Trestle Problem Facilitator Notes

**Goal**: Solve and use a rich task and plan how to facilitate learning of conceptual understanding from students’ multiple solutions while maintaining a high cognitive demand. Model use of equitable environments and practice discussion norms.

**CCSS Connection:** A-CED: Create equations that describe numbers or relationships. SMP 1: Make sense of problems and persevere in solving them,SMP 2: Reason abstractly and quantitatively, SMP 3: Construct viable arguments and critique the reasoning of others, SMP 7: Look for and make use of structure.

**Introduction**: *We’ve used a lot of high cognitive demand tasks throughout the last two years, and our goal with this one is to think about how to use them with students to help them deepen their understanding of concepts. To do that we have to maintain the cognitive demand at a high level while students are solving it. In other words, students need to do the thinking; we don’t give them a method to solve it, or pre-teach or review procedures they need before presenting it, and the thinking they do helps them better understand the concepts and reasons for the procedures they use. However, this does* ***not*** *mean that we give them a task and say ‘go for it’ or refuse to help them. We still need to have a* ***purpose*** *and a* ***plan*** *to reach that purpose; the difficult thing about planning to use a high cognitive demand task is in thinking through how we will help students focus on the concepts while solving it. One strategy for doing that is to use the 5 Practices of Anticipating, Monitoring, Selecting, Sequencing, and Connecting. Also, as part of our planning, we need to think about what our students already know about a concept (prior knowledge) and also think about what might be problematic in the task, and how to use the problematic idea in the task to help students refine and build on their prior knowledge.*

*We are also intentionally asking you to NOT solve the problem first. Research shows that by restraining ourselves from finding an answer and instead exploring the problem allows us to better understand the problem and generate more ideas about it.*

*The relationship distance =rate\*time (when rate is constant) is introduced in 6th grade CCSS.*

* *Discuss at your tables what it would mean for students to have a deep understanding of this relationship before the end of Algebra 1.* (Some teachers may think that this is just a ‘fact’ students should know and be able to use in any problem that requires its application, and some may suggest using the drt chart that is ubiquitous among our students, and if so, I could suggest they explain it and when it is helpful, also asking them to explain how the chart could be used to develop meaning and understanding of the relationship.)
* *What ideas do you have for ways to help students gain deeper understandings of this relationship? In what ways do you ask them to use that understanding to strengthen it?* Note that spending time so that students have multiple experiences that are used to deepen their understanding of a key idea is what is meant by focus in the CCSS. This is different from giving the relationship as a fact and having them practice problems that use it as a fact. (*Cover up each one of the variables and ask* *how the other two are related if that number is constant*.)

Part 1:

*We present the following problem as a way for us to think more deeply about the relationship*:

A man is crossing a train trestle on foot. When he is 4/7 of the way across he sees a train coming toward him head-on. He realizes he has just enough time either to run toward the train and get off the trestle or run away from the train and get off the trestle. If the man can run 20 kilometers per hour, how fast is the train going?

Inefficient as learning.

**Carousel: Posters should be numbered from 1-18, and should have the problem in large print above it. Tape and handouts should be handy.**

**Start a poster:** On your posters, use the top half of the poster to create as many representations of this problem as make sense to your group. Include ways you think your students might approach it if asked to represent it. Solving the problem is not one of the goals at this point. (This is Anticipating what your students might do.)

**Move to the next poster**. Examine it; what do you understand about each representation? *What does each representation tell you about the students’ prior knowledge?* How does each representation illustrate the quantities and their relationships? What relationships are not shown in the representations? Write down as many relationships as you can on the bottom half of the poster. Circle the ones you think are most important. Write a statement that describes what you think is problematic about this task for students.

**(Introduce student work?)** What stops when you stop the with the right answer?

**Move to the next poster:** *Monitoring* means that you are walking around listening to students, asking and answering questions in ways that focus their attention on the ***concepts***, not guiding them to a particular solution strategy. The goal in our questioning is to ***focus*** students’ attention on important concepts, not to ***funnel*** them towards a particular solution strategy or the right answer.

(Handout for recording these questions and a purpose statement, which should then be attached to the poster.) Brainstorm questions for the students who created the representations and relationships on the poster and decide as a group whether each question would help students use or develop a deeper understanding **(D)** of the relationships between distance, rates, and time, or whether they would funnel students towards a correct solution without supporting their deeper understanding **(F)** or neither **(N)**.

In what ways do your D questions engage students’ intuitions and prior understandings, and in what ways do you ask students to extend their intuitions and prior understandings?

Sometimes our questions do not do what we think they will do. Take turns asking each other the questions and anticipate how students might respond.

Write a lesson purpose statement in student-friendly language; be sure to include the SMP you expect students to use and the conceptual goal of the lesson. Attach to the poster.

**After lunch:**

***Selecting*** involves choosing student work that could be used to help ALL students in the classroom better understand the concepts. ***Sequencing*** involves deciding which order you will have students present their solutions. And ***Connecting*** involves deciding what and how you will focus students’ attention on the important ideas within and among the presentations. Consider how you will make connections among all the representations and to the key ideas. How do we see structure in each of the solutions? Which ones are most accessible to your lowest students? How is each student going to make sense of the structure?

**Gallery Walk:** Walk around and look at the other posters and the questions and purposes attached. Select three students’ work that could be used in a whole class discussion to better help students understand the purpose your group wrote. How would you sequence the three students’ work, and what questions would you ask to help ALL students understand. Give rationale for your decisions (Handout: need three pages each group). Feel free to solve the problem now and discuss any other insights that occur or revise your purpose statement.

**Reflection**: What was the most challenging aspect of using this process to plan a lesson?