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| **Steps of Lesson:** **Learning Activities/Key Questions- Minute by Minute**  | **What are students doing? /Expected Responses/ Reactions**  | **Teachers response to student reactions/ Things to remember** | **Goals/Methods of Evaluation/assessment** |
| Step 1.Teacher should clasp their hands and ask students to do the same. A photo can be used, but it should not emphasize the position of the thumbs.  | - Clasping their hands and taking note of which thumb is on top- Wondering what clasping hands is about  | - Assure the correct clasping method was used and then ask who was R-thumbed and who was L-thumbed.- Take a tally (literal tallies-not digits) of the class. And record the total right thumbed and left thumbed students on the board. | * To record the number of right-thumbed and left-thumbed students

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| Step 2.Teacher asks, “Has everyone voted? Can we prove it? How do you know?” | - Counting the number of people in the class and counting the number of tallies on the board * Explaining their reasoning
 | Teacher asks:* What did you count?
* What two things did you compare when you “just counted?”

Teacher asks, “Are we more right- thumbed or left-thumbed as a class? Explain why.” Teacher writes student descriptions – i.e. “8 out of 13 are right thumbed” or “5 out of 13 are left thumbed” or “8 are right thumbed and 5 are left thumbed.” – Teacher summarizes comments, referring to part part and part whole statements | * Students demonstrate understanding through their answers to the “prove it” question.
* Are students explaining the dominant thumb in the class using both parts and wholes?
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| Step 3.The bet: “If one more student walks through the door, would you bet the student would be right or left thumbed? How sure are you, on a scale of 1-10, 10 being positive?  | * In small groups, students will debate/discuss among themselves for 5-10 minutes (may fluctuate)
* Students might suggest that the next student will belong to the more prevalent “thumbness” in the class or students might say the person will be in the other group because they think it should even out
 | - Low confidence -where are you getting that from? Ask students to use the numbers to explain.- Link the confidence to the part part whole ratio  | * Connect the results of the class to the confidence in their bet or to the likelihood of the person walking through the door being R/L thumbed.
* Being able to reference the number of either R or L as it relates to the total surveyed in support of their bet or assumption.

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| Step 4.Pass out a worksheet with “A survey of a previous class showed that they had 15 Left-thumbers and 22 Right-thumbers. Is your class more or less “Left-thumbed” than the previous class? Give evidence for your answer.Teacher should prepare two versions and give out the one that matches the class in terms of being right- or left-thumbed. | -Think-Pair-Share- Students attempt the opportunity on their own-then they will share with a neighborExpected Responses/Reactions:* Uncertainty around how to begin and/or about what makes one class more or less left-thumbed than another
* Adding the R and L to get the whole (37)
* The second class-because there are more L thumbs
* Additive comparison
* Find a percent
* Multiplicative comparison
* Draw a picture
 | -Monitor frustration level and progress to determine amount of time spent individually working on the question- Monitor whether students are considering whether the total of students surveyed in their reasoning? Could it be because there are just more people? -If additive comparisons are being made, teacher can ask, What if the class has 100 students. Would there just be 15 left-thumbers?” Idea is to try to pivot back to its not about the ultimate number as they exist alone, its about the relationship of the quantities as they exist together; the relationship is consistent-the parts are not independent of each other. The part-part-whole work together. - Question to elicit understanding of the quantities as the exist in relation to the “whole”- The instructor should identify students who are employing certain strategies as we are coaching individually. Students who are using informal and/or quantitative reasoning should be identified to show their work- Have students compare, contrast and appreciate various strategies used to arrive at the answer | -Struggle and to persevere while struggling-recognize and re-enforce -For students to understand that part part whole are not independent and when comparing, the total or whole matters-Individual feedback from students as they are working alone-Monitor defense of strategies and explanations in groups or as a class-Students share on board after the individual and group time is over-Identify additive, multiplicative, %, pictures, (multiple strategies) -Able to defend reasoning when challenged |
| Observation Notes for Step 4: |
| **Steps of Lesson:** **Learning Activities/Key Questions- Minute by Minute**  | **What are students doing? /Expected Responses/ Reactions**  | **Teachers response to student reactions/ Things to remember** | **Goals/Methods of Evaluation/assessment** |
| Step 5.Gooberville Arkansas: About how many Left-thumbed people would you expect to find in Gooberville Arkansas, where the population is 4,000? What are the steps/logic that you used to arrive at your prediction? | - Think-Pair-Share - Confusion about whether to use the class totals or the totals from the hand out in step 4.- Larger number should elicit multiplicative comparison- Also be aware of responses and logic similar to the previous question  | - See above- Choose different students who use informal or quantitative reasoning to come to the board to share their responses- Compare and contrast   | -Evidence of multiplicative reasoning - Students able to explain their reasoning-Students able to explain the reasoning of their classmates- Students able to defend reasoning when challenged -See above   |
| Observation Notes: |
| **Steps of Lesson:** **Learning Activities/Key Questions- Minute by Minute**  | **What are students doing? /Expected Responses/ Reactions**  | **Teachers response to student reactions/ Things to remember** | **Goals/Methods of Evaluation/assessment** |
| 1. Closing/Recap:

Pass out reflection, which asks, “Describe one thing you learned today. How did you feel working on the today’s opportunities?Why did you/do you feel that way?”  | - Complete alone first. Go around the room and each student gives a possible response.  | -Ask the class to check each student’s responses - challenge each other to see if what they are saying makes sense to each student.  | - Understand that the quantities that represent the part-part-whole ratio are connected and do not represent quantities on their own and have a consistent relationship with each other.  |
| Observation Notes: |

Materials:

1. Possible picture of thumbs clasped
2. Handout with “Second Class” opportunity (two versions)
3. Handout with “Gooberville” opportunity
4. Chart paper for student responses
5. Reflection sheet- Write one thing you learned today. How did you feel while doing the problems/how they feel now about the problems

Questions to consider:

1. Be aware of difficulty of second question during first lesson for a possible revision. We may want to consider using either multiples of whatever the classroom survey says or close to it. Or even make it more difficult.
2. How do the numbers in the opportunity effect student thinking? Should the numbers be changed?
3. How well did we foresee student responses/reactions?
4. Where there any student responses we did not expect?
5. What were some moments of student confusion?
6. What are some examples of effective questions posed by the teacher?
7. Are all students engaged with each activity? How can you tell?
8. How long did each step take?
9. Describe any moments where the majority of students struggled with an activity?
10. Were the opportunities accessible to students of varying levels (within the same class)? Was there a wide range in the amount of time it took students to complete the activity?
11. What evidence did you see of the lesson itself meeting our goals? Try to give specific examples, using student names when possible.

We want students to be able to Persevere while inventively solving problems

During this lesson, we want students to...

* have the opportunity to be challenged in a situation that is unfamiliar
* inventively solve problems finding their own approach, using their own unique toolbox of understanding including (a) concepts and strategies built in math class, and (b) real world knowledge/math from everyday life (not just money)
* feel (a) capable of bravery, (b) comfortable and committed to trying and making mistakes and (c) assertive towards their own sense-making
* be eager to challenge themselves, both with the given work and seeking further problems and challenges. When they get the answer, they will not just say what's next and want to go on to the next thing - they will say, "What else can I learn from this?"

We decided to target our research lesson on…

Proportional Reasoning & Relationships, with a focus on students recognizing when something is a proportional relationship