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Lesson in Action

Using Precise Language: Define Geometry Terms

AT A GLANCE

Launch

- Review the lesson goal.
- Lead a discussion about mathematical language.

Learning Task

- Demonstrate how to use the geometry software on the interactive whiteboard, showing students how to draw the first object they will define (a ray).
- Guide students through the first geometry term, modeling behavior and encouraging thinking aloud.
- Have students pair up and use the geometry software at the computers to create examples of other objects.
- Lead a discussion to create a class definition, then compare it to the glossary's definition.
- Have students write their own precise definitions in their digital flashcard glossary.
- Repeat process (discussion followed by student writing) for all of the terms.

Closure

- Organize students into groups. Have each group create a display showing examples of each object discussed and defined in the lesson.
- Have each student write a comparison of two objects discussed in the lesson.

Context

Mr. Pierson is starting a new geometry unit with his Grade 4 class. For the first time, his class will work with geometric objects such as points, lines, and angles. Mr. Pierson knows that vocabulary can be an issue for many of his struggling students, especially those with language problems. This seems like a perfect time to draw their attention to the precise meanings of mathematical terms. He wants students to understand that it is especially important to pay attention to these meanings when the words have similar, but less precise, meanings in everyday language.

Common Core State Standards

- ▶ [CCSS.Math.4.G.1](http://www.corestandards.org/Math/Content/4/G/A/1) (<http://www.corestandards.org/Math/Content/4/G/A/1>) Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.
- ▶ [CCSS.Math.MP6](http://www.corestandards.org/Math/Practice/MP6) (<http://www.corestandards.org/Math/Practice/MP6>) Attend to precision.

Lesson Objective

Students will develop definitions for geometry terms, new vocabulary, and symbols. Developing a common mathematical language will help students to communicate their thinking as they learn new concepts in subsequent lessons.

Technology

- ▶ Interactive whiteboard to communicate visually with the class
- ▶ [Online glossary of mathematical terms](http://my.hrw.com/math06_07/nsmedia/tools/glossary/msm/glossary.html) (http://my.hrw.com/math06_07/nsmedia/tools/glossary/msm/glossary.html) to use as a reference
- ▶ [Digital flashcard website](http://quizlet.com/) (<http://quizlet.com/>) to store student-created glossaries
- ▶ [GeoGebra](http://www.geogebra.org/cms/en/) (<http://www.geogebra.org/cms/en/>) (dynamic geometry software) for students to use as they explore terms

Assessment

- ▶ Observe students' discussion of definitions
- ▶ Examine displays of different examples for each type of object
- ▶ Read student comparisons about geometric objects

Mr. Pierson's Class in Action

Launch

Mr. Pierson starts the class by asking a student to read aloud the learning goal for the day projected on the interactive whiteboard. He asks another student to read aloud the ways they can demonstrate their learning:

- ▶ I can give a definition of a point, line, line segment, or ray.
- ▶ I can explain how any two of these things are the same and how they are different from each other.

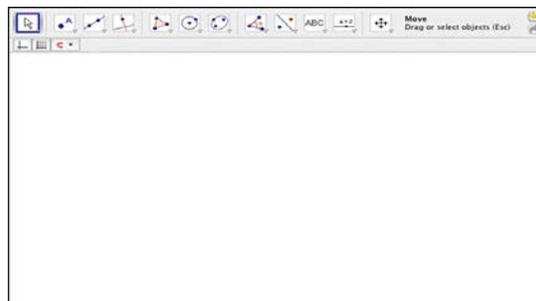
Mr. Pierson asks the class, “Does anyone know what a ray is? What does that word make you think of?”

After a moment, Patsy raises her hand. “Sun rays,” she answers, “or light rays.”

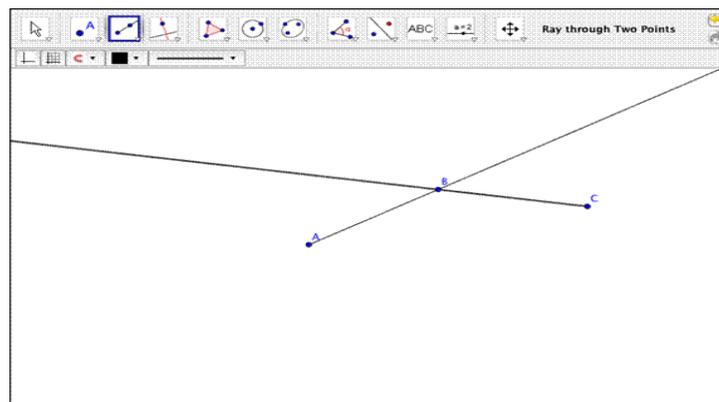
“That’s one thing a ray might be,” Mr. Pierson agrees, “but in mathematics we have a very specific thing in mind when we talk about rays. A line is another example—you might think about one thing when I say, ‘draw a line,’ but the mathematical meaning may be slightly different. In mathematics, it’s very important for everyone to use the same, precise meaning so that we can understand each other better.”

Learning Task

Mr. Pierson displays his dynamic geometry software on the interactive whiteboard. “We’re going to start by letting you do a little exploration with this program,” he tells the class. “You will work with a partner to create points, lines, line segments, and rays.”



“Let’s look at rays first,” Mr. Pierson says, “since we just talked about them.” He draws two rays.



“Work with the others at your table for a moment,” he instructs his students, “and see if you can come up with a definition for a ray as it’s being used here.”

Mr. Pierson gives his students some time to discuss rays and then brings them back together. “Who will volunteer a definition for a ray?” He chooses Eduardo, who rarely volunteers.

Eduardo says, “It’s a line that starts somewhere and goes somewhere else.”

Mr. Pierson replies, “Good start. What do you mean by ‘starts somewhere’?”

Eduardo hesitates and is not sure what to say. “When you made those,” he says, pointing at the board, “you made a point to start them.”

“Okay,” Mr. Pierson says, “but ‘somewhere’ is vague. Our school is somewhere, our classroom is a more specific somewhere, and your house is a completely different somewhere. This is why we need precision in our mathematical language! A point is specific, and we’ll discuss that more a little later.” He writes “Ray: Starts at a point” on the board. He then asks the class, “Does anyone want to add to that definition, or modify it?”

Karen raises her hand and says, “Eduardo says it goes somewhere else, but your rays don’t stop at another point. They keep going!”

“Good observation,” Mr. Pierson says. He expands the definition so it reads, “Ray: Starts at a point, goes forever.” He then adds, “We can’t actually see it going forever, of course, but you might notice that the line goes off the window, however long that is.”

No one suggests anything else, so Mr. Pierson brings up an online glossary “This glossary defines a ray as ‘part of a line that starts at one endpoint and extends forever,’” he reads, “and this is a more precise way of saying what Eduardo and Karen said. Notice that it says a ray is ‘part of a line’. We haven’t talked about what a line or a point really is, so let’s do that now.”

“Work with your partner and create some different objects with the program,” Mr. Pierson continues, “and as you do that, I want you to think about what we mean by points, lines, line segments, and rays. How are these things different from each other?”

Students work with the program for about five minutes and then return to their seats for discussion. He starts with “point.” As he did with “ray,” he asks students to suggest a definition. He then helps them to modify the definition to be more precise.

He finds the term “point” in the online glossary. “Well done,” he says, pointing out that the class’s definition (“a specific place”) is close to the glossary’s definition (“an exact location in space”).

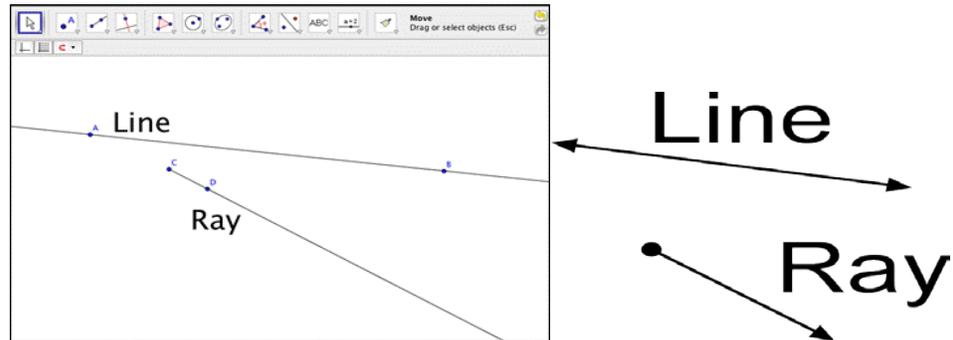
He tells his students, “The wording in this definition is a little more precise: ‘exact’ instead of ‘specific,’ and the definition says ‘in space’ to make it clear that this can be anywhere. By ‘in space,’ it doesn’t mean in outer space, with the stars. Space is everywhere, like right here,” Mr. Pierson stabs the air, “or here” (as he touches the surface of the nearest desk).

“Now,” Mr. Pierson continues, “I want you to write a precise definition in your digital flashcard glossary. Put it in your own words. Draw a picture if you think it will help you remember what this term means.”

He gives students time to record their definitions for “point” and then moves on to the other terms. He has students discuss each term, using their experience to talk about what makes each object different from another. For each term, Mr. Pierson writes the definition they create, guiding them when necessary. He ends the discussion about each term by giving students time to talk about how the definition is similar to the online glossary definition.

Students record their final definitions in their glossaries.

Mr. Pierson also shows his students how the line and ray usually appear with arrows on the ends that keep going (the geometry software doesn't use arrows in that way):



Closure

As a final activity, Mr. Pierson organizes the students into groups. He gives each group two pages with pictures of different objects. He then asks each group to cut their pages up and make a display on a poster board that shows examples of each type of object. As an exit ticket, each student has to explain, in his or her own words, one of the following comparisons listed on the whiteboard:

- ▶ How lines and line segments are the same and how they are different
- ▶ How lines and rays are the same and different
- ▶ How line segments and rays are the same and different

Reflection

That evening, Mr. Pierson considers how the lesson went. He knows that his students could recognize the differences among lines, line segments, and rays. Given past experiences, however, he also realizes that some students will confuse the terms from time to time. As needed, he will refer students to their notebook glossaries or to the online glossary. Tomorrow, he will put the new terms on the word wall before class starts. He plans to use the word wall with students who get stuck trying to explain something—the wall will prompt them to choose which term they want. Mr. Pierson also recognizes that as students use these and other mathematical terms, he will have to return many times to the idea of being precise. As he did with Eduardo's use of "somewhere," he will try to point out what is imprecise and how precision can help students clearly communicate meaning.