3rd Grade Fluency with Flexibility Lesson Study

December 10, 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 connecting number sense to fluency. Each hypothesis is listed below followed by the team's reflection.

Hypothesis 1 – Developing a repertoire of strategies for flexibility

By developing a repertoire of strategies, and understanding of big ideas of why they work and a variety of ways to model the relations, students are creating powerful toolboxes for flexible, efficient computation.

- During the investigation, when asked to think about whether she could group them different both girls re-grouped groups.
- Given time to work on the task, several students changed their models to more efficient strategies without conferrals but due to the tediousness of their strategies they chose to revise their strategies.
- Several kids were able to discover place value patterns in the task, but they needed the time to work on the task to do so eventually.
- There were several flexible uses of reasoning and strategies in the string that students brought forwards.

- The strings should be used to generate different discussions on big ideas on the landscapes.
- The talk moves of waiting, turn and talks, adding on to each other's thinking, interpreting each other's thinking support a productive culture.
- One particular student who had difficulty during the investigation modeling the situation was able to make more sense of the mathematics through another students' model and strategy. This student was able to notice the place value pattern when multiplying by ten.
- Both teachers and students can rely on the structure of context-model-strategy-investigation-congress supports students to think flexibly about doing mathematics.
- When the context does not imply a certain procedure or strategy, students will be given greater access to entry into the problem and creating a model.
- By starting with large numbers, students are forced into thinking about less efficient strategies and better ways to solve a problem so they are not counting by ones.
- *Connections to flexibility – This (supporting multiple strategies, talk moves, focus on reasoning) allows students to invent their own strategies so they can own their way of thinking, empowering them to be willing to problem-solve, take risks and revise their thinking based on what they hear others saying.*

Hypothesis 2 – Use of number strings to promote number sense and fluency

During strings, teachers can encourage students to examine the numbers in the problem and find efficient ways to reach a solution (which is also the hallmark of numeracy).

- This also seems productive during conferrals because the students had used inefficient strategies that took a lot of work and keepingtrack in moving students forward.
- Modeling students' thinking on the T-Chart was helpful because students were able to see their thinking more clearly organized in a model.
- As we understand the landscape more, the students' thinking will continue to be more clear and the teacher will more readily recognize students' ideas in terms of the big ideas and strategies.
- It may be productive to ask kids in a string what "helper problems" there might be to help solve the problem.
- *Connection to flexibility – When students hear other students' strategies that are more efficient than their own provides an opportunity to see that there are multiple ways of solving problems and to take on other students' strategies.*

Hypothesis 3 – Celebrating, getting underneath and challenging

Conferrals should start with celebrating their strategies or what students are trying to do, then re-stating or clarifying ("are you saying") and advancing their reasoning.

- The teacher was re-voicing students' ideas in many conferrasl to get underneath their strategies.
- Using the talk moves to identify or amplify a students' idea is a way of celebrating students' strategies and how mathematicians work together.

- Teachers can model students' thinking and the processes they use so they have objects to discuss and can examine their logic, as well as providing an opportunity to develop a model.
- Listening to students' thinking is critical before deciding how or what to model and advance their reasoning.
- Teachers need to be ok with students being puzzled at the end of the conferral. This is why walking away is an important teaching practice to allow students to do their own reasoning and problem-solving.
- *Connection to flexibility – Having time to grapple with problems and making adjustments to their own strategies supports adaptive thinking during problem-solving. Starting with a celebration supports students to persevere through the problem-solving.*

Hypothesis 4 – Using the congress to move the mathematics forward

By discussing and sharing solution strategies in class the students who first solved the problem by means of a longwinded strategy can come to a higher level of understanding and new mathematical concepts can be constituted.

- During the investigation, several students were sharing strategies the pairs of students
- Having students state their reasoning, asking who understands that idea, directing students to listen to what their idea is, then turn and talk, check in with your partner, now who has a question for that student supports students in understanding each other's reasoning.
- Having students in a meeting place to have a whole group conversation seems a critical factor in having students discuss their ideas with each other.
- The other students and the mathematical models should determine what's true, not the teacher.
- These conversations can be helpful for students in any setting, turn and talk, congress, conferral or string.
- Careful selection and sequencing of students' models and strategies during the congress was a support for students to consider strategies and models that were not considered during the investigation.
- Using the talk moves during conferrals can generate discussion between students and keep authority between the students.
- *Connections to flexibility – As students listen to each other share ideas, allowing those ideas to adjust their current thinking they're being flexible in how they originally thought about the situation, so they get equipped with new strategies for future problems.*

Hypothesis 5 – Models are the bridge between informal and formal levels

Eventually, the models give the students access to more formal mathematical knowledge. In order to fulfill the bridging function between the informal and the formal level, models have to shift from a "model of" a situation to a "model for" thinking.

- Models move in a progression:

    - Of a situation
    - Of students' thinking
    - Models for thinking
- This sequence might occur more over a series of connected tasks/contexts or years.
- Some students started with a model of the situation but made them more concise as they worked.
- *Connections to flexibility – Having models as tools to think with allows more entry points into solving future tasks, helps to keep thinking organized, and supports justification of why strategies work and their own thinking is made clear to their peers.*