Argument, Reflection and Models Lesson Study

October 26, 2020

Research Question:

"Building a classroom culture of reflection, argumentation and mathematical models"

The lesson study team hypothesized that the following actions would be important elements in connecting number sense to fluency. Each hypothesis is listed below followed by the team's reflection.

Hypothesis 1 – Discourse moves to promote reflection

Discourse - Using the Teacher Discourse Moves of waiting, re-voicing, having students' revoice, engaging students' with another's reasoning should be used to move students' mathematical activity towards becoming an object of discussion.

- When students were explaining what they saw or relationships that were noticed, the teacher frequently would ask students to re-voice each other or add on to each other's statements.
- When big ideas are emerging in the discussion (constant of proportionality, scale factor) using the teacher discourse moves is critical for drawing more students into the conversation.
- The teacher discourse moves of re-voicing and having students re-voice each other makes the big ideas more public and part of a discussion for all students to engage in.
- Wait time allows more students to engage in the discussion of each other's ideas, followed by turning and talking can support students in moving forward in their mathematical understanding.

- There were numerous turn and talks in the whole group discussion that allowed all students to engage in good discussion.
- The use of warm-calling allows the teacher to position many students as contributors to the discussion.
- When students are turning and talking, the teacher can use warm-calling to listen for students who are using the model as an object of discussion.

Hypothesis 2 – Models as semiotic mediators

Models - Using models of students' thinking as semiotic mediators between students' ideas and the more formal mathematics will initiate shifts in discourse that make students' mathematical activity an object of discussion.

- Using the students' thinking as the center piece of the whole group discussion pulled students into conversations that they would not have had on their own.
- One particular student clearly moved from skip-counting to scaling to using the ratio table to see the functional relationship between the 2 quantities in the ratio.
- Modeling students' thinking during the string of related problems allowed students to examine relationships and make generalizations about the relationship between ½ and ¼.
- Over time, when teachers model students' thinking they inherit the model as a tool for thinking.
- Some generalizations came out from students in the string where they said dividing by 4 is the same as multiplying times ¼, and further that halving ¼ would be the same as multiplying times 1/8.

Hypothesis 3 – Shifting students' attention towards relationships

Questions - Questions should shift students' attention from computation to general relationships, and prompt for clarification, justification, explanation, elaboration and critique to support unpacking and development of ideas (building blocks of argument).

- When would you use a double number line versus a table? led to students talking about generally about the usefulness of each model in different situations.
- Are you saying each time you multiply each amount in a ratio will give you a give you an equivalent ratio? Why? – Students responded by explaining general reasons that expressed they believed it was true and were trying to find precise language to explain why they thought it was true.
- "Why is it always times 8?" – One student stated it's because we're comparing distance travelled with time.
- Many of these questions occurred during the whole group discussion, which helped to move kids forward from the strategy they used in the beginning of the task. If we neglect the whole group discussion, many students will likely use the same strategy they used in the past without learning something new or have a new entry point for future tasks.

Hypothesis 4 – Focus on big ideas, strategies and models

Identifying the most important big ideas, strategies and models for a unit is critical to ensure the teacher can use less tasks but use the above teaching practices effectively.

- The whole group discussion is instrumental in moving kids forward, but can sometimes be dismissed as teachers feel the need to move to the next task in the unit.
- Identifying the most important big ideas for the unit as a whole allows the teacher to stay focused on the most important mathematical content to spend time on.
- The whole group discussion here was definitely productive in moving students along in the trajectory of learning ratio and linear relationships.

Individual team-member take-aways

- We proved that without the teacher discourse moves and questioning as we described so much would have been lost and many students would not move forward, but continue to simply produce what they already know how to do.
- The whole class discussion is critical and having students be able to sit close and face each other to raise the likelihood that they can hear and discuss ideas with each other.
- I still need a lot of work on asking questions to shift attention away from computation towards general relationships.
- Using students' models as an object of discussion allows struggling students to access the big ideas.
- Even if I don't have time to come back to a whole group discussion in one class period, it should be prioritized to do so because it may take more time in the beginning but will pay back in student understanding later. The more teachers will end up having to re-do later because students don't understand or did not have enough opportunity to generalize.