K:2 Two Groups of Books

Teacher Notes

Central math concepts

Building on their ongoing work with counting and cardinality, students in kindergarten explore the ways in which collections of objects can be composed and decomposed, joined and separated, translating those patterns into relationships between numbers. This launches students on a years-long journey of developing understanding, procedural skill, and problem solving power with problems involving addition and subtraction.

One of the important transitions in the progression from counting to adding is the transition from perceptual subitizing to conceptual subitizing. *Perceptual subitizing* is the term for when students instantly recognize and name the number of objects in a set. *Conceptual subitizing* is the term for when students use pattern recognition to quickly determine the number of objects in a set, such as seeing 2 things and 2 things and knowing this makes 4 things in all.[†] That is, conceptual subitizing involves "recognizing that a collection of objects is composed of two subcollections and quickly combining their cardinalities to find the cardinality of the collection.[‡]

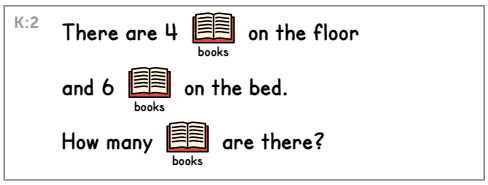
Across grades K–2, students solve problems involving three main meanings or uses for addition and subtraction:

- Adding To/Taking From
- Putting Together/Taking Apart
- Comparing

Elementary word problems in addition and subtraction can be classified as belonging to one of these three main kinds. Furthermore, in a word problem, some quantities in the situation are known while others are initially unknown; the various possibilities for what is known and what is initially unknown combine with the main meanings of addition and subtraction to give a total of fifteen basic situation types for elementary addition and subtraction word problems.

During grades 1 and 2, students work with all situation types and all variations in the known and unknown quantities, with quantities given as whole numbers. In the upper-elementary grades, these understandings of addition and subtraction are applied and extended to solve problems involving fractional quantities. Although the algorithms for performing calculations with fractions are different from those for performing base-ten calculations with whole numbers, the underlying meanings and uses of addition and subtraction are the same regardless of whether the numbers involved are whole numbers, fractions, decimals, or even variables. These meanings and uses begin to be learned in kindergarten.

The situation type in task K:2 is called "Put Together/Take Apart with Total Unknown."[§] Other kindergarten tasks involve the situation types of "Add To with Result Unknown," "Take From with Total Unknown," and "Put Together/Take Apart with Both Addends Unknown." Kindergarten students represent and solve these problems with objects, fingers, mental images, drawings showing the relationships among the numbers, sounds (for example, claps), acting out situations, verbal explanations, expressions,



Answer

There are 10 books.

Click here for a student-facing version of the task.

Refer to the Standards

K.OA.A.2; MP.4. Standards codes refer to www.corestandards.org. One purpose of the codes is that they may allow a task to shed light on the Standards cited for that task. Conversely, reading the cited Standards may suggest opportunities to extend a task or draw out its implications. Finally, Standards codes may also assist with locating relevant sections in curriculum materials, including materials aligned to comparable standards.

Aspect(s) of rigor:

Concepts, Application

Additional notes on the design of the task

Since kindergarten students should see addition and subtraction equations, student work could be summarized by showing and reading to the student the equation 6 + 4 = 10. (Student writing of equations in kindergarten is also encouraged but not expected in standards.)

or equations. These experiences enable students to gain grade-level fluencies and to develop conceptual understandings about addition and subtraction that they will draw upon in grade 1 and beyond.

Word problems vary considerably in the uses to which they put addition and subtraction, and they also vary in the complexity of the calculation required to obtain a final numerical answer. The overall challenge of a word problem depends on both the situational complexity and the computational complexity. The calculation in task K:2 involves calculating 4 + 6 or equivalently 6 + 4. Kindergarten students might calculate this total in many ways; see the gray box in the margin of page 6 of the *Progression* document and the section about "Working within 10" on pp. 10–11. Students for whom the calculation is time-consuming and/or effortful may need to be redirected to the context after obtaining the result, so as to relate the numbers in this equation to the context and answer the question in task K:2.

Relevant prior knowledge

The following mathematics knowledge may be activated, extended, and deepened while students work on the task: counting out (or drawing) a given number of objects; counting to tell the number of objects; conceptual subitizing; and understanding addition as adding to.

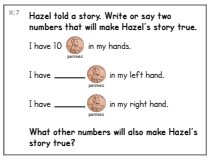
Extending the task

How might students drive the conversation further?

- Students could continue the story of the problem by supposing that 1 book was moved from the floor to the bed. What is the total number of books now?
- If some students added 4 to 6 while other students added 6 to 4, students could be shown the two equations 4 + 6 = 10 and 6 + 4 = 10 to think about and talk about why the answer was the same. Students could make statements generalizing this fact.

Related Math Milestones tasks

K:7



K:10

K:11

Other tasks in kindergarten that involve the kindergarten situation types are **K:7 Ten Pennies, Two Hands**, *Put Together/Take Apart with Both Addends Unknown*; **K:10 Hello, Dogs**, *Add To with Result Unknown*; and **K:11 Bye-Bye, Birds**, *Take From with Result Unknown*.

In later grades, see the Map of Addition and Subtraction Situations in K–2 Math Milestones.

Curriculum connection

1. In which unit of your curriculum would you expect to find tasks like K:2? Locate 2-3 similar tasks in that unit. How are the tasks you found similar to each other, and to K:2? In what specific ways do they differ from K:2?
2. Thinking about the curriculum unit you identified, at what point in the unit might a task like K:2 help students converge toward grade-level thinking about the important mathematics in the task? What factors would you consider in choosing when to use such a task in the unit?*

† See p. 356 of *Mathematics Learning in Early Childhood: Paths Toward Excellence and Equity* (National Research Council. 2009. Washington, DC: The National Academies Press. https://doi.org/10.17226/12519).

‡ Common Core Standards Writing Team. (2011, May 29). *Progressions for the Common Core State Standards in Mathematics (draft): K, Counting and Cardinality; K–5, Operations and Algebraic Thinking*. Tucson, AZ: Institute for Mathematics and Education, University of Arizona, p. 4.

§ For the other situation types, see Table 2, p. 9 of the *Progression* document.

* Math Milestones™ tasks are not designed for summative assessment. Used formatively, the tasks can reveal and promote student thinking.

Anticipating and responding to student thinking about the task

Imagine how students might think about the task, and what you might see and hear while they work.

On this page, you can write your thoughts on the following questions. 

Solution Paths

- What solution paths might you expect to see?
- What representations might you see? What correspondences between those representations might be noticed by students (or be worth pointing out to students) and discussed by them?
- What misconceptions or partial understandings might be revealed as students work on the task? How could you respond to these positively and productively?

Language

- What might you expect to hear from students engaged with the task? What does that language reveal about their mathematical thinking, and how might you respond to different ways of thinking?
- If students are using early English or using multiple languages in an integrated communication system, how might you help their classmates see those mathematical ideas as valuable?
- Even when using nascent language, students are thinking and communicating their thinking. What might it look like to respond positively and productively to the mathematics in their thinking before giving feedback on the language used?

Identity, Agency, and Belonging

- How can you engage students' interests, experiences, or funds of knowledge?
- How can you build students' self-confidence as learners, thinkers, and doers of mathematics?
- What choices are there for a student to make in the task? How can you build students' agency to the point where they notice and make these choices to solve problems?
- How might one use feedback to build student agency? Where might there be opportunities to build students' self-confidence?