3-D Molecular Designs
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The Data Dilemma©

Modeling the Scientific Method

The “scientific method” is often taught as sequential progression beginning with (1) defining the problem, (2) forming a hypothesis, (3) designing and conducting an experiment, (4) making observations, and (5) finally drawing conclusions. Although this is a perfectly acceptable way to introduce students to the process of science, it may give them the misconception that scientific investigation is a linear, step-by-step process. You can use the *The Data Dilemma*© to dispel this misunderstanding by creating a simple scenario.

1. Instruct your students to find the large triangular-shaped piece labeled “A”. This piece represents an area of interest or a current “science in the news” topic. We suggest you propose a topic that is relevant to your students in your specific community.

2. Have your students simulate gathering data on their topic of interest by picking out the second large triangular-shaped piece labeled “B”.

3. Students must integrate the topic of interest (piece A) with the data gathered (piece B) to create a testable hypothesis. They model this by creating a common, two-dimensional geometric shape. NOTE: a triangle, parallelogram or square may be created using these two pieces.

4. Pose the following question: “How do scientists determine which path they will take in further investigations when it appears that there are multiple explanations to explore?”

5. Have students continue their “research” in an undergraduate lab while in college, and discover data pieces “C”, “D” and “E”. Students must integrate all FIVE pieces into a common, two-dimensional geometric shape. NOTE: Students may experience frustration at not being able to immediately solve the puzzle. Take the opportunity to guide your class in a discussion about the frustration that scientists often experience in their research. Identify some of the characteristics an individual would need in order to become a successful scientist. You may wish to comment on the collaboration or competition that may occur between science laboratories, as some students succeed in solving the puzzle while others are still struggling.

6. Have students imagine that they have earned their PhD and are running their own lab. A graduate student working in their lab presents a piece of data that does not seem to fit the current model. Ask your students about what should be done with the new data.

7. After multiple trials, the new data persists. The data cannot be ignored! Have students integrate all six pieces into a common, two-dimensional geometric shape. NOTE: Students will discover that the old model must be abandoned in favor of one that allows the incorporation of a new data piece.