Introducing *ORIGO Thinking Tasks*

Problem solving is at the heart of classroom mathematics and rightly receives significant attention in any curriculum. However, a growing concern within the literature is that we are exposing students to an overabundance of the same types of problems, typically ones that are low level, isolated, and quick to solve. This has led many scholars to question the mathematical dispositions that are actually being developed.

> "Students who have finished a full twelve years of mathematics have worked thousands upon thousands of 'problems' – virtually none of which were expected to take the students more than a few minutes to complete." (Schoenfeld, 2016, p. 27)

ORIGO Thinking Tasks break this mold by presenting students with rigorous, problem-solving opportunities. These problems may become messy and involve multiple entry points as students carve out a solution path. By placing emphasis on the complexity of problem solving, we strive to create a culture for all learners that engages and inspires while developing their confidence and perseverance in the face of challenging problems.

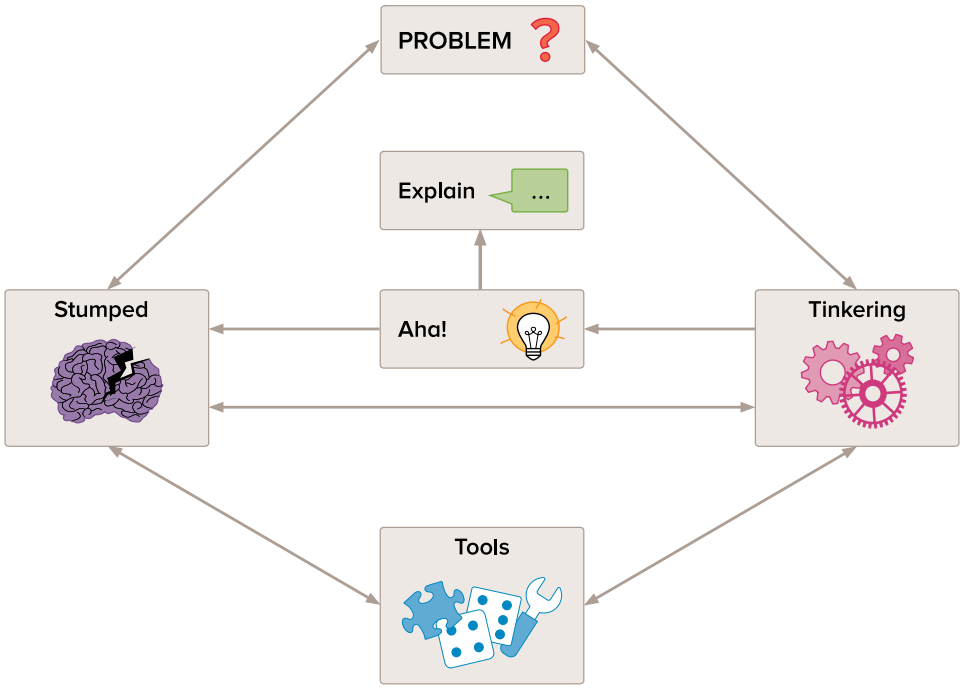
Implementing *ORIGO Thinking Tasks*

- Distribute one task to each student. Read and discuss the context of the problem together to ensure that all students understand the scenario.
- Have the students work through the problems independently or collaboratively. The problems are ramped, meaning each subsequent question is likely to have a higher cognitive load than the one that came before it.
- Encourage productive discussion. Mathematics is, after all, a social construct in which students learn by sharing and critiquing each other's ideas. Often, it is this sharing that constructs new ideas and understanding.
- These tasks are not intended to be a summative assessment item. Instead, they provide teachers with formative opportunities to observe how students approach a problem and what kinds of obstacles they encounter.
- Project the cognitive learning map (slide 1) once the students have completed the

task. Encourage students to share the thinking path that they followed. What obstacles did they encounter? How might these obstacles be avoided next time?

Interpreting the Cognitive Learning Map

Metacognition can be defined as thinking about one's thinking. There is a growing body of literature to suggest that such practices can improve student learning. The cognitive learning map shown below facilitates metacognition by helping students visualize their own thinking throughout a problem-solving process. There is no right or wrong path that students should follow. The arrows are merely a suggestion and imply that solving a problem is not a linear progression, but a winding path. For example, it is possible that one could have an *aha* moment, yet return to the preceding stage of *stumped*, if their reasoning is flawed. It's important for students to understand that this winding path, and perhaps the frustration that comes with it, is normal and expected when we set out to solve a real-world problem. Reflecting upon the thinking path they chose and the hurdles they encountered can be as valuable as the mathematics itself.



** The cognitive learning map was inspired by Cathy Humphreys, and refined by Cristina Charney, Janeal Maxfield, and Hailey Gilmore.*

Recommended readings

Ball, D. L. (1993). "With an Eye on the Mathematical Horizon: Dilemmas of Teaching Elementary School Mathematics." *The Elementary School Journal*, 93(4), 373–397.

Council, N. R. (2001). *Adding It Up: Helping Children Learn Mathematics.* Washington National Academy Press.

Cuoco, A., Goldenberg, P. E., & Mark, J. (1996). "Habits of Mind: An Organizing Principle for Mathematics Curricula." *Journal of Mathematical Behavior*, 15, 375–402.

Humphreys, C. (2017). Retrieved from: http://www.insidemathematics.org/assets/problems-of-the-month/misc/jumpstart-POM-ebook.pdf

Lampert, M. (1990). "When the Problem is not the Problem and the Solution is not the Answer: Mathematical Knowing and Teaching." *American Educational Research Journal*, 27(1), 29–63.

Schoenfeld, A. H. (2016). "Learning to Think Mathematically: Problem Solving, Metacognition, and Sense Making in Mathematics" (reprint). *Journal of Education*, 196(2), 1–38.