**Mathematical Practice Standard #1:** Make Sense of Problems and Persevere in Solving Them

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. … —CCSS

The problems we encounter in the “real world”—our work life, family life, and personal health—don’t ask us what chapter we’ve just studied and don’t tell us which parts of our prior knowledge to recall and use. In fact, they rarely even tell us exactly what question we need to answer, and they almost never tell us where to begin. They just happen. To survive and succeed, we must figure out the right question to be asking, what relevant experience we have, what additional information we might need, and where to start. And we must have enough stamina to continue even when progress is hard, but enough flexibility to try alternative approaches when progress seems too hard.

The Standard in Elementary School

The same applies to the real life problems of children, problems like learning to talk, ride a bike, play a sport, handle bumps in the road with friends, and so on. What makes a problem “real” is not the context. A good puzzle is not only more part of a child’s “real world” than, say, figuring out how much paint is needed for a wall, but a better model of the nature of the thinking that goes with “real” problems: the first task in a crossword puzzle or Sudoku is to figure out where to start. A satisfying puzzle is one that you don’t know how to solve at first, but can figure out. And state tests present problems that are deliberately designed to be different, to require students to “start by explaining to themselves the meaning of a problem and looking for entry points to its solution.”

Mathematical Practice #1 asks students to develop that “puzzler’s disposition” in the context of mathematics. Teaching can certainly include focused instruction, but students must also get a chance to tackle problems that they have not been taught explicitly how to solve, as long as they have adequate background to figure out how to make progress. Young children need to build their own toolkit for solving problems, and need opportunities and encouragement to get a handle on hard problems by thinking about similar but simpler problems, perhaps using simpler numbers or a simpler situation.

One way to help students make sense of all of the mathematics they learn is to put experience before formality throughout, letting students explore problems and derive methods from the exploration. For example, students learn the logic of multiplication and division—the distributive property that makes possible the algorithms we use—before the algorithms. The algorithms for each operation become, in effect, capstones rather than foundations.

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| 1 Aha! | 1 Question… | 1 Application |
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Video: Persistence in Problem Solving

-The Teaching Channel

**Questions to consider:**

* How does the graphic organizer help scaffold problem solving for students?
* Why does Ms. Saul choose to have students work alone without help?
* How do “Heads Together Butts Up” and “Student-led Solutions” contribute to the class culture around problem solving?
* Do you use similar/different problem solving techniques in your classroom?
* Something you are interested in trying might be…

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**Make sense of problems and persevere in solving them…**

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| Teachers shape mathematically proficient students by… | Questions to develop mathematical thinking… |
| * Providing time for students to think about and analyze the problem. * Facilitating discussion between students about the meaning of the problem. * Modeling problem solving process and appropriate strategies to solve problems. * Monitoring and evaluating student progress. * Providing descriptive feedback. * Helping students shift toward a more efficient strategy when solving and computing problems. | * How would you describe the problem in your own words? * How would you describe what you are trying to find? * What do you notice about…? * What information is given in the problem? * Describe the relationship between the numbers. * Talk me through the steps you’ve used to this point. * What steps in the process are you most confident about? * What are some other strategies you might try? * What are some other problems that are similar to this one? |