Discourse Moves for Measure Review of Invented Measures of Precision: Unit 3
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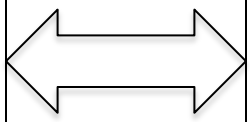
Eliciting a method:

Ask another student to try to describe the method that a student used to find the measure of precision. For each method, alternate between questions in Box 1 and Box 2 to build relations between the procedure itself and the characteristics of the data that each procedure uses to find the measure of precision.

Box 1: Summarizing the method

- "_____, how do you think that _____ tried to find the measure of precision?"
- "Based on _____'s information, what method did _____ use to find the best guess?"
- "Following this method, how do we get the measure of precision?"
- "What is the main idea behind this method?"



Box 2: Identifying which features of the data the method uses

- "What part of the data do these authors think is important?"
- "What do these authors think is important about the data?"
- "What part of the data does this method care about? What part does it ignore?"
- "What about the collection of measurements is important for this method?"

Building collective understanding:

1. Restate that student's hypothesis or have someone else restate the hypothesis to make the hypothesis public.

- "_____ found the measure of precision by adding up all of the differences between each value and the mean."
- "_____, tell us what _____ thinks the method for finding the best guess should be in your own words."
- "Can anyone explain what _____ just said about what these authors think is important about the data?"
- "So you think this method that subtracts the highest and lowest values only depends on the most extreme measurements and ignores the rest?"
- "_____ claims that this method of precision really values that middle clump of measurements."

2. Ask any extension/clarification questions if necessary to help others understand.

- "When you say, "*where the most people had their numbers,"* What do you mean by *most?"*
- "You said to count the "*number of same measurements*." How did you find that number?"
- "What do you mean when you say _____?"
- "I'm not sure I understand what you mean by _____?"
- "How could you give more specific directions so that anyone following your method would end up with the same measure?"

Eliciting a response to the hypothesis:

Ask the authors if that is what they had intended to show, and open it up to other students for opinions.

- "_____, did you intend to use only the repeated values when finding your measure? Why did you make that choice?"
- "_____, do you agree with what _____ said your method cares about?"
- "Can you explain your method to the class? Did your peers understand your method as you intended?"
- "Did this group find the same measure you did when they followed your procedure?"
- "Is that how you were trying to show your measure?"
- "Do you agree with _____ that this method really only uses two data points – the highest and the lowest?"

Connective statements/questions:

Ask questions or make comments to promote thinking about tradeoffs of design choices and which measures would be more informative with particular data qualities. Avoid positioning one method as "better" than another. Different methods might more or less accurately characterize different types of data sets.

- "How does _____'s method, which <u>*only includes repeated values,*</u> give a different best guess than _____'s method, in which <u>*all the values were used?*</u> Which method do you think gives us a more reliable measure of precision?"
- "Let's compare Group 1 and Group 2's methods. What things did they do that were similar?"
- "How is this method like this other one?"
- "How were their methods different?"
- "Which method is the most helpful for _____?"
- "Where do you see _____ in the other method?"
- "Which method is easiest/hardest to understand? Why?"
- "Which method would almost always be a good measure of precision, no matter what and how we measured? Why?"
- "Why do you think mathematicians use different methods for finding the measure of precision?"

Transformation:

*Ask students to apply their reasoning to <u>imagined</u> data points or data sets. The purpose of these questions is to create situations that will **very** clearly show why certain reasoning is problematic when it is generalized to other data sets. Therefore, this requires thinking about how the reasoning is problematic **and** what kind of situation would highlight that problem clearly. Both general suggestions as well as specific types of common problems are addressed below:*

General examples:

- "Will your method work with other data sets? Could anyone use this method by following your description?"
- "What would happen if one of the measurements is out here (outlier)?"
- "Which of these methods would work with other data too? Why do you think so?"
- "What would happen if we used this method on a bigger/smaller set of data?"
- "What if we use this method on a set of data that looks like this ("center" clump is way off to one side or the other)?"
- "What if this was our data (give 5 new numbers in a chosen order) and we used this method to find the measure of precision? Does this value really show what we think that measure should be?"

Problem 1: Students sum differences without finding an average of those differences.

- "What would happen if we used this method on a data set of 5 values that were really spread out?"
- "What would this method tell us about a set of 1,000 values that were tightly clumped like this?" (Illustrate with Tinkerplots or by drawing)
- "What could we do to make the method fair even if the number of measurements is not the same?"

Problem 2: Students propose the range.

- "What would happen if we used this method on a data set that was tightly clumped in the center but that had two poor measurements? Would the range be a good measure of precision/consistency of the measurements?"

Problem 3: Students propose an average deviation (perhaps to make comparisons between unequal sample sizes).

- "What might happen to the average deviation if the data had a few extreme scores, while most of the data was in the center clump?"
- Would the IQR be as vulnerable to the same extreme scores?

Pulling it together:

Teacher makes a brief summary highlighting a "big idea" that students have developed through discussion about the methods. The teacher may want to add something extra to help make this idea salient. Include both points of consensus as well as issues to remain "on the table." Record on an anchor chart.

- "_____'s group considered only repeated values in their measure of precision. Their method helps us get rid of outliers that probably don't represent the true measure."
- "In this method, our best guess is affected by outliers in a very big way. This method might be best to use on data that _____."
- "What I think I hear people saying is that our best guess depends heavily on _____. We might use it most often on data that _____."
- "I think the point we're agreeing on here is that we want to use this method on data like this, because _____."