

1st Grade Fluency with Flexibility Lesson Study

October 13, 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 – Contexts are a source for learning

Context problems with a low floor and high ceiling should function as a source for the learning process.

- We can see how the context provides an open door for an entry point into the task. The story provides something the kids can fall back on so they do not get lost in the abstraction.
- The context when paired with the model provides a foothold that the teacher can keep supporting students to represent the situation on the model as kids continue to make progress in their development of important mathematical ideas.

- Because there were multiple aspects in this task for students to work on, and multiple levels of understanding that could be pressed (what are other way, did we find all the ways and how do you know you have them all?), the there was a “high ceiling” so all kids had an opportunity to learn something new.
- Since the context was realizable or imagine-able, there was not just one answer or way to find many combinations, students were all able to enter into the task, but also had enough room to grow.
- **Connection to flexibility** – Students have to go beyond what the story tells them to find more ways. The initial task/context serves as an anchor that students can fall back on during their problem-solving and reasoning in future tasks, as students continue to work on tasks with these characteristics they will develop a productive disposition towards doing mathematics, hence leading to a more flexible way of thinking about mathematics and approaching future problems.

Hypothesis 2 – Horizontal and vertical mathematizing

Mathematics should be seen as the process of mathematizing (horizontally and vertically).

- Many started by seeing the mathematics as connected to the story with the bunk beds, then started noticing patterns and were coming up with other combinations based on those patterns.
- Both should be used and are of equal value in order for students to become flexible with procedures.

Hypothesis 3 – Models and contexts work in tandem

First, students develop strategies and tools closely connected to the context. Later on, certain aspects of the context situation can become more general to give support for solving other but related problems.

- The math rack was easily seen in connection to the bunk beds, but also provided opportunities to see commutativity and compensation, as well as cardinality and counting on. This allowed the model to be used to model the situation (horizontal), but also has characteristics that connect to the formal mathematics, making it a bridge between the informal and more formal mathematics.
- Because the rack was promoted in connection to the context, the team could see where students were on the landscape and in their development (one-to-one tagging, prioritizing 5, hierarchical inclusion, etc). A separate assessment did not need to be given, but assessment was embedded within the teaching and learning.
- It’s critical that the model is closely connected to the context so the students can model the situation but also move to a more general model.
- **Connections to flexibility** – The contexts paired with the models should provide opportunity for the model or context to become mental objects that help them make sense

of computation later. As students develop mental objects of powerful mathematical models, they will use them as they work towards automatizing the basic facts.

Hypothesis 4 – Models as a bridge between informal and formal levels

In order to fulfill the bridging function between the informal and the formal level, models have to shift from a “model of” to a “model for” thinking.

- The teacher used a conferral to have students connect the model to the context, but also to ask what happened as students were modeling the situation, which promoted reflection and movement towards use of the model as a tool for thinking.

Hypothesis 5 – Mathematics as a social activity

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.

- During the investigation, students were watching each other, engaging in discussion, asking what each other is doing, comparing their ways of thinking.
- During the congress, students were collaborating to decide different ways to represent their thinking on the rack.
- In pairs, students were sharing strategies and trying to prove their ideas to each other.
- During the congress, the teacher displayed one students’ strategy and asked the other students to engage with that reasoning and use it to find other strategies, thereby improving their own thinking.

Individual team-member take-aways

- I would like to focus on supporting and understanding flexibly and horizontal and vertical mathematizing.
- I am going to try to move more into using the units to so that I can use sequences of tasks and contexts to promote fluency with flexibility.
- I want to make sure I am using the landscapes to help in questioning and moving kids forward.