MP5 Use appropriate tools strategically.

Mathematically proficient students at the elementary grades consider the tools that are available when solving a mathematical problem, whether in a real-world or mathematical context. These tools might include physical objects (cubes, geometric shapes, place value manipulatives, fraction bars, etc.), drawings or diagrams (number lines, tally marks, tape diagrams, arrays), paper and pencil, rulers and other measuring tools, scissors, tracing paper, grid paper, virtual manipulatives or other available technologies. Proficient students are sufficiently familiar with tools appropriate for their grade and areas of content to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained from their use as well as their limitations.

(Illustrative Mathematics, *Standards for Mathematical Practice: Commentary and Elaborations for K–5*)

In this unit, students gain experience in using a variety of tools to represent and compare fractions. These include drawings, rectangular "brownies," sets of fraction pieces, pattern blocks, and number lines. As students become more familiar with the tools, they can use or visualize these tools to solve problems. Here, students are discussing their solutions to a problem about comparing fractional parts:

Gil drank $\frac{2}{6}$ of a glass of milk. Jane drank $\frac{5}{6}$ of a glass of milk. Who drank more? Show how you know.

Keisha: I drew a glass of milk and divided it into six parts. Well, they're not exactly equal, but just pretend that they are. I colored in $\frac{2}{6}$. I had to color in 3 more sixths to get to $\frac{5}{6}$, so Jane drank more.

Adam: They are both made of $\frac{1}{6}$ pieces, like the green triangles. I thought of the hexagon as the glass of milk, and 2 green triangles is less than 5 green triangles.

Nicholas: If you make sixths on a number line, $\frac{3}{6}$ is the same as $\frac{1}{2}$. $\frac{5}{6}$ is more than a half and $\frac{2}{6}$ is less than a half.

Each student chooses a tool that helps him or her make sense of the problem. Any tool has its limitations and its advantages. Freehand drawings, such as what Keisha uses, are easy to make, but it may be hard to create equal parts accurately enough to compare them. Her drawing works well for her in this problem, because she understands how her drawing represents equal parts, even if they don't look quite equal. And because both fractions are multiples of $\frac{1}{6}$, it is clear how they compare in the drawing. The pattern blocks used by Adam are pre-cut to fit together, so that they provide a consistent representation of certain fraction relationships.

If the hexagon is considered to be 1, it is easy to use the other pattern blocks to represent halves, thirds, and sixths, and to combine them to see that, for example, $\frac{1}{2}+\frac{1}{6}+\frac{1}{3}=1$. On the other hand, the pattern blocks can be used to represent only a limited set of fractions. Nicholas visualizes a number line and the benchmark of $\frac{1}{2}$. He reasons about the positions of the two fractions on the number line relative to $\frac{1}{2}$. The number line illuminates how fractions are numbers, and how they are related to each other and to whole numbers. Because the number line can be extended indefinitely and any segment of the number system can be expanded, it provides a flexible tool for representing fraction relationships.

It is important that students become comfortable with all of these tools. Moving among them helps them deepen their understanding of fractions, provides different insights into the meaning of fractions, and provides multiple images with which they can think. Keep in mind that these tools are designed to support students to *reason* about the fraction relationships. The point of using any of these tools to compare fractions is not to achieve an accurate physical manipulation that gives the result, but to provide images of fraction relationships that can be used as the basis for students to reason about fractions. While Keisha's drawing is not entirely accurate and Nicholas is just imagining his number line, they are both able to use these tools to solve the problem.

Modeling in this unit is closely related to the use of tools as described above. Students use these tools to abstract the mathematical elements of the situation in order to model it and solve problems. In particular, the number line is itself a mathematical model, used in this unit to focus on the idea of a fraction as a number and on where fractions fall in relationship to each other and to whole numbers.

The following chart shows where Mathematical Practice Notes specifically address MP5 and when that mathematical practice is assessed.

MP5 Use appropriate tools strategically.

SESSION	MPN	ASSESSMENT CHECKLIST
1.2	•	
1.4	•	
1.5	•	
2.3	•	•
2.4		•