

### **Day 3: Ranking Rates and Introducing Algebraic Notation**

**Mathematics Content:** The primary mathematics content of this lesson is data analysis, including ranking of data, aggregating ranked data, and weighting ranks. Other mathematical ideas involved are average and the relationship between summing the data ranks and averaging the data ranks, the notion of rate, and symbolizing mathematical relationships.

**Mathematical Goals:** The primary goals of the lesson are for students to be engaged in (a) explaining their systems and understanding other students' systems for analyzing the crime data and deciding on Nashville's safety, and (b) determining how to give some categories of crime data more weight.

**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' lists and systems for the first data set for the Crime problem, calculators, newspaper articles, large copies of the second set of data for the Crime Problem, markers, masking tape

#### **Discussion of Class Activities:**

*Small Group:* Have the students finish their lists for the first set of data for the Crime Problem. Some groups may need to rank the cities and/or add information that will help clarify their system.

*Whole Class:* Have several groups share their systems so that all types of systems are presented. Sequence the sharing of systems so that the discussion moves toward more sophisticated ways of reasoning. Discuss the similarities and differences among the systems; especially have students compare systems which use rankings of rates versus those that use rankings of ranks or rankings of average ranks. Ask groups to represent their processes symbolically. Revisit relationship between a ranking based on sums and a ranking based on average. Introduce the idea of weighting the ranks by asking whether the data should be viewed equally, or if some categories of crime are more important to consider than others. Depending on time, introduce the second set of data using the scenario that the mayor's critics want to compare Nashville to different cities.

*Small Class:* If time permits, have students begin working on analyzing the second set of data for the Crime problem. Encourage students to make use of what they have learned by analyzing one data set and hearing other groups' systems.

#### **Possible Questions to Ask to Prompt Students' Thinking:**

What is your procedure or system?

How is your system similar to this other system? How is your system different from the other system?

In your system, what does a low ranking mean?

How can you use symbols to explain the procedure you used?

What difference does it make if we use the rates or if we use ranks?  
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?  
Where does Nashville rank compared to these other cities?  
How can you make use of what you learned from the other groups' systems?

**Assessing Students' Understandings:**

What methods are groups using to analyze the data and answer the question?  
Are students' analysis methods becoming more sophisticated? Are they using things they have learned through the whole-class discussion?  
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 goals in having groups share their systems for deciding whether or not Nashville is safe is to enable students to understand different solution processes, and to move the students toward representing mathematical relationships symbolically.

Introduce the second data set for the Crime Problem by using the scenario that the Mayor's critics do not agree with the cities chosen for the first data set. Encourage students to think about issues of sampling, but help them see that the size of a city is not an issue since the data are expressed in terms of rates.

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