CONCLUDING MATHEMATICS DISCUSSION: WHAT DO NOVICE TEACHERS DO AND HOW CAN WE SUPPORT TEACHERS’ PRACTICE?

Michaela Krug O’Neill, Meghan Shaughnessy, Nicole Garcia, & Sarah Kate Selling

National Council of Supervisors of Mathematics • Oakland, CA• April, 13, 2016

Acknowledging our colleagues:
• TeachingWorks Assessment Development Group & Elementary Mathematics Methods Planning Group at the University of Michigan
• Special thanks to some specific people: Timothy Boerst, Susanna Farmer, & Deborah Loewen Berg Ball

This research was supported in part by a grant from the Bill & Melinda Gates Foundation. The opinions, findings, and recommendations expressed are those of the authors and do not represent the views of the Bill & Melinda Gates Foundation.
IMPORTANCE OF WHOLE CLASS DISCUSSIONS

- Whole class discussions support student learning of mathematics
- Leading a discussion is a high-leverage teaching practice
- Crucial need to attend to issues of equity, access, and inclusion in teaching

How will students know what to take away from participating in a whole class mathematics discussion?
HOW MIGHT STUDENTS KNOW WHAT TO TAKE AWAY?
OVERVIEW OF THE SESSION

① Unpacking the practice of concluding mathematics discussions
② Exploring novices’ skills with concluding discussions
③ Supporting teachers to conclude mathematics discussions
④ Considering next steps and discussion
UNPACKING THE PRACTICE OF CONCLUDING MATHEMATICS DISCUSSIONS
WHOLE CLASS DISCUSSION

- A period of relatively sustained dialogue among the teacher and multiple members of the class
- In a whole-class discussion, participants respond to and use one another’s ideas to develop ideas about specific content

TeachingWorks, 2015
# LEADING A MATHEMATICS DISCUSSION

<table>
<thead>
<tr>
<th>Discussion Enabling</th>
<th>Discussion Leading</th>
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<tr>
<td>Selecting a task</td>
<td>Framing</td>
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<td>Anticipating student thinking</td>
<td>Orchestrating</td>
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<td>Setting up the problem</td>
<td>- Orienting</td>
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<td>Monitoring student work</td>
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<td>- Making contributions</td>
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<td>Framing</td>
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<td>- Concluding</td>
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<td>Recording</td>
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CONTEXT OF VIDEO

- An experienced 5th grade teacher in a multi-lingual classroom is leading a discussion around a problem involving comparing decimals.
- Students have worked with several comparison problems and have offered several key ideas related to decimal comparison.
- The teacher uses modeling to summarize student ideas to make them accessible to all students.

Which is greater, 0.7 or 0.29?

Student ideas:
- 7 rods > 29 units
- 7 is in the tenths
- 7 is 70
- 0.7 = 0.70
CONCLUSION: COMPARING DECIMALS

- What does the goal of the conclusion appear to be?
- What work is the teacher doing to enact this conclusion?
POSSIBLE OBSERVATIONS

- Goal of conclusion
  - Summarize the mathematics learning that happened in the lesson so that students know what to take away from the discussion experience
  - Highlight student thinking or responses that were notable in some way
- Work of the teacher to enact this conclusion
  - Drawing students’ attention to key ideas that had been shared
  - Taking stock of what the class had collective figured out
  - Supporting students to participate in the conclusion
TYPES OF CONCLUSIONS

- Summarize the mathematics learning that happened in the lesson so that students know what to take away from the discussion experience.
- Highlight student thinking or responses that were notable in some way.
- Connect the present discussion to previous or future mathematical work.
- Reinforce productive discussion norms.
- Pause a discussion so that it can be returned to later (with a focus on a particular mathematical learning goal that will be picked up later).

Mathematics Methods Planning Group, 2011
② EXPLORING NOVICES’ SKILL WITH CONCLUDING DISCUSSIONS
CONTEXT FOR ANALYZING BEGINNING PRACTICE WITH CONCLUDING

- Project investigating beginning teachers’ skill with leading a whole class mathematics discussion
- Pilot study with first year teachers ($n = 17$)
  - 9 elementary teachers (Grades 1 – 5)
- Data sources
  - Video records of discussion assessments (15 - 45 min)
  - Background surveys
ELEMENTARY DISCUSSION ASSESSMENT

- Mathematics Task: “Make number sentences for 10”
- Goals: Elicit several solutions to the problem and to have students explain why they are or are not solutions and to notice similarities and differences among the solutions

<table>
<thead>
<tr>
<th>Grades 2-3</th>
<th>Mathematics Task: “Make number sentences for 10”</th>
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<tbody>
<tr>
<td>Generate number sentences for 10 using multiple operations</td>
<td>Students will likely generate number sentences</td>
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<td>determine whether the value of a proposed expression is 10</td>
<td>for ten that move beyond integer pairs that</td>
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<td>sum to 10 (e.g. 1 + 9). Their expressions</td>
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<td>are likely to contain multiple terms and are</td>
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<td>likely to incorporate subtraction, although</td>
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<td>some students may need prompting</td>
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<td>The types of expressions that students might</td>
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<td>generate include: 1 + 1 + 1... = 10, 2 + 3 +</td>
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<td>3 = 10, 11 - 1 = 10, 83 - 73 = 10</td>
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<td>Students might notice number patterns that</td>
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<td>allow them to generate many expressions quickly,</td>
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<td>e.g. 12 - 2, 22 - 12, 32 - 22...</td>
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<td>Students may also incorporate multiplication and</td>
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<td>division.</td>
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<td>If students introduce subtraction, multiplication</td>
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<td>and/or division, they are likely to think that</td>
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<td>there is a very large finite number of solutions</td>
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<td>to the problem (e.g., “We can’t find all the</td>
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<td>solutions because we don’t have enough time.”).</td>
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<td>Students may state that the number of solutions</td>
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<td>to the problem is infinite.</td>
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<th>Materials: Paper for students to use for recording their work on the problem</th>
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CONCLUDING: VIEWING FOCUS

- What type(s) of conclusion is this teacher enacting?
  - **Summarize** the mathematics learning that happened in the lesson so that students know what to take away from the discussion experience
  - **Highlight** student thinking or responses that were notable in some way
  - **Connect** the present discussion to previous or future mathematical work
  - **Reinforce productive discussion norms**
  - **Pause a discussion** so that it can be returned to later (with a focus on a particular learning goal that will be picked up later)

- What work is the teacher doing to enact the conclusion?
HOW DO BEGINNING TEACHERS CONCLUDE?
POSSIBLE OBSERVATIONS

- What type(s) of conclusion is this teacher enacting?
  - Summarize the mathematics learning that happened in the lesson so that students know what to take away from the discussion experience
  - Highlight student thinking or responses that were notable in some way
  - Connect the present discussion to previous or future mathematical work

- What work is the teacher doing to enact the conclusion?
  - Taking stock of what was figured out in the discussion
  - Making explicit the idea of infinitely many solutions
  - Referencing future work with decimals
  - Inviting students to participate in taking stock
CONCLUDING: VIEWING FOCUS

- What type(s) of conclusion is this teacher enacting?
  - **Summarize** the mathematics learning that happened in the lesson so that students know what to take away from the discussion experience
  - **Highlight** student thinking or responses that were notable in some way
  - **Connect** the present discussion to previous or future mathematical work
  - **Reinforce productive discussion norms**
  - **Pause a discussion** so that it can be returned to later (with a focus on a particular learning goal that will be picked up later)

- What work is the teacher doing to enact the conclusion?
HOW DO BEGINNING TEACHERS CONCLUDE?
DISCUSSION ACROSS SET OF VIDEOS

- What type(s) of conclusions did the teachers enact?
  - Summarize the mathematics learning that happened in the lesson so that students know what to take away from the discussion experience
  - Highlight student thinking or responses that were notable in some way
  - Connect the present discussion to previous or future mathematical work
  - Reinforce productive discussion norms
  - Pause a discussion so that it can be returned to later (with a focus on a particular learning goal that will be picked up later)

- What work are the teachers doing to enact the conclusions?
HOW DO BEGINNING TEACHERS OFTEN CONCLUDE?

It’s time to put away your math notebooks.

Please pass your papers to the front and get ready to line up for lunch.

Oops, we’re out of time. Please get out your writing folders.

There’s the bell. Time to go.
③ SUPPORTING TEACHERS TO CONCLUDE DISCUSSIONS
CHALLENGES OF CONCLUDING

- Managing of time to discuss vs. time to conclude (and time in general)
- Knowing which ideas are the key ideas to highlight in a discussion
- Helping students transition from active discussion to conclusion
- Managing tension between student thinking and disciplinary goals
  - Being responsive to what was collectively discussed
  - Taking stock in authentic ways
ACTIVITY 1.
EXAMINING A CLASSROOM DISCUSSION

- Introduce a decomposition of the work of leading a discussion
- Watch a discussion in three parts: launch, orchestration, conclusion
- For each part:
  - Have teachers note teacher moves, questions, etc.
  - Have teachers briefly discuss observations with a partner
  - Discuss in whole group
ACTIVITY 2. TYPES OF CONCLUSIONS & TECHNIQUES FOR ACCOMPLISHING

INTRODUCE DIFFERENT TYPES OF CONCLUSIONS

- Summarize the mathematics learning that happened in the lesson so that students know what to take away from the discussion experience
- Highlight student thinking or responses that were notable in some way
- Connect the present discussion to previous or future mathematical work
- Reinforce productive discussion norms
- Pause a discussion so that it can be returned to later (with a focus on a particular mathematical learning goal that will be picked up later)
HIGHLIGHT STUDENT THINKING OR RESPONSES THAT WERE NOTABLE IN SOME WAY

Techniques for accomplishing include:

- Summarizing the main idea related to the learning goal(s)
- Emphasizing the key points of the lesson by demonstrating an example
- Eliciting the main point of the lesson from students
- Eliciting from students what they learned
- Naming a mathematical concept or a mathematical practice that was worked on in the lesson
- Reflecting what students have accomplished in the lesson
- Generalizing a mathematical idea that was worked on across different examples
THE CHALLENGES OF IMPROVING CONCLUSIONS

- Contingent nature: The content of a “good conclusion” is constructed from the specific ideas that are discussed during the discussion.
- Interactive nature: Some conclusions are co-constructed with students.
- Different types of conclusions are differentially hard.

TEACHERS NEED OPPORTUNITIES TO PRACTICE CONSTRUCTING CONCLUSIONS WHICH ACCOUNT FOR “WHAT HAPPENED IN THE DISCUSSION”
ACTIVITY 3: PLANNING FOR A CONCLUSION

- Read a transcript of a discussion which ends right before the conclusion
- Plan a conclusion to the discussion

**Purpose**: Highlighting student thinking or responses that were notable in some way

**Possible techniques** for accomplishing include:
- Summarizing a common student strategy
- Restating student ideas that were heard throughout the discussion
- Clarifying a misconception

- Discuss in whole group, with a focus on what student thinking is being highlighted (and why) and the technique(s) employed and why
ACTIVITY 4. REHEARSING A CONCLUSION

- Watch a video of a fifth grade discussion and stop right before the conclusion.

Students seem convinced that all three answers are reasonable.

Correct answer; counts tick marks.

Incorrect answer, correctly identifies the whole; counts tick marks.

Incorrect answer, correctly identifies the whole; counts tick marks.

Treats shown interval as whole; reference to equal parts.
ACTIVITY 4.
REHEARSING A CONCLUSION

- Plan a conclusion to the discussion

**Purpose**: Reinforce productive discussion norms

**Possible techniques** for accomplishing include:
- Highlighting a productive thought process or way of working (e.g., listening to other students’ ideas)
- Reflecting what students have accomplished in lesson (in terms of maintaining productive norms)

- Rehearse in whole group, including debriefing
ACTIVITY 4. REHEARSING A CONCLUSION
ACTIVITY 5. PLANNING FOR A DISCUSSION AND DEBRIEFING ENACTMENT

In grade-level groups, select an upcoming discussion in curriculum materials:

- Anticipate the potential student solutions
- Anticipate the potential trajectory of the discussion
- Consider the affordances/constraints of particular types of conclusions given the focus of the discussion and learning goals for students
- Enact the discussion
- Debrief the enactment in grade-level groups & discuss new insights into the work of concluding a discussion
ACTIVITY 6. COLLECTING & ANALYZING RECORDS OF PRACTICE

In grade-level groups, select an upcoming discussion in curriculum materials:

- Anticipate the potential student solutions
- Anticipate the potential trajectory of the discussion
- Consider the affordances/constraints of particular types of conclusions given the focus of the discussion and learning goals for students
- Enact the discussion in classrooms & videorecord
- View the video record of the enactment and analyze the conclusion
④ CONSIDERING NEXT STEPS AND DISCUSSION
QUESTIONS FOR FURTHER CONSIDERATION

- What does the identification of different types of conclusions afford for analyzing and supporting teaching?
- What are some of the challenges in helping teachers learn to conclude?
- How do students make sense of different types of conclusions to discussions?
THANK YOU

Michaela Krug O’Neill: mkoneill@umich.edu
Meghan Shaughnessy: mshaugh@umich.edu
Nicole Garcia: nmgarcia@umich.edu
Sarah Kate Selling: sselling@umich.edu

Slides will be available on the TeachingWorks website:
http://www.teachingworks.org/publications_presentations