Fluency with Flexibility Lesson Study

September 15, 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 – Students start with their own strategies/models

Students should be able to bring their own conceptions of the context/situation first. It's important for students to be given problems that can be solved on different levels of understanding while allowing mathematical language to evolve progressively towards more formal mathematical language.

- Students were starting to solve the problems on various levels which included skip-counting, partial products, scaling, proportional reasoning, using relationships.
- The teacher did not imply a certain strategy to be used, which allowed for student to bring own conceptions to the start of the task.
- The sequence of the tasks is critical for supporting students progressively so the contexts are sequenced in ways that promote development of the strategies.

Hypothesis 2 – Models emerge from contexts

Contexts that have model potential serve as an important device for bridging this gap between informal and more formal mathematics. First, the students develop strategies closely connected to the context. Later on, certain aspects of the context situation can become more general, which means that the context more or less acquires the character of a model and as such can give support for solving other, but related, problems. Eventually, the models give the students access to more formal mathematical knowledge.

- Several students used a double number line with annotations to represent and/or communicate their thinking in this task, probably because it made sense to model the situation with a double number line.
- In this case, the table was part of the task but allowed students to look for relationships between the numbers within the model.
- Students used an image of the clock to support thinking about fractions of hours.
- Modeling students' thinking during the strings that have been developed in the context is useful for supporting reasoning.

Hypothesis 3 – Conferrals to support development

To represent a problem accurately, students must first understand the situation, including its key features. They then need to generate a mathematical representation of the problem that captures the core mathematical elements and ignores the irrelevant features, supported by the teacher using conferrals to celebrate students' ideas, get underneath their strategies and challenging them to advance their thinking/reasoning.

- There were a few students who revisited the context and were readily able to ignore irrelevant features.
- In this case, we tried to use conferrals to support students in capturing the core mathematical ideas in their models.

Hypothesis 4 – Mathematics as a social activity

Education should offer students opportunities to share their strategies and inventions with each other. By listening to what others find out and discussing these findings, the students can get ideas for improving their strategies. Moreover, the interaction can evoke reflection, which is necessary to reach a higher level of understanding.

- The teacher provided many opportunities for students to share their ideas and get ideas from others.
- Several students revised their thinking and added onto each other's ideas as they talked through their reasoning in the whole group discussions.
- Peer review groups may be something useful for this group to explore in the future.

- Warm-calling students after turn and talks was helpful in moving the discussion forward during the number strings.

Individual team member take-aways

- Purposeful pairing may be helpful.
- Modeling students' thinking during the string or conferrals can support students' reasoning.
- Splitting up the investigation over 2 days can help to have productive conferrals.
- I'd like to be better about re-voicing students' thinking and possibly recording it (or modeling students' thinking in the conferrals, string or congress).
- Probing students' thinking by asking students to say more.
- Reminding students that mathematicians are always revising their thinking and models.
- We are interested in a digital gallery walk where students can take pictures of their models and insert them into slides.
- Learning the landscapes is crucial.