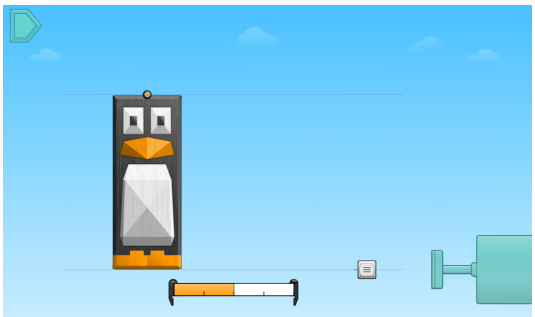
Puzzle Talk Facilitation Guide

This is a guide to provide support for facilitating student thinking as teachers engage students in academic discourse around math concepts and strategies using ST Math puzzles. This talk can be done over multiple days. ***Pre-work can be given to encourage students to think about the concept prior to the Puzzle Talk.*** *Read the Puzzle Talks Overview to learn more.*

Grade Level: Sixth
Objective: Percents
Game: Percent Objects



Teacher Prep

Description	• **Purpose:** Focus on the relationship between fractions and percents using visual proportional models. Use guiding questions for each step in the Problem Solving Process to support student thinking and the development of problem solving skills. • **Materials Needed:** Provide students with whiteboards and markers. • **Puzzle Location:** Grade 6 > Percents > Percent Objects > Level 1 • **Game in a Minute:** View video. • **Duration:** Multiple days • **Time:** May vary 10 - 20 minutes each session

Look Fors	**How does the student:** • represent the fractional portion of the whole? • express fractions as percents? • convert fractions into percents? • use mathematical vocabulary and mathematical operations to describe the puzzle? • use the terms part, whole, and percent?

Puzzle Progression	There are seven levels in this game. The puzzles include a JiJi model representing a whole and a scaling tool (with tick marks) that indicates the fraction or percent of the whole to shrink or stretch JiJi in order to solve the puzzle. In the first three levels, fractions or percents will always be related to one whole (JiJi) or 100%, and the unknown in the puzzle changes with each level. In Levels 4-6, students will encounter the same type of puzzles with fractions greater than one or greater than 100%. Students estimate and are not required to have an exact answer. In the final level, percentages are shown on the scaling tool, and the unknown changes each time.

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Facilitation Suggestions (This is what a student-led discussion might look like.)

This would occur over multiple days

Notice and Wonder

- Display the first puzzle from Level 1.
- Ask students, “What do you notice?”
- Allow a few students to share their thinking with the whole class. Listen for ideas that might include:
  - “JiJi with a line above and below”
  - “A scaling tool with a part shaded.”
  - “There is a slider bar.”
  - “There is a tube on the right side of the screen.”
- Ask, “What do you wonder about this puzzle?” Allow students to share out. Listen for ideas that might include:
  - “What happens when you move the slider bar?”
  - “What does the empty rectangle with the dashed line around it represent?”

Predict and Justify

- Ask students to think individually about how they could solve the puzzle, then turn and share with a partner before sharing as a class.
- Students should provide mathematical reasoning for the idea they want to try. They can use their whiteboard to represent the puzzle.
- List these ideas for the class to consider.

Test and Observe

- Select one of the students' strategies.
- Solve the puzzle and have students describe what happened.
  - Draw students’ attention to the purpose of the scaling tool and how it changes JiJi.
  - The fraction and percent of JiJi needed to solve the puzzle.
- Consider:
  - “How could you describe the amount that is shaded on the scaling tool?”
    - For example, students could describe it as “one-half or 50 percent” or write “½ or 50%” on their whiteboards.
  - “If we stretch or shrink JiJi to match the scaling tool, what might happen?”
- You can use the animation controls to pause the puzzle while students check if their answer matches the puzzle on the screen. Discuss how this might provide evidence for why the solution will work - or not work.

Analyze and Learn

- Continue with puzzles from Levels 1, 2, and 3. In Level 2, students need to represent the change on the scaling tool. In Level 3, students need to identify what the whole would be.
- Ask students how what happened compared to what they thought would happen.
  - If the answer was incorrect, discuss what was learned and what they think is best to try next. Have students share why that is the best way to solve the puzzle.
  - If the answer was correct, ask how they can take what they learned and apply it to the next puzzle.
- Show the next puzzle and have students discuss their strategies for solving it and why.
- Ask questions like:
  - "How is this puzzle different from the puzzle we just solved?"
    - JiJi is a different size.
    - Listen for students' vocabulary, such as "half of the whole or 50% of the whole".
  - "In this puzzle, what does the gray rectangle represent?"
  - "How could we describe the change in JiJi?"
  - "Once we have the change written as a fraction, can we find an equivalent fraction with a denominator of 100?"
    - For example, students might describe the second JiJi as "½ of the original JiJi". Begin to layer in a discussion of percents by describing it as "½ is equivalent to 50/100" which could be described as "50% of the original JiJi".
- Select a student's strategy to try and observe the feedback.
  - You can use the puzzle controls to pause the puzzle while students check if their answer matches the puzzle on the screen. Discuss how this might provide evidence for why the solution will work - or not work.

Connect and Extend

Levels 4 and 5

- Continue with puzzles from Levels 4 and 5. These puzzles demonstrate increases of greater than 100%.
- Discuss different ways to represent and solve the puzzle.
  - "How are these puzzles different from the puzzles we've solved before?"
  - "How could we describe the change in JiJi?"
    - For example, "The second JiJi is equal to 1½ original JiJis, which is the same as 150/100." or "JiJi grows by 150%.
  - "Why is the scaling tool important?"

        - For example, can the scaling tool represent a fraction, decimal, or percent? This is an opportunity to reinforce the relationship between fractions, decimals, and percents.
- Use the animation controls to replay and examine what happens in the puzzle.
    - If the puzzle was correct, discuss why the strategy used was successful.
    - If the puzzle was incorrect, analyze what happened and consider how to adjust the strategy to try again.
        - "Should we move the slider more or less? What will happen if we try it?"
        - "How much is too much? What will happen if we try it?
    - Continue with puzzles from Level 2.
        - "How are these puzzles different from the puzzles we've solved before?"
        - "How is this scaling tool different?"
        - "How do we know how much of the whole will fill the gray rectangle?"
        - "Is there a mathematical equation that can be written for this puzzle?