Oodles of Math Doodles: Droodles

Problem Solving, Spatial Sense, Mathematical Reasoning, & Justification

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Grade Level	6th – 8th Grade	**Time Frame**	1-2 class period(s)
Subject	Mathematics	**Duration**	75 minutes
Course	Middle School Mathematics		

Essential Question

How can students develop their problem solving, mathematical reasoning, and justification skills?

Summary

In this lesson, students engage in three different learning explorations around Droodles, which were originally created as silly drawings by Roger Moore with witty captions. This lesson borrows from Moore's work to create an experience that promotes problem-solving, mathematical reasoning, and mathematical justification. Students will extend their learning by creating their own explorations for peers to solve. This lesson can be implemented in many different grade levels ranging from middle school through high school. This lesson includes optional modifications for distance learning. Resources for use in Google Classroom are included.

Snapshot

Engage

Droodles (easy engagement around creating a caption)

Explore

Droodle exploration.

Explain

Students share how they used mathematical reasoning for each exploration.

Extend

Students create their own Droodles.

Evaluate

What? So what? Now what?

Standards

Common Core State Standards for Mathematics (Grade 7)

CCSS.Math.Practice.MP6: Attend to precision.
CCSS.Math.Practice.MP7: Look for and make use of structure.

Attachments

- Droodles.pdf

Materials

- Stockpile of Droodles

Engage

To begin this lessson, you will first need to print (and laminate if you wish) the Droodles from the book "Classic Droodles" by Rodger Price (1992). There is a handout attached to this lesson that has copies if you do not have access to the book. This Engage activity is completed in two rounds as described below.

Round 1:

1. Display the Droodles on a flat surface. Ask students to select a Droodle that "speaks to them."
2. Have students return to their desks and create a caption for their Droodle.
3. Ask students to share their captions at their tables and explain why they chose the Droodle.
4. Solicit several responses from the class. These are typically a great way to get students engaged in conversation, which will be helpful for the explorations later.

Round 2:

1. Ask students to identify mathematical constructs found within their Droodle. This might include shapes, angles, line segments, symmetries, or other things students find mathematically interesting.
2. Have students share at their tables what mathematics they see within their Droodle.
3. Solicit several responses from the class.

Optional Modification For Distance Learning

If conducting this lesson in an online or distance learning environment, you may choose to modify this Engage activity. You can substitute the above group activity with a website like VoiceThread. With VoiceThread, you can upload the droodle images to the site beforehand. Then, students can choose whether they would like to make a quick video, a voice memo, or a written note to give feedback on the Droodle they chose and the mathematical constructs they found inside. Download all attachments to use this lesson in Google Classroom here.

Explore

Droodles

Whole Group: Follow the directions below, making modifications as needed. Centers: If you opt to work in centers, have one third of your class move to the Droodles Center. You will still need to have print-outs made for pairs. For example, if you have a class of thirty students, assign ten to the Droodles Center, forming five pairs to complete the task. From here, students follow the directions as outlined below and in the Droodles Exploration handout.

Scaffolding

Depending on your students' level, you might choose to provide directions for students to take notes. Have students record their sorting techniques and decisions where they typically take notes in class. This exercise can provide a nice scaffolding if your students need to process their thinking as they explore.

This exploration is designed to help students classify and justify reasoning in a systematic way. Ask students to work in pairs for this activity.

First, make sure each pair of students has at least a dozen, but preferably more, Droodles at their table.

Next, ask students to organize their Droodles into two categories. The organization criteria is up to them.

Ask pairs to form groups of four. If there is an odd number, ask three pairs to join together. Have one pair justify how they categorized their Droodles, and then switch. Afterward, ask students to find new partners.

With their new partners, ask students to categorize their Droodles into four categories. Again the organization criteria is up to them.

Repeat the process of having pairs form groups of four. Have one pair justify how they categorized their Droodles, and then switch. Afterward, ask students to again find new partners.

Finally, ask students to categorize their Droodles further into as many or as few groups as they wish. The criteria they use is up to them.

This time, ask groups to explain their reasoning to the whole class. To do this, ask the class to gather around one group, giving them their full attention. Then, move on to the next group.

Optional Modification For Distance Learning

Consider creating multiple copies of the attached Droodles using Google Docs. Assign three students to each copy of the Droodle handout and have them collaborate virtually. Students can add notes to the document and collaborate as a group using the "chat" feature in the document. You may also consider making this activity a discussion board post to which your students can respond directly. Download all attachments to use this lesson in Google Classroom here.

Explain

The purpose of this section is to discuss the challenges students faced with categorizing their Droodles. Using the sentence stems below, ask students to reflect on their exploration:

1. One thing I found challenging about this activity was....

2. One thing I did really well was...

3. Sorting Droodles made me think...

4. I used mathematics to....

5. I was able to justify my categories because...

Optional Modification For Distance Learning

Depending on the technology available to you and your students, you may want to discuss these questions as a class in a group chat or digital document. You might also consider making this activity a discussion board post to which your students can respond directly. Download all attachments to use this lesson in Google Classroom here.

Extend

To create Droodles, distribute paper, a straightedge, a compass, and pencils to each student.

Ask students to fold their paper into four equal qudrants, like a window

Each quadrant will require students to incorporate different geometric shapes and patterns.

Top Left: Ask students to create a Droodle that incorporates at least one line of symmetry

Bottom Left: Ask students to create a Droodle that incorporates one square and one circle of equal area

Top Right: Ask students to create a Droodle with similar triangles

Bottom Right: Ask students to create an original Droodle that incorporates at least three geometric figures of their choice.

Optional Modification For Distance Learning

Students can use any number of digital drawing or art programs to create their Droodles (such as Google Draw or similar applications). If splitting the digital workspace into four quadrants presents a problem, students can submit four separate drawings instead. Download all attachments to use this lesson in Google Classroom here.

Evaluate

Use the What? So What? Now What? strategy to evaluate students' learning. Ask:

- What did you do in your activity today?
- How did you use mathematical reasoning when sorting Droodles?
- How can this apply to other areas of mathematics?

Optional Modification For Distance Learning

Depending on the technology available to you and your students, you may want to discuss these questions as a class in a group chat or digital document. You may also consider making this activity a discussion board post to which your students can respond directly. Download all attachments to use this lesson in Google Classroom here.

Resources

- K20 Center. (n.d.). What? So what? Now what?. Strategies. Retrieved from https://learn.k20center.ou.edu/strategy/b30762a7557ba0b391f207f4c6002113
- Price, R. (1992). Classic Droodles. Los Angeles, CA: Price Stern Sloan.