

Exploring Balance

The following episodes come from a summer school lesson about exploring the idea of mean as the point of balance of a set or data. Rather than have the formula in advance, students were to explore ideas about balance in general and different approaches to finding the point of balance. Activities were designed to support quality interactions, characterized by sustained talk (exploring ideas in depth and at breadth) and reciprocal interactions (responding to, building on, and revising the ideas of others).

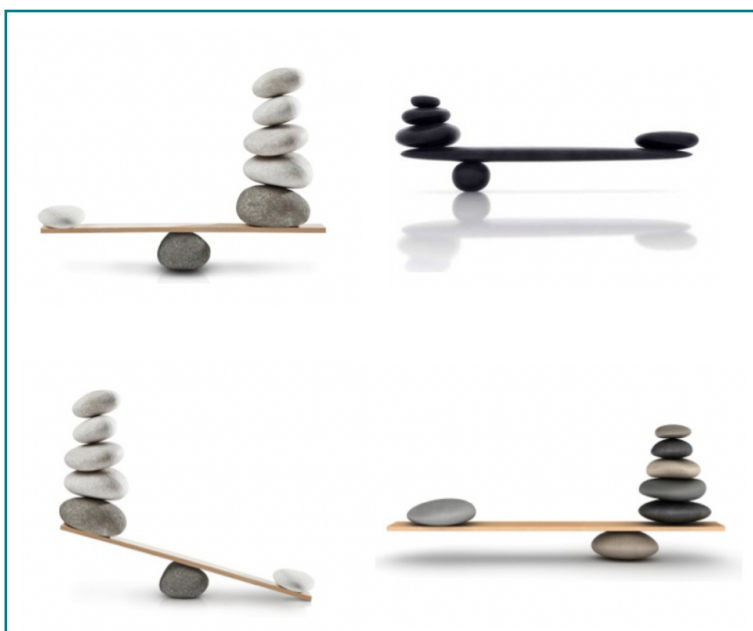
As you read this vignette, please keep in mind the following two questions:

- How are students engaged in quality interactions?
- How do student uses of language develop over time?

Sharing Ideas

Four English Learners worked in pairs in a summer math class, responding to the prompt:

Select one image and decide if you think it is balanced or not. Give reasons why.



Students wrote individually for three minutes.

Teacher: Talk with your partner about your ideas. You're not going to share what you thought, but what your partner thought.

Tina: I think they will all lose balance...

Lola: This was like a trick question. None of them are going to be balanced, none of the rocks seem equivalent. They are all technically balanced, the first one is going to be steady, the rock in the bottom is the middle, and the others are on the sides...

Tina nodded and jotted some notes. The students shared their partners' ideas:

Elena: Brenda says she says the top right would be balanced, because it has less rocks than the other one, so the left side is heavier.

Brenda: She said that the bottom right would be the one that is balance, the rock underneath the bigger amount of rocks is closer, but it was still balanced.

Tina: Lola said she thinks it's a trick question. It will either fall or the first one will balance, because it's the one in the middle, and others are set for failure.

Lola: They are all going to lose balance.

Tina: [Adding on.] I eliminated all of them. I did a little experiment with my pen and my finger, and seeing if it was balancing... and then that was already falling. That's my conclusion.

Transforming Data Together

The students then generated numerical data about themselves and created dot plots, which show in individual values. The idea was that the points of dot plots are like rocks for which they are trying to find the point of balance. In one exploratory activity, a *Step it Up*, Tina and Lola engaged in the following sequence of transformations and talk. The aim was to transform the dot plot to better see the point of balance.

Lola: So there's one square at the value of 4. Then there's one square over the 5, and two squares over the 6 value. Then there's one square on the 8. And there's three squares on top of the nine all above each other.

Tina drew the plot [in pink] Lola described. They began transforming.

Lola: I move this one [8] to the center [7].

Tina: I move this one to here [5 to 6]

Tina: You draw it on the 7? It's in the middle...

Lola: Oh, whatever.

Tina: What about my six?

Lola: You have to draw two then one more.

They drew a new plot in pink and purple and began a new round of changes.

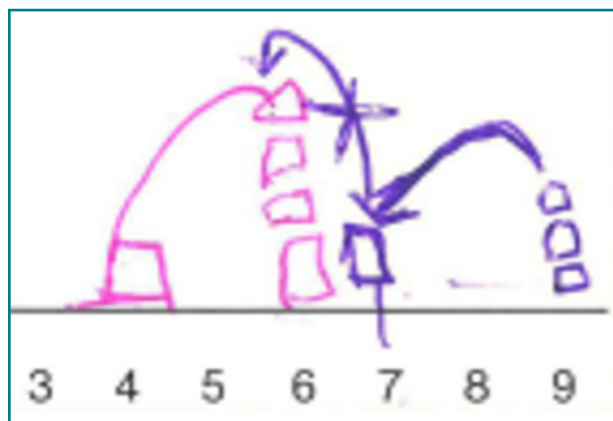
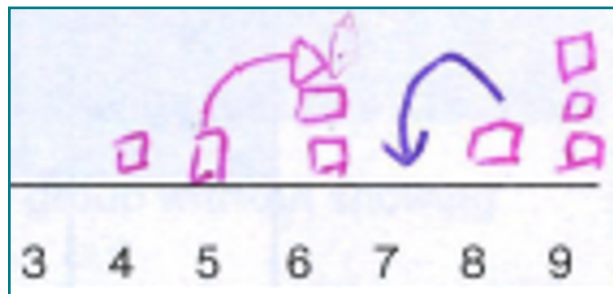
Tina: Can I move two spaces? I am going to move this one [4] to that one [6].

Lola: I am going to move the 7 to the 6.

Tina: Does that balance?

Lola: I guess not... [crosses out move] Let me move the 9 to the 7 instead.

They drew the resulting dot plot. Then they continued to transform data so that the point of balance is easier to see, eventually finding 7 as the point of balance.



Sorting and Labeling

Toward the end of their sorting activity, a different group of three students had constructed a variety of groups of dot plots.

Julia: One on the 6 and one on the 7. [Puts {6, 7} card, next to {5, 8} card]. If you move this [5] one [to the 6] and this one [8] to the 7, then it is the same [as {6, 7}]. (See bottom left of Fig. 3)

Bernardo: [Reviews a card with {2, 4, 4, 6}] And this has two on 4, and there is one on the two and one on the six, and then there are two already so two on each side, and so this center is the 4. It's 4. (See long column on right of Fig. 3)

Julia: Another one on four and another on five. And another on 3. [{3, 4, 5}] So, 4.

Julia: So, I am going to move one of these. [Puts {2, 2, 5} and {3, 3, 3} together] (See top left of Fig. 3)

Teacher: Let's look at these last ones [that Julia moved]. Is there a center of 3? Do you agree? [Julia nods]

Nina: I picked the three [as a balance point] and not the four because it is closer to the heavier side [the {2, 2}]. So, the center is three.

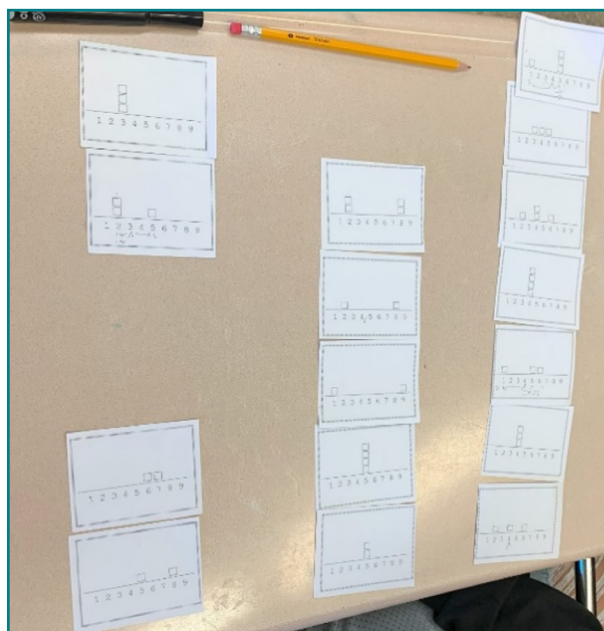


Figure 3. Bernardo, Julia, and Nina Sorted Dot Plots Based upon Point of Balance