MEASURING STUDENT MATHEMATICAL THINKING

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Los Angeles, CA
Come see us on Saturday at 11:30 AM for Session 661 in 204 AB!

DEVELOPING POSITIVE MATH IDENTITY

Problem Solving
MP 1, 2, 4, 5, 6

Mathematical Thinking
MP 1, 3, 6, 7, 8

Self-regulation
Zimmerman, 2002

Positive Mathematical Identity
MATHEMATICAL THINKING AGENDA

- Define the “perfect mathematical thinking classroom”
- Observe students engaging in mathematical thinking
- Refine our Definition of Success for the “perfect classroom”
- Reflection
<table>
<thead>
<tr>
<th>Specialising</th>
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<tbody>
<tr>
<td>Generalising</td>
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<tr>
<td>Conjecturing</td>
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<td>Convincing</td>
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DEFINITION OF SUCCESS: MATHEMATICAL THINKING

- **Specialising**: trying special cases, looking at examples (NCTM, 2014)

- **Generalising**: looking for patterns and relationships (MP 7 & 8)

- **Conjecturing**: predicting relationships and results (MP 1, 3 & NCTM)

- **Convincing**: finding and communicating reasons why something is true (MP 3,6 & NCTM) (Stacey, 2006)

What are your interests, values, or priorities?
“Mathematical thinking is a whole way of looking at things, of stripping them down to their numerical, structural, or logical essentials, and of analyzing the underlying patterns.”

(Devlin, 2012)

Where is one connection?
Conjecturing Sample Bullet 1:

Students make their own conjectures
(Student ⇔ Math Task)

Student pairs, share and evaluate the
reasonableness of their conjectures
(Student ⇔ Student)

Student share whole group and
student pairs adjust.
(Teacher ⇔ Student, Student ⇔ Student)

Students defend “why” their
conjecture will work in all cases.
(Student ⇔ Student)

Ideate: What would your “perfect
generalising classroom” look like?
MATH TASK (CLIP 1)
CC STANDARD: HAS-APR.B UNDERSTAND THE RELATIONSHIP BETWEEN ZEROS AND FACTORS OF POLYNOMIALS.

During the observation, collect evidence of student interactions (peer, task, teacher) when they are generalising.
Student Success Criteria (Generalising): See complicated things, such as algebraic expressions, as single objects or as composed of several objects. (CCMP 7)

Interaction(s) between students-teacher-content: S1 explains to S2 how factoring by grouping works with 4 terms and how it might work in this situation, but groups might look different.

Notice that this is a one directional interaction between two students.
During the observation, collect evidence of student multi-directional interactions (peer, task, teacher) when they are Generalising.
IMPLICATIONS FOR INSTRUCTIONAL PRACTICE

1. Share the evidence that you collected of multi-directional interactions that elicited Generalising

2. Find the gap between this evidence and your “perfect classroom”
Build understanding of multiple representations/forms
Support students to find patterns/structures in representations
Facilitate students’ general description of the pattern/structure
Encourage students to make connections to find a relationship
Ask students to create general rule that works for all cases

TEACH Accountable Talk to make student thinking visible. (Hattie, 2017)
IMPLEMENTATION RECOMMENDATIONS:
MAKING THINKING VISIBLE THROUGH ACCOUNTABLE TALK

ACCOUNTABLE TALK MOVES

<table>
<thead>
<tr>
<th>Move</th>
<th>Examples</th>
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<tbody>
<tr>
<td>Press for clarification and explanation</td>
<td>• Could you describe what you mean?</td>
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<td></td>
<td>• Can you provide an example that supports your claim?</td>
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<td>• Can you tell me more about your thinking about . . . ?</td>
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<tr>
<td>Require justification of proposals and challenges</td>
<td>• Where did you find that information?</td>
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<tr>
<td></td>
<td>• How did you know that?</td>
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<td></td>
<td>• How does that support your claim?</td>
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<td>Recognize and challenge misconception</td>
<td>• I don’t agree because . . .</td>
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<td></td>
<td>• Have you considered an alternative such as . . . ?</td>
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<td></td>
<td>• I think that there is a misconception here, specifically . . .</td>
</tr>
<tr>
<td>Require evidence for claims and arguments</td>
<td>• Can you give me an example?</td>
</tr>
<tr>
<td></td>
<td>• Where did you find that information?</td>
</tr>
<tr>
<td></td>
<td>• How does this evidence support your claim?</td>
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<tr>
<td>Interpret and use each other’s statements</td>
<td>• David suggested . . .</td>
</tr>
<tr>
<td></td>
<td>• What I heard Marla say was . .</td>
</tr>
<tr>
<td></td>
<td>• I was thinking about Jackson’s idea and I think . . .</td>
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(Hattie, 2017)
Teachers:

- Thinking about what are you currently working on in your own practice, what is your next step to move closer to the perfect mathematical thinking, generalizing classroom?

Administrative Roles:

- Thinking about what your staff is currently working on, what is your next step to support staff in moving closer to the perfect mathematical thinking, generalizing classroom?
QUESTIONS?

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# REFERENCES