Proportion Playground - Bank Shots

Overview

Lesson Overview: Either in pairs or individually students use the pool table sim to discover equivalent ratios.
- The lesson is designed for there to be cycling between small group work and whole class discussions. The activity sheet has horizontal lines to show where these shifts occur. The teacher will need to circulate the room, listen to student discussions, and support learning as needed.

Learning Goals
- Students use proportional reasoning to make sense of patterns.
- Students develop strategies for finding equivalent proportions.
- Students use scaling to write equivalent proportions.

CCSSM
- 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."*
- 6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

Math Practices
- ➢ 1. Make sense of problems and persevere in solving them
- ➢ 2. Reason abstractly and quantitatively
- ➢ 3. Construct viable arguments and critique the reasoning of others
- ➢ 5. Use appropriate tools strategically
- ➢ 7. Look for and make use of structure

Lesson Prep

Activity Sheet Notes: The Activity Sheet is broken up into sections denoted by a horizontal line. These lines show the transitions between individual, small group, and whole class discussions.
Differentiation: The lesson is designed to differentiate itself. For example, some students can work with larger tables and/or be encouraged to work with dimensions that are too big for the sim early on in the process. Additionally, students can use formal and informal ways of proving equivalency.
Student Grouping: Teacher determines if they want students to work independently or in pairs. A mix of students working alone and in pairs can also work well.
Graph Paper: Have graph paper handy for students to use.
Lesson Duration: 50 mins

Lesson

1) **(10 mins)** Draw students' attention to the learning goals. One strategy is to ask students to name all of the verbs they see in the goals. These verbs are the *actions* students will take during the lesson.

   Prompt students to explore the sim. **Optional:** Students write down the 2-3 things they think a classmate should know. Key features for students to recognize:
   a) All of the items can be set side by side to compare different outcomes using the toggle button
   b) Bracelet: The pattern is a repeating pattern
   c) Paint: Paint colors combine to different colors based on how much of each color is added

      d) Paint: The color can move back and forth towards blue and yellow and no just go in one direction

      e) Pool Table: Max length and width = 20

      f) Pool Table: The 'Predict' sim hides the results until the 'eye' icon is selected

2) **(3 mins)** Focus on the pool table sim. Review the screenshots and discuss ideas for accurately counting the line segments.

3) **(15 mins)** Students experiment using the 'explore' sim and keep track of results. There is no right or wrong with what students discover other than counting the number of line segments. Some may see patterns and some may not. Students may opt to use the side by side feature, but it is not required.

      a) Avoid referring to the relationship of length to width as a fraction. This may lead to misconceptions regarding the part-to-whole nature fractions compared to the part-to-part nature of ratios.

      b) Draw a [table](#) on a board or project one from a device with the header being the numbers 1-5. Have students fill in the cells below each number with the length and width of the pool table that made the corresponding number of segments. This focuses the lesson on the most repeatable equivalent ratios. Differentiate as you see fit and extend the table down to include more dimensions as you wish. If time, prompt some or all of the students to share their thinking about what they or a classmate wrote.

      c) Ask students if there are any dimensions incorrectly placed. Students can use the sim to prove which number of line segments is correct for any given dimension.

      d) Prompt whole class discussion about what students noticed. Avoid providing a rule for equivalent ratios at this point. If students are able to see a pattern of equivalency on their own and share with the class, that is preferred to a teacher provided rule. It is not necessary at this point in the lesson that students have identified the tables with the same number of line segments as tables with equivalent ratios.

4) **(10 mins)** Students complete section 4 attempting to find 4 different dimensions that work for any given number of line segments. The side by side feature may be very helpful for some students, particularly visula lerners.

      a) After time to attempt, prompt whole class discussion of results and patterns found. It is not required at this point in the lesson that students have a formal strategy developed for finding equivalent ratios or an equal number of line segments.

      b) Students may continue to use informal and pre-formal strategies such as ratio/ rate ate tables for finding equivalent ratios or tables.

5) **(5 mins)** Students use the predict mode to test their ideas for making pool tables with the same number of segments.

      a) Whole class discussion to work to formalize strategies for equivalent ratios. Emphasizing strong math vocabulary will support students in writing a rule for Part 6.

6) **(5 mins)** Students write a rule in their own words.

      a) Whole class share out if there is time.

7) **(5 mins)** Exit Ticket