

Number Sense with Fluency Lesson Study

October 28, 2020

Research Question:

“How can we develop students’ number sense so that they, over time, become procedurally fluent, automatize of the basic facts and extend this understanding to other situations?”



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 – Differentiating through a common task or context

There is a strong preference for keeping the class together as a unit of organization and for adapting the education to the different ability levels of the students.

- All students were able to get started working on the task from their current level of understanding.
- The teachers’ questions in the investigation while students were working in pairs were good for both students in the partnership, allowing the partner to move forward from the other students’ way of thinking. The teacher leveraged what one student did by asking questions in partnership. This would not have occurred if students were not working on the same task.
- Including into the task the use of markers compared to pencil allows us to track changes in thinking and may press students to think more about what they are going to write before writing.

- The variety of different ways of thinking in the congress allowed students to justify their thinking, analyze other students' ways of thinking and to decide if they agree or disagree.
- Because all students worked on the same task, they can enter the whole group discussion with some common understandings that can be revised through their models and thinking.
- There was a strong discussion about whether or not “straight” should be important in defining a triangle, which came from the differences in how the students viewed the necessity of that as part of the discussion.

Hypothesis 2 – Horizontal and vertical mathematizing

Questions should shift students' attention away from computation towards general relationships. (“Horizontal mathematization involves going from the world of life into the world of symbols, while vertical mathematization means moving within the world of symbols.” These two forms of mathematization are of equal.)

- The teacher kept students grounded in the context by asking questions about how Lloyd could have gone and referring to pathways prior to asking students to vertically mathematize.
- The teacher pressed students for generalization by asking
- What other paths we can make with 3 straight lines and 3 turns?
- Are there other paths that still have 3 straight lines and 3 turns?
- Students would “predict” shapes that would work when pressed to generalize other shapes that would work.
- The teacher posed many questions that prompted the students to think about what's the same and different about the variety of shapes they used to map the pathway.
- Questions were asked that were grounded in the context but focused students' attention on certain features of the context that will make it likely for students to discuss more general aspects of the model.

Hypothesis 3 – Modeling students' thinking

Teachers should model students' thinking and the processes they use so they have objects to discuss and can examine their logic. (Models need to serve as a bridge between the informal and formal mathematics.)

- The teacher was modeling students' thinking as they described their thinking by modeling the pathways occurring from the context.
- The context was clearly useful in developing the model in this task.
- In this lesson the context did more of the work of allowing students to model their thinking.

Hypothesis 4 – Talk moves to facilitate meaningful discourse

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 teachers' questions in the investigation while students were working in pairs were good for both students in the partnership, allowing the partner to move forward from the other students' way of thinking. The teacher leveraged what one student did by asking questions in partnership. Because of this, both students were able to think about the students' thinking, evoking reflection and improving strategies.
- During the conferrals, one student was mixing up names of shapes (rectangle/triangle) and the teacher made an attempt to have the partner listen with the possibility of the students' working together to negotiate the language together.
- Because students were paired up during the investigation, students were able to interact in ways that caused them to listen and think about each other's thinking.
- The teacher's use of the Teacher Discourse Moves (waiting, re-voicing, having students engage with each other's reasoning) focused the discussion on the important elements connected to what the students were contributing.
- Starting all discussions with the students' work and ideas helps students to see they are the authors and owners of ideas, prompting trust in each other as fellow reasoners and problem-solvers.
- Students were beginning to develop arguments, pressing each other to be more precise in their language to try to convince them of what they were thinking (is straight important, etc).
- The turn and talks impose the need to reflect on students, and also allow for an opportunity to assess students' thinking or for the teacher to warm-call students to bring important ideas into the whole-group discussion.
- during the congress that allowed the dialogue ball to keep moving between the kids.

Individual team-member take-aways

- I want to make sure I am oriented to the development of the math so I can make sure they have opportunities to experience or walk through the mathematics in depth so they're not just spouting off things that they've heard.
- I want to trust the process of investigation, the congress, the gallery walk and recognize there are reasons for that structure.
- We need to remember that learning is messy and a lot of learning happens in the investigations.
- Listening to what the kids are saying in the congress is critical in making teaching moves to share, argue and question in order to go really in depth in the mathematics.
- It's critical to remember that we as teachers don't have the same perspective as the students' do so we have to be flexible enough to let their learning be most important.
- I want to continue to think more about the landscapes and what's on the horizon for all students, including those that are further along in development.