

Video Facilitator's Guide: Sixth Grade
Ratios and Proportions (Making Lemonade)

Highlighted Process Standards for Mathematics

- #2 – Reasoning abstractly and quantitatively
- #3 – Construct viable arguments and critique the reasoning of others
- #4 – Model with mathematics
- #6 – Attend to precision
- #7 – Look for and make use of structure
- #8 – Look for and express regularity in repeated reasoning

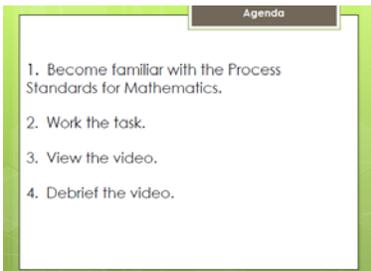
Summary of Video

In this lesson, the teacher gives students a multi-step task to compare the recipes for lemonade. In order to do this, students must make sense of proportions, rates, and ratios and use this understanding to explain the differences in the recipes. Students will be creating rate tables and graphs to support their answers.

Prepare for Facilitation

Make sure that you do the following before your presentation:

1. Read Facilitator's Guide Overview and this document that is specific to the Ratios and Proportions video.
2. Download the video onto desktop of computer.
3. Make copies of handouts.
4. Review the Process Standards for Mathematics.
6. Review PowerPoint slides provided.
7. Ensure that the presentation room includes appropriate audio and video equipment for showing video.

 <p>Agenda</p> <ol style="list-style-type: none">1. Become familiar with the Process Standards for Mathematics.2. Work the task.3. View the video.4. Debrief the video.	<p><u>Agenda</u></p> <p>Briefly share the agenda for the session. Remind participants that the purpose of this session is to introduce teachers to the Process Standards for Mathematics and observe how they are enacted in the elementary classroom.</p>
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Become familiar with the Process Standards

- Read the brief descriptions of the 8 Process Standards for Mathematics (PS).
- Underline key words for each PS.
- In small groups, share your thoughts or questions about each PS. Be prepared to share your understanding of the PS with the rest of the participants.

Process Standards for Mathematics(PS)

Pass out handout entitled “Brief Version of the Process Standards for Mathematics”. Have participants read the descriptions of the eight PS. As they read, have them underline key words for each of the eight standards. After everyone has finished, have the participants get into small groups to share their thoughts about each PS. After sufficient time has passed, debrief the findings in whole group discussion. One way to do this would be to ask each group to share their thoughts on one PS, until all groups have shared or all PS have been discussed. As each group shares, ask for additional input from other small groups and/or add your own ideas, if necessary, to clarify the intent of each practice.

Note: This step may be optional if the participants are already familiar with the SMPs or have participated in other video reviews from the *Process Standards for Mathematics in Action!* series.

Work the task, part 1



What can you tell from this picture about how we can make the lemonade?



Work the Task

This task has multiple steps. Provide copies of the picture, the rate table, and the graph. Each step is divided into separate slides to allow for in-depth discussion. As participants are working the task, prompt them to convince you that their strategies and solutions are correct.

IAS-M Connection

6.NS.8 Interpret, model, and use ratios to show the relative sizes of two quantities. Describe how a ratio shows the relationship between two quantities. Use the following notations: a/b , a to b , $a:b$.

6.NS.9 Understand the concept of a unit rate and use terms related to rate in the context of a ratio relationship.

6.NS.10 Use reasoning involving rates and ratios to model real-world and other mathematical problems (e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations).

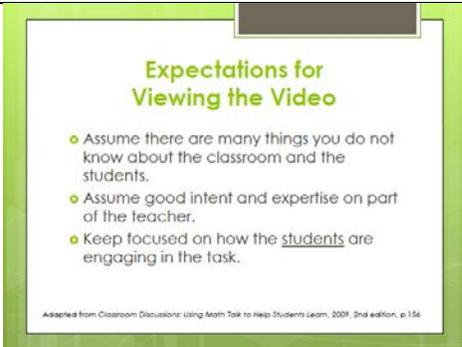
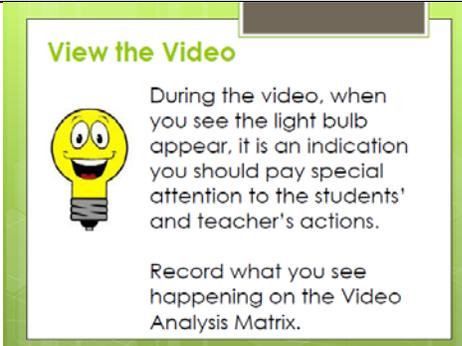
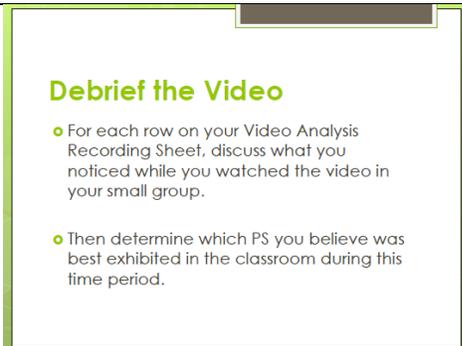
Connect to IAS for Mathematics

Ask participants to consider the potential of this task to support the development of the skills necessary for children to meet the standards listed below:

6.NS.8 Interpret, model, and use ratios to show the relative sizes of two quantities. Describe how a ratio shows the relationship between two quantities. Use the following notations: a/b , a to b , $a:b$.

6.NS.9 Understand the concept of a unit rate and use terms related to rate in the context of a ratio relationship.

6.NS.10 Use reasoning involving rates and ratios to model real-world and other mathematical problems (e.g., by

	<p><i>reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations).</i></p>
	<p><u>Expectations for Viewing Video</u></p> <p>Go over the following expectations before viewing the video.</p> <ol style="list-style-type: none"> 1. Assume that there are many things you do not know about the students, the classroom, and the shared history of the teacher and students on the video. 2. Assume good intent and expertise on the part of the teacher. If you cannot understand his or her actions, try to hypothesize what might have motivated him or her. 3. Keep focused on how the students are engaging in the task(s) and whether they are interacting in ways that align with the PS.
	<p><u>Viewing the Video</u></p> <p>Before viewing the video, distribute the Video Analysis Matrix. Explain that when the participants notice the light bulb icon, they should begin watching for teacher and student actions that align with one or more of the mathematical practices.</p> <p>View the video together. You may want to pause the video briefly at the end of each time period when an icon is displayed to allow participants time to note their ideas on the Matrix. (See sample matrix in this facilitator's guide for when each time period ends.)</p>
	<p><u>Video Debriefing:</u></p> <p>After watching the video, ask participants to share in small groups what they noticed for each time period listed in the Video Analysis Matrix. Ask participants to add a third column to the matrix in which they identify the possible PS that are exhibited.</p> <p>After sufficient time has passed, ask if anyone is willing to share his/her PS, supporting it with evidence from the video. Repeat this process for each time period. If necessary, have teachers re-watch segments of the video. Explain to the participants there may be differing opinions about which PS is most prominent; however, each SMP mentioned must be backed up by evidence from the video. If necessary, have the</p>

	<p>participants refer back to the wording of the PS to clarify its meaning. (For large groups of participants, consider the use of small-group discussion prior to whole-group discussion.) Remember that student and teacher actions may be interpreted in different ways, so there are no “right” answers, although the table does provide sample responses. The goal of documenting evidence of the PS is to provoke teacher reflection and discussion about the PS.</p>
<div data-bbox="207 625 673 970" style="border: 2px solid green; padding: 10px;"> <p>Additional Questions</p> <ol style="list-style-type: none"> 1. How does the task chosen by the teacher foster the Process Standards? 2. How does the teacher facilitate (prompt) the Process Standard in this video? 3. What type of classroom environment supports the Process Standards? </div>	<p>If time allows, follow up the discussion of the PS with one or more of these questions:</p> <ol style="list-style-type: none"> 1. How do the tasks chosen by the teacher foster the PS? <i>Possible answers:</i> This particular task fosters the SMPs because the students are connecting ratios and proportions to a real life context. The task also allows for students to see the math in multiple ways as well as represent their solutions in multiple ways, such as: calculating, using graphs, and explaining. 2. How does the teacher facilitate (or prompt) the PS in this video? <i>Possible answers:</i> The teacher encourages students to verbalize their understandings of, and solutions to, the problem. The teacher implements questioning techniques that push students’ thinking towards forming appropriate rationales for their problem solving choices and critiquing their classmates’ reasoning. 3. What type of classroom environment supports the PS? <i>Possible answers:</i> The classroom environment depicted in this video example shows students working together to solve problems. The students have grown accustomed to sharing and discussing their work with their classmates and teacher. Students are encouraged to think about mathematics problem solving as process rather than a procedure.



Process Standards for
Mathematics VIDEO
SERIES

Sample Video Analysis Matrix

Video Clue	Evidence of Student and Teacher Actions
 1 3:03	<p>PS 1 – Making sense of problems and persevere in solving them. The teacher asks students questions about how they make lemonade to help them understand the picture. Students have to determine what the spoons and cups mean.</p> <p>PS 4 - Modeling with Mathematics – in this question, the teacher brings a realistic example of ratios and proportions using a picture. She precedes this picture with a discussion about how students make lemonade to build background knowledge about the use of a lemonade mix and water.</p>
 2 4:01	<p>PS 8 – Look for and express regularity in repeated reasoning - Students are using background knowledge to answer the question using shortcuts. The student uses the reasoning of getting from 5 to 100, you have to multiply by 20. Another student multiplied to get to 50 first then to 100, stating that she used the “longer way”</p>
 3 6:02	<p>PS 3 – Construct viable arguments and critique the reasoning of others – Students must explain their strategies and how they got the answers. This gives the teacher a clear picture if the students have a good conceptual understanding of the math.</p>
 4 6:23	<p>PS 3 – Construct viable arguments and critique the reasoning of others - Students are asked to comment on the student’s thinking and explanation. The student explains that $\frac{2}{5}$ is 40%.</p> <p>PS 2 – Reason abstractly and quantitatively – the teacher asks if the students could answer the question using percentages. In doing so, she is connecting ratios/proportions to another concept as well as using the real life scenario of making lemonade.</p>
 5 7:09	<p>PS 3 – Construct viable arguments and critique the reasoning of others – The teacher continues to ask the students “Is there another way?” to garner multiple responses and ways to solve the problem.</p>
 6 8:42	<p>PS 3 – Construct viable arguments and critique the reasoning of others – The teacher continues to ask the students why. This forces the students to further explain their reasoning and solutions. It also gives the teacher valuable information about whether the students have good conceptual understanding of the math.</p>

 7 9:21	<p>PS 6 – Attend to Precision – the student is asked to clarify a student’s answer of $\frac{4}{10}$ of a spoon instead of $\frac{2}{5}$. He explained that he did the calculation as a decimal and got 0.4 so he put the answer into a fraction.</p>
 8 11:00	<p>PS 3 – Construct viable arguments and critique the reasoning of others – the teacher encourages the students to ask the question, “what is a unit fraction?” and allows time for the student to explain the definition. The teacher also gets students to share 3 different ways to solve that particular question PS 6 – Attend to precision – because the student uses the term “unit fraction,” it is important for the teacher to clarify the term and definition. She further asks the student to explain how he found the “unit fraction.”</p>
 9 13:11	<p>PS 3 – Construct viable arguments and critique the reasoning of others – the teacher continues to encourage students to ask questions for further explanation. This helps the students gain a better conceptual understanding.</p>
 10 14:47	<p>PS 7 –Look for and make use of structure – the students are looking for patterns in their calculations to complete the rate tables with two recipes.</p>
 11 16:05	<p>PS 3 – Construct viable arguments and critique the reasoning of others – students explaining their ideas about their recipe calculations. Two different ideas, but the same conclusion.</p>
 12 17:13	<p>PS 4 – Model with mathematics – because the teacher is utilizing graphs, she is having the students connect their math with real-life tools. PS 6 – Attend to precision – the teacher explains the type of line graph, uses correct terminology for the graphs (axes, vertical, horizontal, etc.), and asks the students how they will help the reader of the graph see the different in the recipes.</p>

 18:26 13	<p>PS 6 – Attend to precision – the teacher asks the students to clarify again what type of graph they are making and what is the difference between different types of graphs.</p> <p>PS 3 – Construct viable arguments and critique the reasoning of others – teacher continues to ask, “How do you know?” She also asks students to predict based on what they have and justify their predictions.</p>
 21:09 14	<p>PS 3 – Construct viable arguments and critique the reasoning of others - “Kara says...?” She pauses to allow for student discussion on Kara’s explanation.</p> <p>PS 7 – Look for and make use of structure – The student uses the structure in the table of values and notices that when the two recipes have the same amount of water, the amount of mix varies and when the two recipes have the same amount of mix, the amount of water varies. He is able to use both to explain how one recipe is weaker than the other.</p>
 22:31 15	<p>PS 4 – Model with mathematics – the teachers asks the students to tell the story based upon just the picture. Using charts and graphs to make assumptions is a great way to model mathematics.</p>
 23:14 16	<p>PS 3 – Construct viable arguments and critique the reasoning of others – the teachers asks them to explain how this connects to rate, ratios, and proportions.</p> <p>PS 6 – Attend to precision – the teacher asks them to clarify their knowledge of rate, ratios, and proportions. This is a formative assessment question for the teacher.</p>