Day 1: Ranking Data—The Sneakers Problem

Lesson Overview: The Sneakers Problem involves the task of deciding on the criteria or factors that students would consider in purchasing a pair of sneakers, followed by a ranking of the criteria.

Mathematics Content: The primary mathematics content of this lesson is data analysis, including ranking of data and aggregating ranked data. Other mathematical ideas involved are average and the relationship between totaling the data ranks and averaging the data ranks.

Mathematical Goals: The primary goal of the lesson is for students to be engaged in analyzing data within the context of purchasing a pair of sneakers by generating ranked data and then compiling one class list of ranked data from the group lists of ranked data.

Goals for Classroom Norms: The students are expected to listen to others, ask questions of each other, explain their thinking so that others can understand, and for all students to be involved in the lesson.

Materials: large pieces of paper, markers, masking tape, homework problem about totaling versus averaging

Discussion of Class Activities:

Whole Class: Take about five minutes to introduce the Sneakers Problem. Then have the students generate a list of 8-10 criteria for buying a pair of sneakers. After the list is generated, give directions about ranking the criteria from most important to least important.

Small Group: Allow the students about five minutes to work in small groups to rank the list of 8-10 criteria. As this is not a mathematical aspect of the lesson, encourage the students to work quickly.

Whole Class: Post the lists from the groups as the students complete their work. Once all the lists are posted, have the students make observations about the group lists of ranked data. Guide the discussion so that students see the importance of coming up with one class list—ideally the students themselves will pose this problem. Next, ask students to work in their small groups to develop a strategy for combining the individual group lists into a single class list.

Small Group: Have the students work on combining the group lists into a single class list. In aggregating the group lists into a single class list, the students will likely spend some time looking at how the different lists compare. They may investigate several ideas (including the mode and the mean) as they devise a way to compile a single list. Allow the students adequate time to develop and refine their way of creating a single list. Be sure that the students are using the groups' lists as their data for the new list and that they are not just coming up with their own revised opinion. A primary goal during this time will be to monitor the groups in order to clarify the method that each group is using so that the whole-class discussion can be planfully orchestrated.

Whole Class: Select several groups to share and compare their compiled lists and methods. This should be based on moving from less to more sophisticated ways of reasoning about how to combine the lists. Begin with a group that has used a frequency-based or mode strategy and then proceed to groups that have ranked totals or averages. Groups should present only if their system is different than some other group's system. This, again, will involve sequencing the sharing of the group's solutions so that the discussion moves toward more sophisticated ways of reasoning about the task. Discussions in class should be focused the different methods and the relationships between different methods.

Possible Questions to Ask to Prompt Students' Thinking:
What criteria do you think are important when trying to buy a pair of tennis shoes?
Are any of these criteria the same as other ones we have already listed?
What do you notice about the group lists of ranked data?
How can these different group lists help me in deciding what is important when I go to buy tennis shoes?
How did you consider the group lists when coming up with one list? For example, how did you get the one that is ranked #7?
Do you think your method is a good one? Why?
If one sum is smaller than another one, how could it have a better ranking?
How do you rank criteria that have the same sums?
What question could you ask to help you to better understand this group's way?
Can you give us an example of how your method works?
Should the order of the ranks when using the sum method be the same as the order of the ranks when using the average method?

Assessing Students' Understandings:
What methods are groups using to compile group lists into one list?
Are students using the group lists to compile one list?
If students use frequency methods, how do they deal with difficulties that may arise?
If applicable, do students understand the relationship between totaling ranks and averaging ranks? Do they understand that the order for these two cases will be the same?
Are students able to explain their methods?
Are students able to explain why a certain criterion's total would have a better or worse rank than another criterion's total?

Assessing Students' Interaction With the Problem:
Do students understand the directions?
Do students get bogged down in the context of the problem?

Teaching Notes: The Sneakers Problem involves the task of deciding on the criteria or factors that students would consider in purchasing a pair of sneakers, followed by a ranking of the criteria.

Remember to remind students of classroom norms. Also remind them that when their group uses all the group lists to come up with one list they need to also have an explanation of how they came up with the list.

Check that all the groups' lists have used the same original lists and have used all of the information there.

It is possible that some systems will result in ties. This could lead to a discussion of how to break ties and how they recorded the ties.

It is critically important to monitor the groups' methods and purposefully select the groups that will present and in what order.

The issue of ranking with total versus ranking with average is critical. If this does not naturally emerge by comparing groups' systems, pose this problem either by comparing or using one or the other system and speculating about it relationship to the other.