8th Grade Math Lesson: Unit Rate as Slope

To be used after students have seen y= rules graphed on the coordinate plane and have discussed the two key features of a linear graph: slope and y-intercept. If students are new to the Proportion Playground sim, the lesson plan step labeled Sim exploration & class discussion *should be done in an earlier lesson to allow enough time for students to experience and manipulate the sim before attempting the* Groupwork *and* Gallery walk *portions of the lesson.*

Content Objectives:

- Students will model different real-world proportional relationships and examine the ratio of parts to determine unit rate.
- Students will interpret the slope of the graph as the unit rate and describe key features of the proportional relationships as features of the related graph.

Common Core Standards:

- Describe the connections between proportional relationships, lines, and linear equations. (CCSS: 8.EE)
- Graph proportional relationships, interpreting the unit rate as the slope of the graph. (CCSS: 8.EE.5)

CCSS Math Practices:

MP2: Reason abstractly and quantitatively.
MP4: Model with mathematics.
MP6: Attend to precision.
MP8: Look for and make use of structure.

Materials:

- ❏ Chromebooks (class set)
- ❏ Access to PhET Proportion Playground Simulation
- ❏ Task Cards (2 copies printed per group of 4 students)
- ❏ Group worksheets (posted as Google Classroom Assignment):
  - Necklace Creator
  - Paint Splash
  - Pool Tables

The Plan (48 minute lesson):

Time	Activity	Notes
0:00-0:10	Warm-up	Students should work for 5 minutes silently and independently. They should talk to their table partner for 3 minutes. Then, use equity cards (or some other randomization technique) to choose students to show/discuss their solutions. Be sure to guide students in discussion about equivalent ratios and formatting.
0:10-0:20	Sim exploration & class discussion	Students will pick up their assigned chromebooks and play with each scene in the “Explore” mode of the Proportion Playground sim. Encourage students to play with at least 2 different scenes of the 4 options given. Guiding questions for whole class discussion: *What did you notice?* *When did the necklaces have a pattern?*

		How can you tell 2 paint splotches are the same color? *How are the ball-path patterns created? What makes them the same or different?* *How are apple prices compared?*
0:20-0:35	Groupwork	Students will be assigned to a group of 4. Begin by explaining the Roles that students need to delegate before beginning to work on their task card. Each group will be given a different task card (using a different scene on the Proportion Playground sim). Each group of 4 students will record their results on group Google Classroom assignments (to be viewed during Gallery Walk later). As students are working, good guiding questions to ask are: *How can you tell those designs are the same?* *What clues are you using?* *What is your strategy for finding another "same" design?* *What might be the best way to organize your data in the Desmos table?* *What are you noticing about the data points on your graph?* *How can we use the m and b values that Desmos provides to write a complete y= rule?* *What do the different symbols and numbers mean in a y= rule for a linear trend?* ***Note that the slope of the trend line will be probably be the INVERSE of the ratios students will calculate (depending on how they define x and y)! This may lead to some rich discussion in a future lesson about how to calculate rate of change.***
0:35-0:45	Gallery walk	Each student will be given 4 sticky notes that they can use to post on other students' chromebooks, using the guiding questions below to help frame their comments… **Guiding Questions:** How were the other groups' tasks similar to yours? How were they different? What did they notice about their ratios? What did they notice about their equation and the ratios? How were these answers similar to or different from yours?
0:45-0:48	Learning Logs	What is a connection you noticed between proportional relationships, lines, and linear equations?

Follow-up lessons:

Continue to have contextual interpretation of slope (or "grow-by number" or "rate of change") and y-intercept ("figure 0") for each of these scenarios. In particular, an emphasis on the meaning of the y-intercept could be used to probe a discussion about how you can tell if a relationship is proportional on a graph -- to address confusion about whether you can use the techniques from 6th and 7th grade math with ratio tables in any *linear x-y table. It would be interesting to see if students could use the same ideas from these scenes but create linear trends that are not proportional (for example, adding a clasp on the necklace, calculating blue:total, and graphing (blue, total); starting with a quantity of base paint for the paint splash, calculating green:total, and graphing (green, total); or having a 2 inch wide border around the pool table, calculating width:length, and graphing (width,length)... all of these are linear cases that are not direct variation (not proportional), though the interpretation of the slope is equivalent).*