Day 2: Ranking Rates—The Crime Problem

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, and the notion of rate.

Mathematical Goals: The primary goals of the lesson are for students to be engaged in (a) analyzing the relationship between totaling the data ranks and averaging the data ranks, and (b) analyzing data within the context of the Nashville crime data by generating 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: students' compiled lists for the Sneaker problem, paper with all six compiled lists, calculators, large copies of the first set of data for the Crime Problem, markers, masking tape, newspaper articles*

*View the *Nashville Tennessean* article at:

Hefner, D. (1999, January 3). Police survey rates risk of becoming crime victim. *The Tennessean*, http://www.tennessean.com/sii/99/01/03/survey03.shtml

Also see:

Loggins, K. (1999, January 4). Metro needs judges, police, grand jury says. The Tennessean, http://www.tennessean.com/sii/99/01/04/laworder04.shtml

Discussion of Class Activities:

Whole Class: Take several minutes to have Megan give her explanation about why averaging the data is not needed once the data have been totaled. Lead into the question of whether a ranking obtained by totaling the data ranks is different than a ranking obtained by averaging the data ranks.

Small Group: Allow the students about five minutes to calculate the averages of the data ranks using the six lists, and find the ranking of the averages.

Whole Class: Record the averages that the students calculated for the data. Discuss the relationship between the ranking of the totaled data and the ranking of the averaged data. Move into discussion setting up the Crime Problem by referring to recent articles in the newspaper about crime. Ask students what kind of crimes would they want to have data for if they were moving to Nashville and trying to decide if it was a safe place to live. Generate list of crime categories and

discuss the meaning of the categories. Introduce the Nashville crime data set to students and discuss some particular entries to see if students understand how to interpret them. Have students discuss what it means that these are rates.

Small Group: Have the students work on analyzing the Nashville data set and answering the question of whether Nashville is safe. In aggregating the data, the students may use various methods (mode, mean, total) to come up with an answer to the question. Some groups may use six columns of data (the three columns of violent crime and the three columns of property crime) while other groups will only use the two columns of totals. Allow the students adequate time to develop a way of analyzing the data to answer the question of Nashville's safeness. 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: Depending on time, select several groups to share and compare their systems for analyzing the data. 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:
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?
What number are you dividing by when finding the average of these ranks?
How do we know what order these averages go in?
How would you break a tie between totaled or averaged ranks?
What criteria do you think are important when deciding whether a city is safe?
If you were moving to Nashville, what kind of crimes would you want to know about?
What is the difference between a robbery and a burglary?
What does it mean to say that the murder rate for Atlanta is 12.4?
Where does Nashville rank compared to these other cities?

Assessing Students' Understandings:
What methods are groups using to analyze the data and answer the question?
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?
Are students overwhelmed by the amount of data?

Teaching Notes: The primary goal in wrapping up the Sneakers Problem is to bring out student comments from yesterday regarding no need to average the totaled data since the rankings will not change.

Be sure to introduce the Crime Problem by discussing the current situation in Nashville through recent newspaper clippings. It is important that students understand the differences between the violent crime and property crime categories.

Some students may feel overwhelmed by the data set in the beginning; allow them time to discuss and develop a system of dealing with the data.

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