walked to the store at the end of his street, bought a newspaper, and then ran all the way back.</td>
<td></td>
</tr>
<tr>
<td><img src="image13.png" alt="Graph M" /></td>
<td><img src="image14.png" alt="Graph N" /></td>
</tr>
<tr>
<td><strong>7</strong> Tom went out for a walk with some friends. He suddenly realized he had left his wallet behind. He ran home to get it and then had to run to catch up with the others.</td>
<td></td>
</tr>
<tr>
<td><img src="image15.png" alt="Graph O" /></td>
<td><img src="image16.png" alt="Graph P" /></td>
</tr>
<tr>
<td><strong>8</strong> This graph is just plain wrong. How can Tom be in two places at once?</td>
<td></td>
</tr>
<tr>
<td><img src="image17.png" alt="Graph Q" /></td>
<td><img src="image18.png" alt="Graph R" /></td>
</tr>
<tr>
<td><strong>9</strong> After the party, Tom walked slowly all the way home.</td>
<td></td>
</tr>
<tr>
<td><img src="image19.png" alt="Graph S" /></td>
<td><img src="image20.png" alt="Graph T" /></td>
</tr>
<tr>
<td><strong>10</strong> Make up your own story!</td>
<td></td>
</tr>
</tbody>
</table>
Adding a Different Representation

2. Opposite Tom’s home is a hill. Tom climbed slowly up the hill, walked across the top, and then ran quickly down the other side.

1. Tom ran from his home to the bus stop and waited. He realized that he had missed the bus so he walked home.

6. Tom walked to the store at the end of his street, bought a newspaper, and then ran all the way back.
Sharing Posters

5. Tom left his home for a run, but the run went well and gradually came to a stop.

4. Tom walked slowly along the road, enjoying his time, realizing he was late, and then started running.

2. Opposite Tom's home is a hill. Tom climbed slowly up the hill, walked across the top, and then ran quickly down the other side.

6. Tom walked to the store at the 10th of his street, bought a newspaper, and then ran all the way back.

3. Tom skateboards from his house, gradually building speed. He slowed down some tough ground, but sped up again.

8. This graph is just plain weird! How can Tom be in two places at once?

1. Tom ran from his home to stop and waited! He realized his head was wrong the bus, so he walked home.

7. Tom went out for a walk with friends. He suddenly realized he had left his wallet behind. He ran home to get it and then had to run to catch up with the others.
5. Students Taking Ownership of Their Own Learning

<table>
<thead>
<tr>
<th></th>
<th>Where the learner is going</th>
<th>Where the learner is now</th>
<th>How to get there</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teacher</strong></td>
<td>1. Clarifying, understanding, and sharing learning intentions</td>
<td>2. Eliciting evidence of student learning</td>
<td>3. Providing feedback that moves learners forward</td>
</tr>
<tr>
<td><strong>Peer</strong></td>
<td></td>
<td></td>
<td>4. Activating students as learning resources for one another</td>
</tr>
<tr>
<td><strong>Learner</strong></td>
<td></td>
<td></td>
<td>5. Activating students as owners of their own learning</td>
</tr>
</tbody>
</table>
Classroom Challenge Structure

Before the lesson

• **Individual task**
  Students work unaided on an assessment task
  Teacher reviews work and prepares qualitative feedback

The lesson

• **Collaborative activity**
  After a whole class introduction, students work in small groups on a collaborative task

• **Small group discussion**
  Students compare their work with their peers

• **Whole class discussion**
  Students share as a whole class what has been learned

After the lesson

• **Individual reflection**
  Students reflect on their pre-assessment and use what they have learned to complete a post-assessment task
Sylvia bikes along a straight road from her friend’s house, a distance of 7 miles.
The graph shows her journey.
Describe what may have happened.
Include details like how fast she bikes.
**Student Ownership Opportunities**

- **Students assess work containing errors**
  Students imagine they are teachers and assess the work. They underline mistakes, state the correct answer and explain the thinking that could have led to the mistake, writing advice for the work’s author.

- **Students produce a revision guide**
  With worked examples, explanations of key words and full answers.

- **Students create their own class test**
  Devising questions to test understanding of a mathematical idea, producing an answer and scoring scheme and then marking the test.

- **Students interview each other**
  Asking questions like ‘what were you expected to learn/have you learnt?’, ‘what did you find hard to understand/are still confused by?’, ‘what did you understand well?’, ‘what mistakes did you make?’ etc.
Reflections
Formative Assessment Opportunities

a. Students work on an individual task designed to reveal their current understandings

b. Teacher reviews this work, creating questions for students to answer in order to improve their solutions

c. Whole-class introduction provides guidance on how to work through the collaborative task

d. Students work in small groups matching written descriptions with graphs

e. Tables of data are added to match with existing matches

f. Students share their work with another group

g. As a whole-class, significant learning points are discussed

h. Students return to original task and try to improve their individual work on a post task
Supporting Formative Assessment

- **Student feedback** e.g. mini-whiteboards, manual signaling, traffic light colors, no hands up, popsicle sticks, exit cards
- **Classroom response systems using technology** e.g. Kahoot, clickers
- **Presentation of work** e.g. posters, students presenting to class
- **Self assessment** e.g. opportunities for students to reflect
- **Peer assessment** e.g. sharing/exchanging work, sample student work used in some Classroom Challenges
### Five Formative Assessment Strategies

<table>
<thead>
<tr>
<th></th>
<th>Where the learner is going</th>
<th>Where the learner is now</th>
<th>How to get there</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>1. Clarifying, understanding, and sharing learning intentions</td>
<td>2. Eliciting evidence of student learning</td>
<td>3. Providing feedback that moves learners forward</td>
</tr>
<tr>
<td>Peer</td>
<td>4. Activating students as learning resources for one another</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learner</td>
<td>5. Activating students as owners of their own learning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adapted from Wiliam and Thompson (2007)
Thank you

< insert contact details >