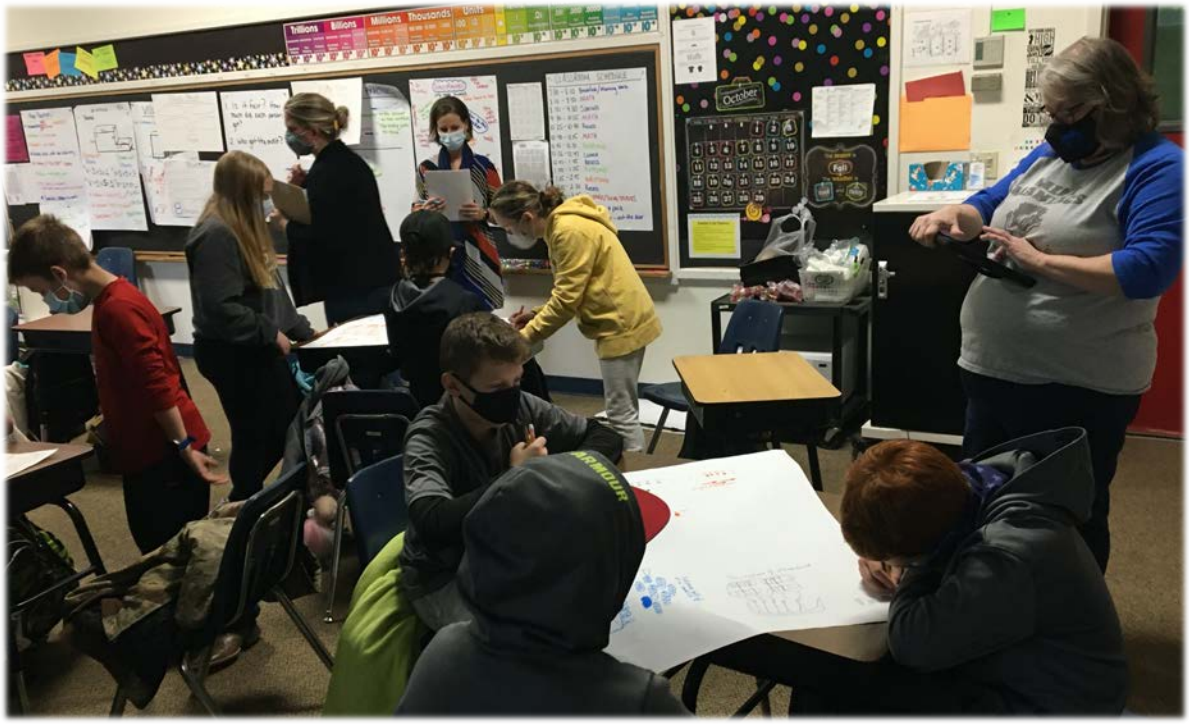
Flexible Reasoning and Problem-Solving Lesson Study

October 29, 2020

Research Question:

Supporting students to reason and problem-solve flexibly and adaptively



The lesson study team hypothesized that the following actions would be important elements in supporting students to reason and problem-solve flexibly and adaptively. Each hypothesis is listed below followed by the team's reflection.

Hypothesis 1 – Questioning to support mathematical development

Useful questions come from understanding the specific mathematical development that teachers want to encourage

a. *probing to understand a learner's thinking,*
b. *helping inconsistencies or "dead ends" become apparent,*
c. *encouraging inquiries,*
d. *pushing for generalization and proof.*

- There were multiple times where the teacher was probing students' thinking to model the situation, helping students to discover inconsistencies in their model compared to the situation.
- The teacher pressed for students to prove how they know which "boat" got more sandwich and how you could compare.
- There seemed to be an indication that students felt that showing your work meant the same as proving.
- The teacher was pressing students to think about whether their strategy will work in other situations.
- Recognizing that "the whole matters" was useful in supporting the teacher in knowing to probe thinking as they begin to come out in students' reasoning.

Hypothesis 2 – Kid-watching that considers big ideas on the horizon

Kidwatching begins to consider emergent big mathematical ideas underlying the strategy, and on the child's horizon.

- Learning the landscape and understanding the big ideas on the landscape is critical for understanding what to push on, where their understanding is in development and how to move them forward with appropriate questions.
- Understanding ideas that underlie big ideas and strategies are also important in powerful questioning.
- Keeping the landscape in mind is critical in maintaining a perspective about students' thinking framed in what they are trying to do versus a deficit mindset.

Hypothesis 3 – Questions that promote cognitive reorganization

Questions are used to promote disequilibrium, puzzlement, and cognitive reorganization as a result of understanding of the landscapes of development.

- The teacher's re-voicing of students language of 7/8 as being equivalent to seven 1/8's and modelign it caused students to reflect on the relationships between those ways of thinking about 7/8.
- Asking students to interpret their model relative to the situation of people and sandwiches prompted reflection on the relationship between both.
- This teaching practice pairs well with modeling students' thinking to give them opportunities to reorganize previous ideas.

Hypothesis 4 – Modeling students' thinking

Teachers need to model students' thinking and the processes they use so they have objects to discuss and can examine their own logic.

- The teacher did a lot of modeling students' thinking with 7/8 being equivalent to 7 x 1/8.
- The teacher can model students thinking with expressions to promote puzzlement and cognitive reorganization (1/5 of ½ = 1/10).

Hypothesis 5 – Building fluency from a foundation of understanding

Teachers should create opportunities through Teacher Discourse Moves for students' questions to become the focus of inquiries of individual students as well as whole group conversations.

- Using turn and talks gives students an opportunity to discuss further what another student said, gives the teacher time re-organize his/her thoughts and understand the students' thinking and keeps more students in the conversation.
- Teachers should "throw the dialogue back to the kids".
- The TDM's give everybody more time to think about their own and other's ideas.
- Students may have a fear of failure in thinking the teacher is looking for the "right answer", but rather the questions should be about sharing their thinking.

Individual team-member take-aways

- I think that my take-away is to use my curriculum in a more effective way to build a mathematical community while students are in school.
- Within the materials that we have, I would like to have richer, deeper investigations where we can launch contexts to students where they explore big mathematical ideas and lead the discussions.
- We need to make sure to use whole group discussions where their work is the centerpiece of discussion and a catalyst for moving everybody forward (rather than just sharing).