Differentiating Instruction with Middle School Students

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Opening Activity

Please take a moment to respond to the following questions on the index card:

Name, grade level(s), school

1. What are essential elements of differentiated instruction, in your view?
2. What do you currently do in your teaching to differentiate instruction?
3. What concerns you most about differentiating instruction?

Why differentiate instruction?

- ***Professional observations:***
  - My students in the same class are in many different places in their understanding.
  - What I do in class works differently with different students; my instruction is not "the same" instruction for all students in the same class.
  - Students benefit from interacting with many different thinkers, which they don't get to do in tracked classes.
- ***Professional choices:***
  - Want to communicate mathematically with more students
  - Need to help more students be successful
  - Want alternatives to tracking

The IDR^{2}eAM Project

- **I**nvestigating **D**ifferentiated Instruction and **R**elationships between **R**ational Number Knowl**e**dge and **A**lgebraic Reasoning in **M**iddle School
- *Purposes of IDR^{2}eAM:*
  - To investigate how to differentiate mathematics instruction in middle school for students with diverse cognitive characteristics
  - To understand relationships between students' rational number knowledge and algebraic reasoning
  - To build a community of educators interested in exploring how to differentiate mathematics instruction for middle school students

What is differentiated instruction for us?

- *Working definition:* Proactively tailoring instruction to students' different learning needs, such as students' readiness and cognitive abilities, interests, and learning profiles and backgrounds (Tomlinson, 2005) while developing a cohesive classroom community.

- Responsive and adaptive
- Rooted in formative assessment
- Student-centered
- A blend of whole-class, small group, and individual instruction

What have we done? (Years 1–2)

- Conducted three after school math classes with small groups of 7th and 8th grade students with diverse cognitive characteristics
  - 9 weeks, 18 episodes
  - Video-recorded with 3 cameras and Screenflow software
- Selection of students was based on classroom observations, initial interview, math worksheet
- Currently analyzing data to understand student thinking and features of differentiation

Foundations of differentiating instruction

- **On-going development of learning goals for students about a Big Idea**
  - E.g., How do students at different mathematical levels learn to reason proportionally?
- **Implementation of on-going assessment to get to know students' thinking**
  - E.g., How do I know where my students currently are in their mathematical thinking about this particular topic (part of the Big Idea)?
- **Establishment of specific norms in classrooms**
- **Choice**
- **Flexible grouping for different purposes**

Year 3: Teacher Study Group

- 15 middle school math teachers from around the state serving a wide range of student populations
- *Purposes:*
  - to learn together about differentiating math instruction
  - to learn from each other about what we each know about differentiating instruction
  - to experiment with differentiating instruction in each of our classrooms
- 3-day workshop in July
- Monthly meetings after school

Getting started with differentiation

- Carol Tomlinson

- **The "ground" for differentiation**: Getting to know students' ways of thinking, as well as other aspects of students

- *Our guiding question for this fall in the TSG:* **How can I work as a teacher to see a wider range of student thinking in this unit?**

Some strategies for differentiation

- Lower prep (examples):
  - Small group check-in and instruction
  - Open Questions
  - Choice Questions
  - Number Talks
  - Student-teacher goal-setting
  - Varied supplemental materials
  - Giving variable amounts of time for tasks, assessment
  - Check ins: Fist to 5, thumbs, highlighter colors
- Higher prep:
  - Open-ended problems and request for two solutions
  - Open Questions
  - Choice Questions and Parallel Tasks
  - Tiered Instruction
  - Learning Contracts

Open Questions (Small & Lin, 2010)

- *An Open Question* is a question or problem for which a variety of responses are possible, including more basic responses and more complex ones (Small & Lin, p. 7).

- An open question typically has many answers.

- Open questions can spark good mathematical discussions, in part because many students can contribute.

Strategies for Making Open Questions

- Turn around a question: Instead of giving the question, give the answer and ask for the question.
- Ask for similarities and differences between two numbers, shapes, graphs, probabilities, measurements, etc.
- Replace a number (or more than one number) with a blank(s).
- Ask students to create a sentence that includes certain numbers, quantities, and words.
- Use “soft” words—words that are somewhat vague but not too ambiguous, such as "about" or "greater" or "slowly."
- Use a standard textbook problem but change the question.

Strategies to Avoid in Making Open Questions

- Not having mathematical meaningfulness. It's okay to ask "what does the number 3/4 make you think of?" *occasionally*, but this kind of question by itself is usually not meaty enough.

- Too much ambiguity.

- Too much specificity.

Marie – Open Questions for Order of Operations

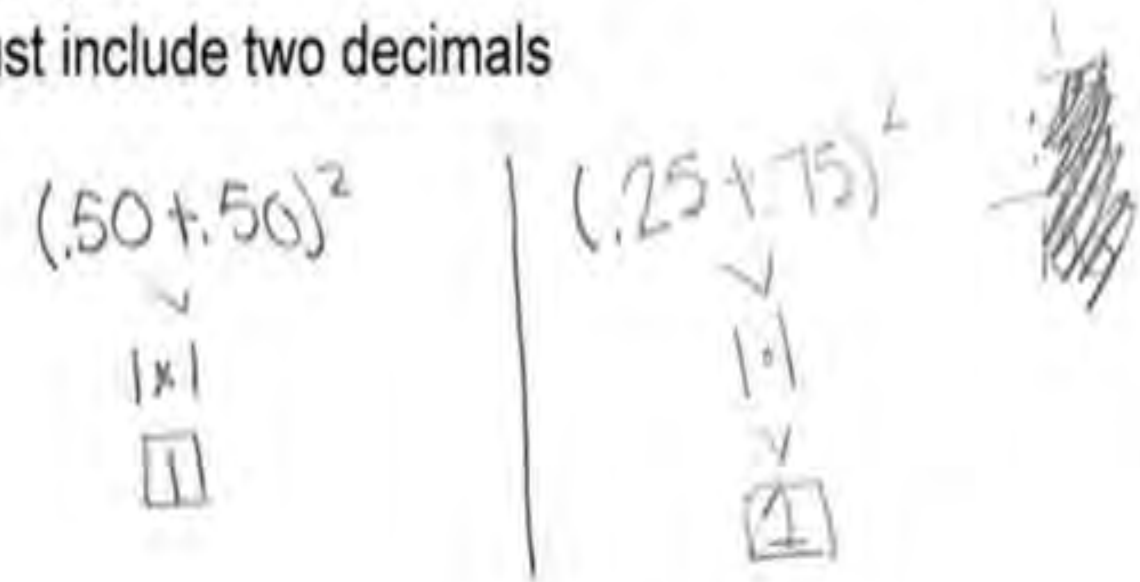
- Open Question: Write an order of operations problem using the following criteria.
  - Answer is between ____ and ____
  - Use at least ____ operations (addition, subtraction, multiplication, division, exponents)
  - Use at least ____ decimals [or fractions, or negative numbers]

Student Response

The answer is between 1 and 4

You must have at least 3 operations (including parentheses and exponents)

You must include two decimals



Student Response

The answer is between 1 and 4

You must have at least 3 operations (including parentheses and exponents)

You must include two decimals

$$1(6.6-4.6)^2-2.1$$

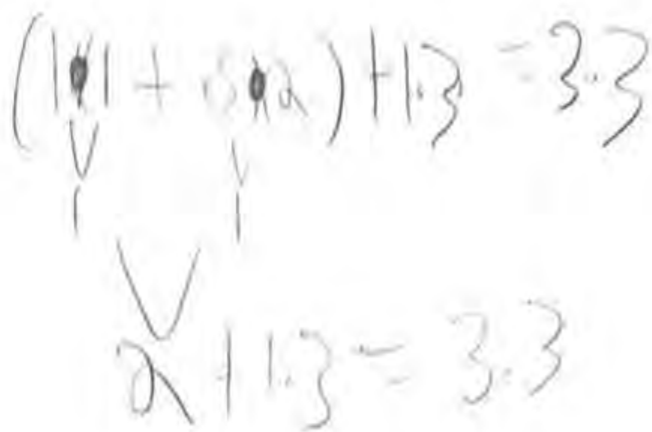
$$1(2)^2-2.1$$

$$1(4)-2.1$$

$$4.0 - 2.1 = 1.9$$

Student Response

The answer is between 1 and 4
You must have at least 3 operations (including parentheses and exponents)
You must include two decimals



(1*1+.5*2)+1.3=3.3

Student Response

- The answer is between 1 and 4
- You must have at least 3 operations (including parentheses and exponents)
- You must include two decimals

$$[(1.1+1.1)^2 - 0.84] = 4$$

$$2.2^2$$

$$4.84$$

$$\begin{array}{r} 2.2 \\ 2.2 \\ \hline 44 \\ 440 \\ \hline 484 \end{array}$$

Student Response

The answer is between 4 and 11

You must have at least 3 operations (including parentheses and exponents)

You must include one fraction

$$\frac{3}{4} \div 1\frac{1}{2} + (2.1)^2$$

$$\frac{3}{4} * 2/3 + (4.41)$$

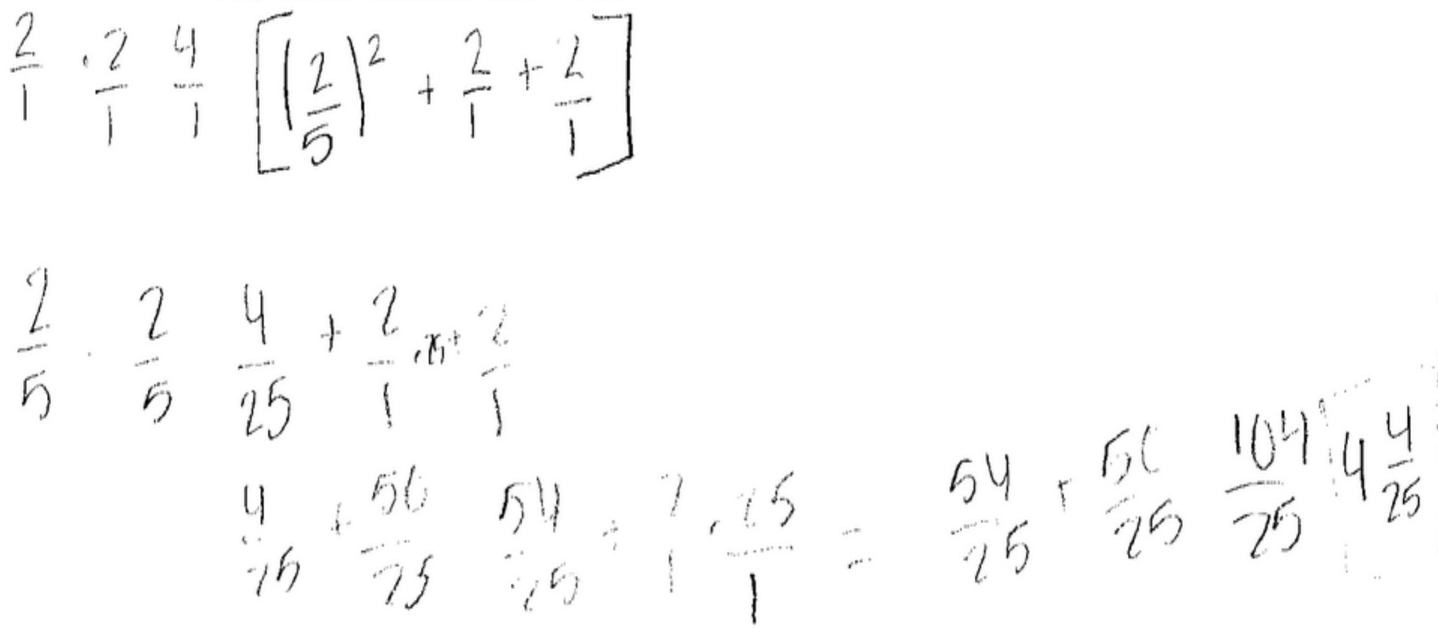
$$\frac{1}{2} + 4.41$$

$$4.91$$

$$\begin{array}{r} 2.1 \\ \times 2.1 \\ \hline 21 \\ +420 \\ \hline 4.41 \end{array}$$

Student Response

- The answer is between 4 and 11
- You must have at least 3 operations (including parentheses and exponents)
- You must include one fraction



4/25 + 50/25 = 54/25 + 2/1*25/1 = 54/25 + 50/25 = 104/25 = 4 4/25

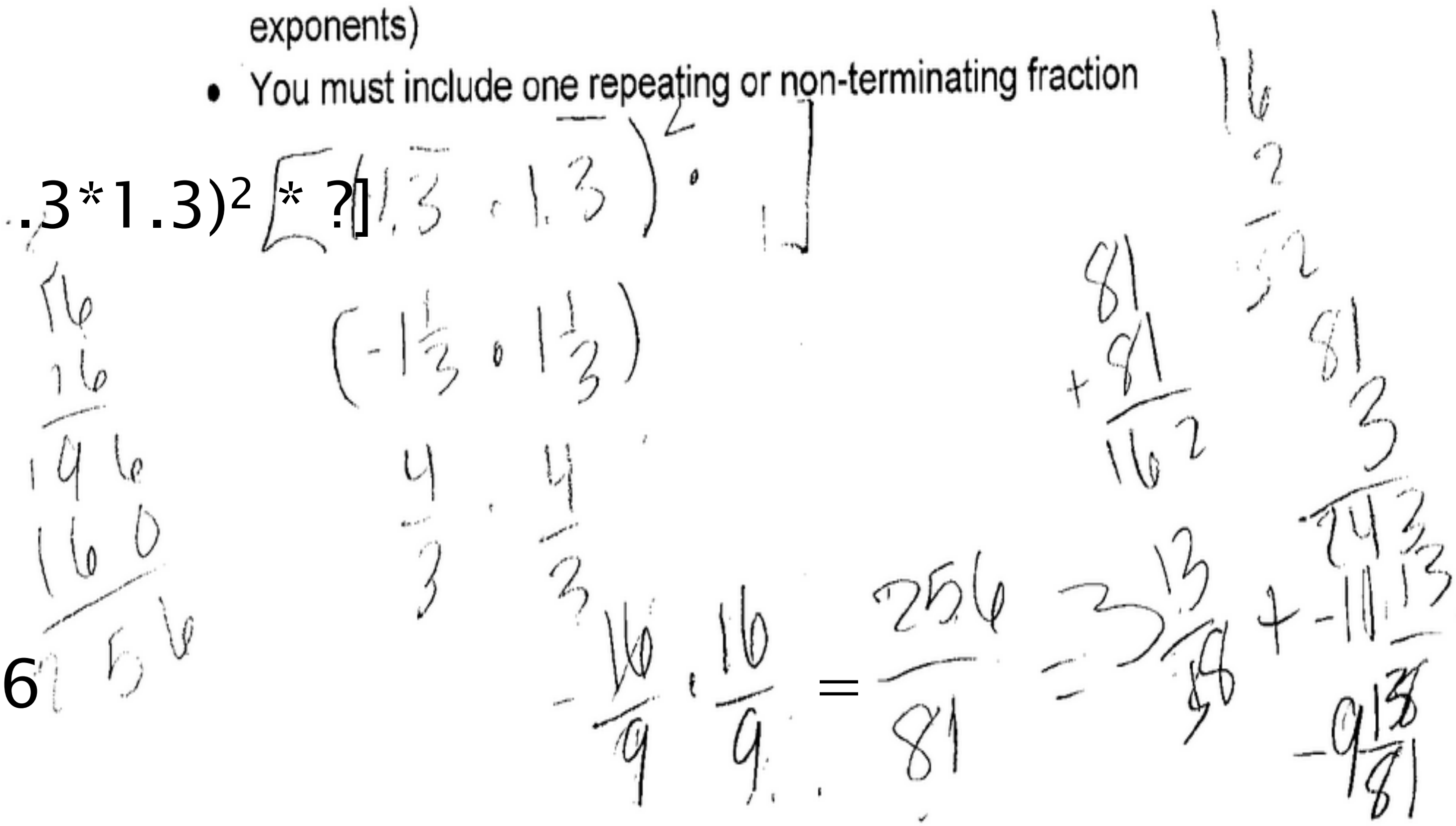
Student Response

- The answer is between -12 and -8
- You must have at least 3 operations (including parentheses and exponents)
- You must include one repeating or non-terminating fraction

$$\left[\left(-1.\overline{3} \cdot 1.\overline{3}\right)^2 \cdot -4\right] = -10.6244$$

Student Response

- The answer is between -12 and -8
- You must have at least 3 operations (including parentheses and exponents)
- You must include one repeating or non-terminating fraction



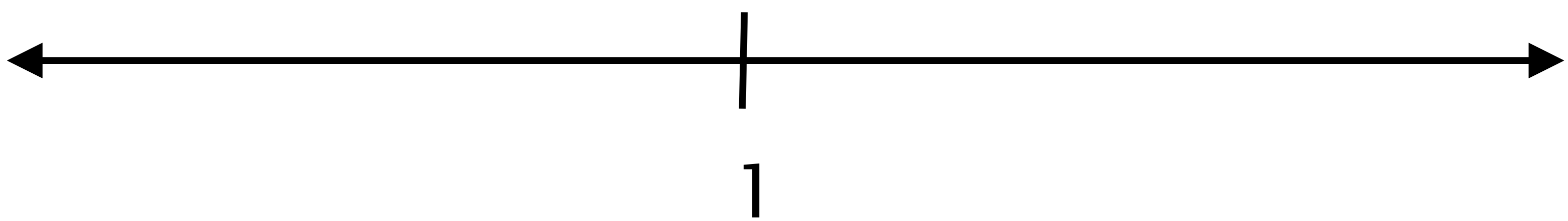
[(-1.3*1.3)^2 * ?]

256

3 13/81 + -11 = -9 13/81

Patti – Questioning to Elicit Student Thinking

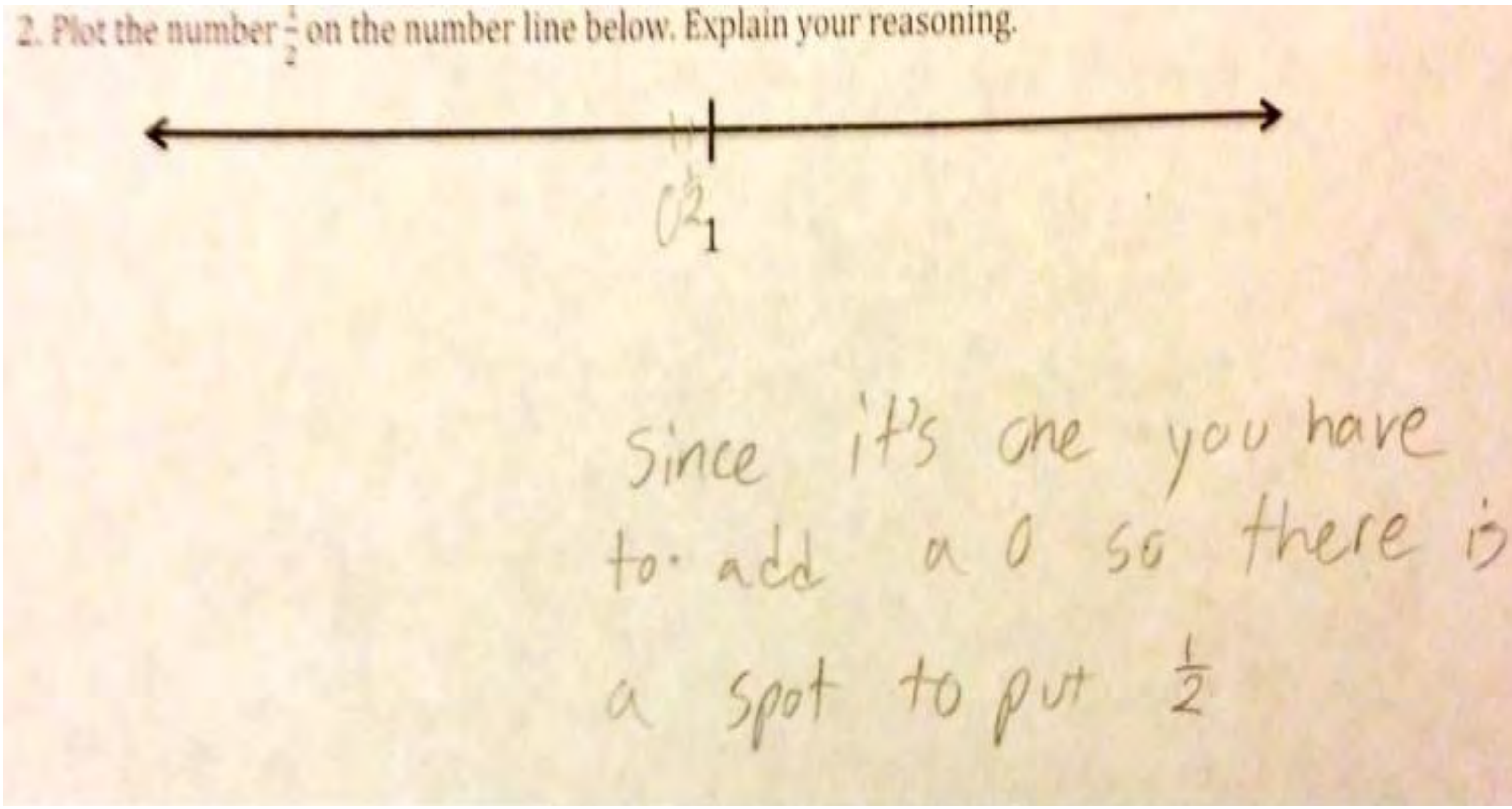
- Question: Plot one-half on the number line. Explain your reasoning.



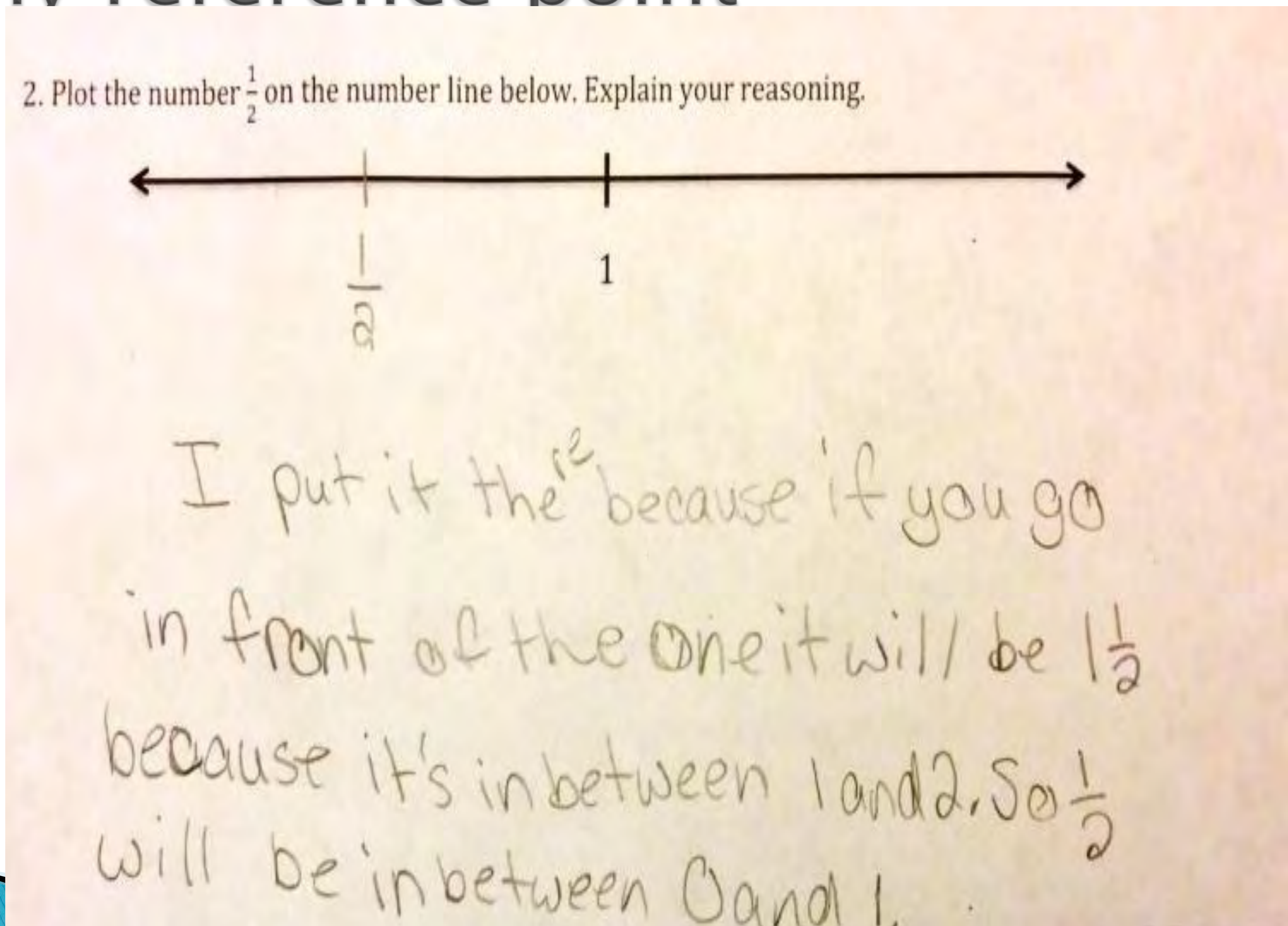
Student Responses:

What the students did	Percent
Included a 0 as a reference and plotted ½ to the left of 1	48%
Plotted ½ to the left of 1 without any reference point	33%
Plotted ½ to the right of 1 without any other reference points	10%
Plotted ½ to the right of 1 with a reference point (usually the number 2)	9%

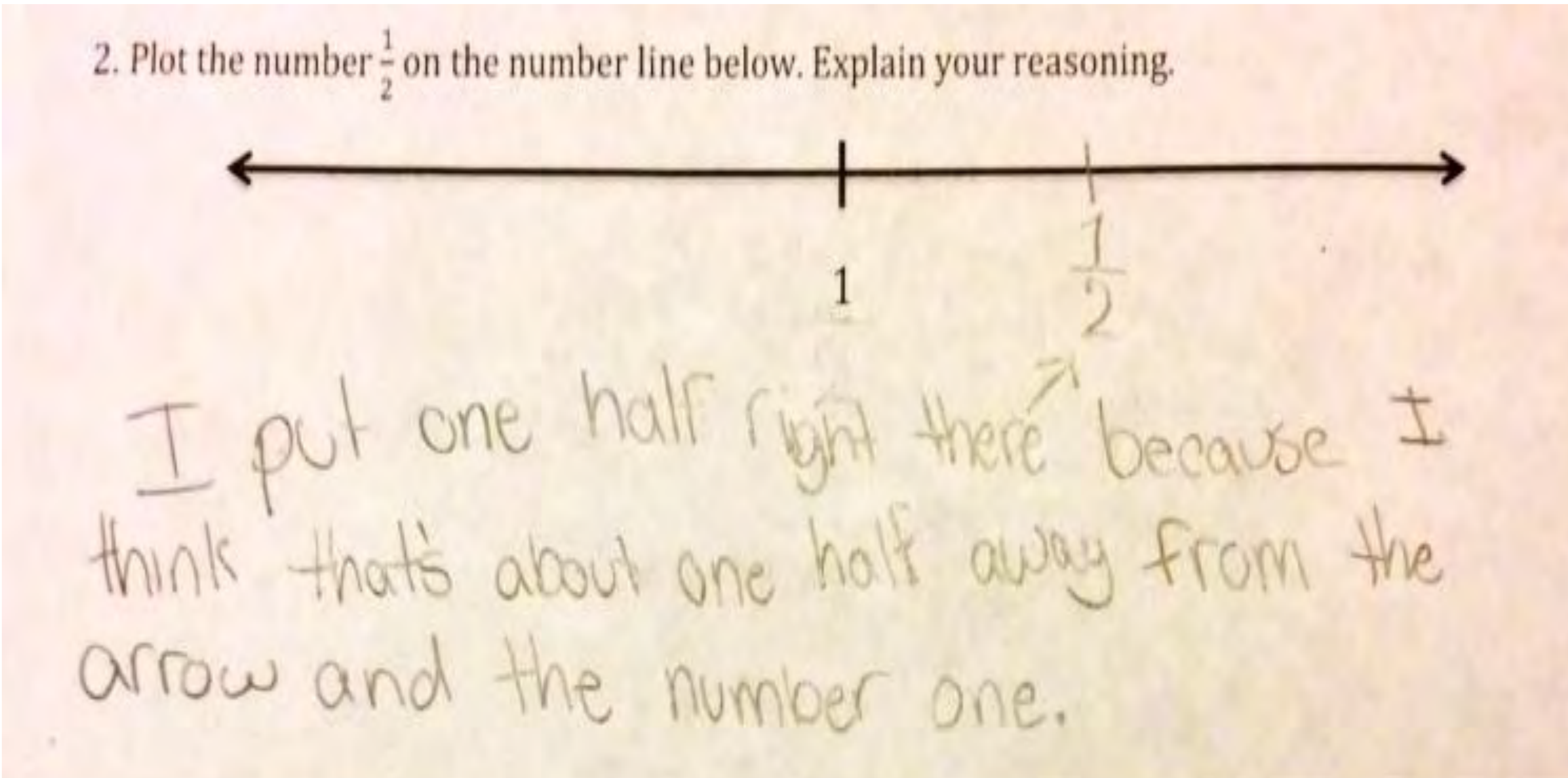
Included a 0 as a reference and plotted 1/2 to the left of 1



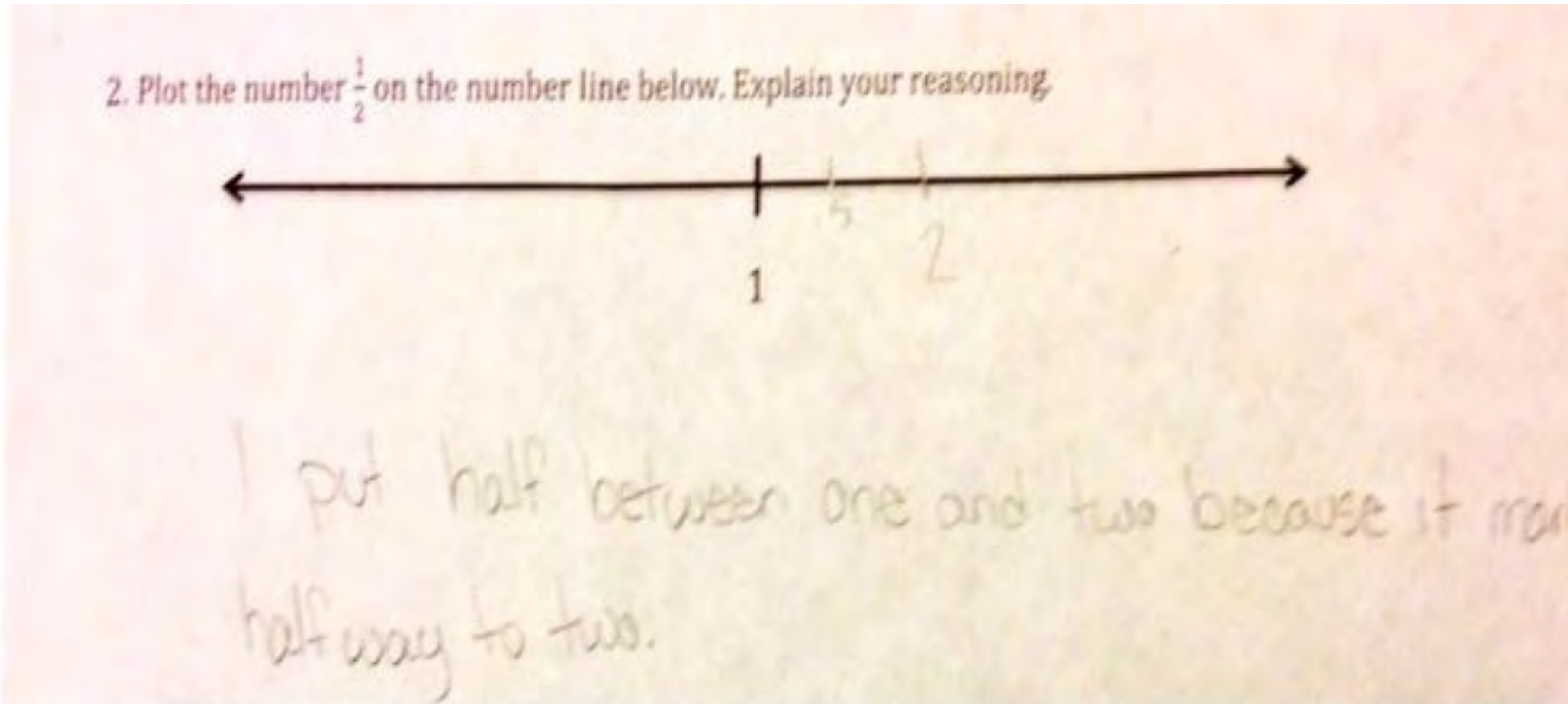
Plotted ½ to the left of 1 without any reference point



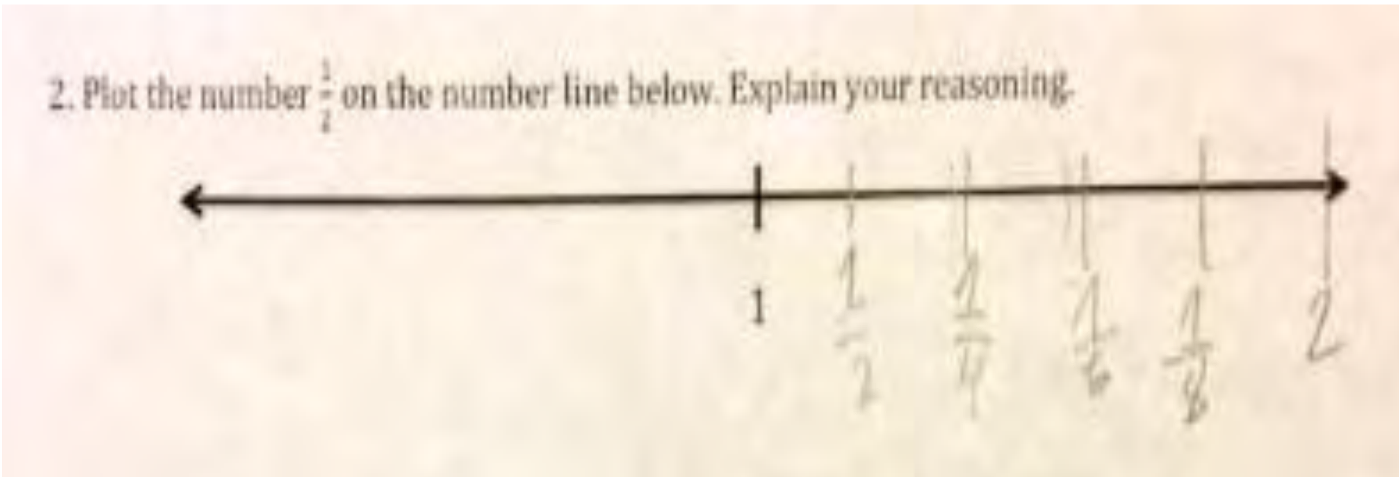
Plotted ½ to the right of 1 without any other reference points



Plotted ½ to the right of 1 with a reference point (usually the number 2)

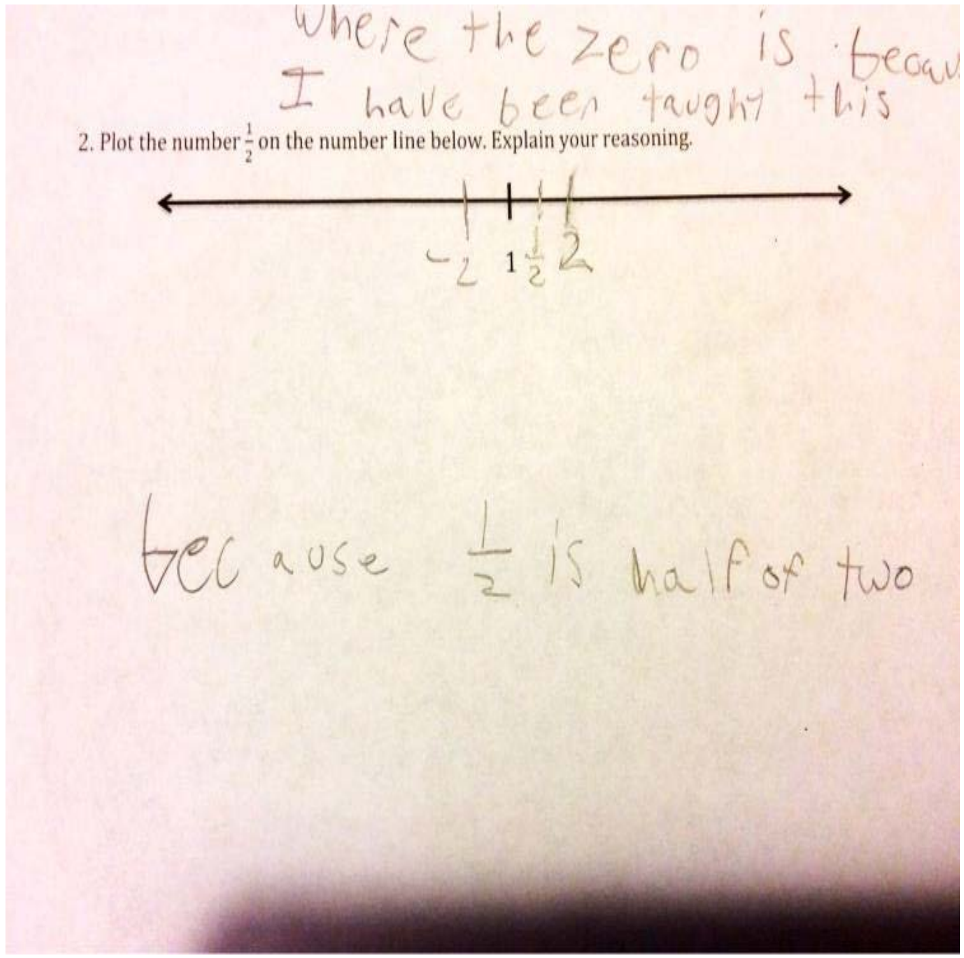


Understands how decimals increase

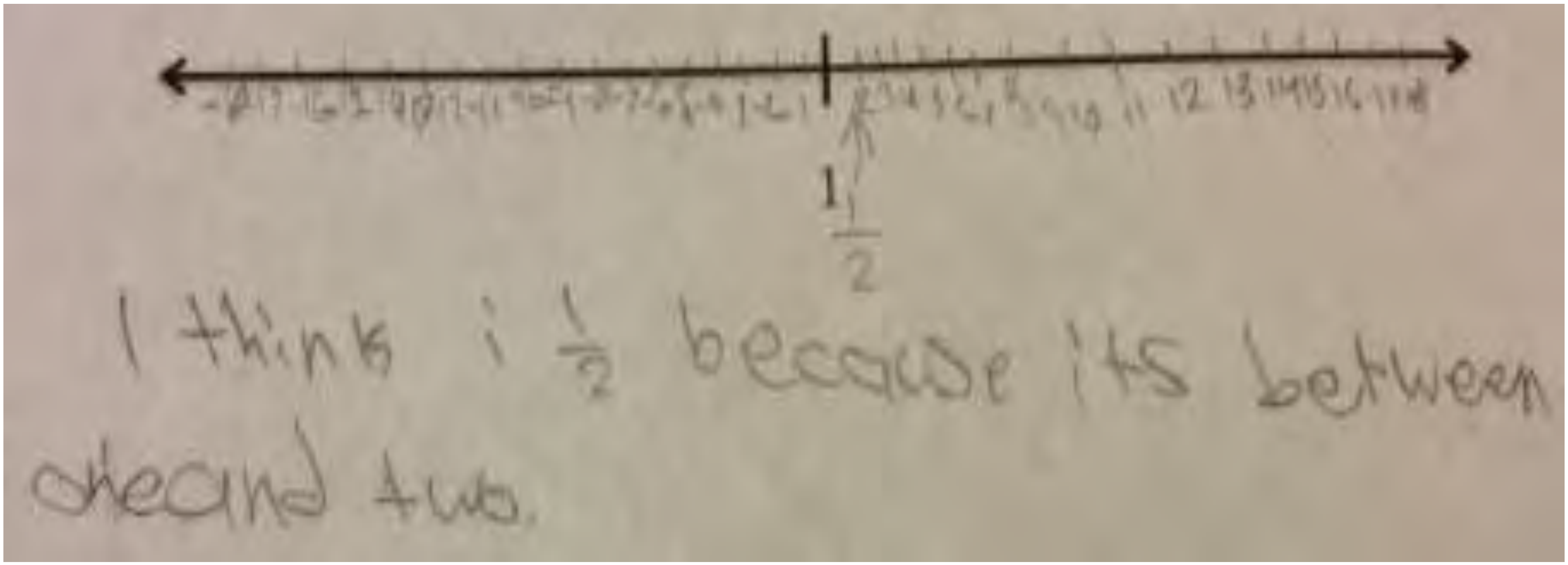


It is because if you were counting to 2 on the line it would go1, 1.2, 1.4, 1.6, 1.8 and 2 so and the distance between the lines is the same amount each time

Understands that 1/2 is 1/2 of something



Understands that 1/2 is between two amounts



Discussion Time: Questions? Comments?

Thank you!

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- Tomlinson, C. A. (2005). *How to differentiate instruction in mixed-ability classrooms* (2nd ed.). Upper Saddle River, NJ: Pearson.
- Carol Tomlinson's website: http://www.caroltomlinson.com/