

Modeling Students' Thinking Lesson Study

December 16, 2020

Research Question:

Supporting students to develop and use mathematical models used as tools for thinking flexibly and generalizing important mathematical ideas



The lesson study team hypothesized that the following actions would be important elements in supporting students in the development of models used as tools for thinking. Each hypothesis is listed below followed by the team's reflection.

Hypothesis 1 – Teacher discourse moves paired with modeling thinking

Teachers can choose to model students' thinking (or withhold) then have students make sense of each other's reasoning, then model a viable fit that will generate discussion between students that brings about new ideas.

- Students were using the number line to support their reasoning when trying to justify relationships between the numbers, their magnitudes and their direction.
- The number line seemed to support gesturing of their thinking to support communication and reasoning.
- Some students were able to, within the string, begin using the model as a tool to represent the situation and think with.

- The teacher used a significant level of “teacher discourse moves” to orient students’ towards each other’s thinking.
 - Can you say what you think __ means?
 - Asking students to repeat themselves or re-voice other students.
 - Teacher re-voicing paired with modeling of students’ thinking
 - Wait time
 - Think-pair-share at critical moments (when students make an imprecise or inaccurate statement, moments of perceived high-risk, when the teacher felt like too much of the discussion was being led by the teacher, conversation is moving too fast to process what is happening)
 - Probing thinking, pressing for justification
- It seemed that some students were prioritizing the modeling of students’ thinking that was occurring on the board to consider whether to revise their own models or leave them as is.
- When students offer imprecise ideas, the teacher can ask students to turn and talk about what they think about what that student just said, warm-calling after/during turn and talk students to offer new ideas in the whole group discussion, drawing attention to model, pressing elaboration/justification.
- The teacher questions seemed to be low-risk questions that were more about about reasoning and thinking versus about getting the right or wrong answer.

Hypothesis 2 – Emerging big ideas to drive modeling student thinking

When modeling students’ thinking, teachers should consider emerging mathematical ideas in deciding how and what to model.

- Having identified big ideas ahead of time was helpful in knowing what and how to model in the string.

Hypothesis 3 – Connecting sequences of tasks and “sub-models”

Sequences of tasks and how they can be used to generate sequences of sub-models need to be developed over time.

- Because this was a string of related problems, the sequence of the problems within the string supported a change in the models connected to their reasoning.
- The team discussed modifying future strings to spend more time on the earlier ideas in the string may be useful for students.

Hypothesis 4 – Modeling student thinking to generate new insights

Models of students’ thinking should be used first as a model of their thinking, but also as a vehicle for extending their thinking to generate new mathematical insights.

- Even when students' thinking was not completely accurate, modeling of the students' thinking led to students evaluating what is reasonable. This means that the teacher can use the model to prove what makes sense, rather than trying to correct the student (Can we have two zeroes on the number line?)
- The model also provided a means for proof of what is true, and also useful as a tool that represents relationships (without having to be an exact match).
- Pairing the teacher's consistent push for justification with modeling of students' thinking was important for extending the discussion for students to generate new mathematical insights.