Modified Lesson #2: Relations

Goals

Lesson Goals

1. The student will identify and represent two-dimensional relations on the Real numbers as an *extensional definition* (a set of ordered pairs), graphically (as a set of points on a coordinate system), in table or T-chart form, and as a pictorial *mapping* (oval diagrams).
2. The student will identify and construct the domain and range of a relation. The student will locate the domain and range in an extensional definition, on a graph, in a table, and in a mapping.
3. Given a relation, the student will identify the inverse and any non-inverses of that relation. The student will construct inverses from given relations. The student will construct relations from inverses. The student will recognize patterns between relations and their inverses in extensional definitions, graphs, tables, and mappings.

State Standards

6.11.a. The student will identify the coordinates of a point in a coordinate plane.
6.11.b. The student will graph ordered pairs in a coordinate plane.
7.12. The student will represent relationships with tables, graphs, rules, and words.
8.14. The student will make connections between any two representations (tables, graphs, words, and rules) of a given relationship

The Five ‘E’s

Engage

1. What activity will I use to stimulate curiosity and activate prior knowledge?

Summary	Students will create a T-chart consisting of ages and heights of students in the class.
Directions	The students will record their age (accurate to the month) and height (to the inch) on a T-chart. Ages can be represented by X and heights can be represented by Y.
Justification	The T-chart will serve as the introduction to ordered pairs. Students will begin to grasp the concept of an ordered pair, and that the x and y values are “linked.” This activity has connections to subsequent knowledge. Teachers in statistics classes can use this data to explore measures of central tendency.

2. What tools and materials are needed for this activity?
Tape measure; chart paper; graph paper; markers; colored pencils.

3. What prior knowledge do I want to activate?
Measurement; significance and accuracy; rounding; ordering of Real numbers.

4. What nonconceptual vocabulary do I need to preteach?
Ordered pair; coordinate; value; relation.

Explore

1. *What concepts will students explore?*
   Relations; ordered pairs; graphing points; T-charts; pictorial mappings; inverses.
2. *What activity will I use to encourage students to explore the concepts?*

Summary	Students will create multiple representations of the data they gathered in the Engage phase.
Directions	The students will choose the order in which to place the (age, $height$) pairs. They will list all the ages, thereby describing the *domain*, and list all the heights, thereby describing the *range*. The T-chart can serve as the *extensional definition*. The students will plot these points on a graph and construct *mappings* of ages to heights. The students will repeat this process with the ages and heights reversed, thereby constructing the relation's inverse. Students will explore the relationships and patterns between a relation and its inverse, using T-charts, graphs, and mappings. (To be continued in the Explain phase.)
Justification	Note that when the students choose the order of data points, they are choosing the relation—be it the "standard" relation or its inverse. The students may write, draw, use small stickers, or use any other manipulatives to plot the points. The students may derive their own "rules" for the graphs and mappings. Some advanced students may question why multiple points can have the same x-coordinate (a segue to *functions*). The graph can be either on chart paper for the class, or on individual graph paper. It is important to make clear that this is not a line chart or bar chart, but simply a set of points. The use of color, stickers, or construction paper allows the students to be creative and expressive with their work and helps with the process of memory recall.

3. *What tools or materials will allow students to become directly involved in exploring the concepts?*
   Chart paper; graph paper; rulers; markers; colored pencils; scissors; stickers.
4. *What vocabulary and symbols do students need for this phase?*
   Relation; domain; range; inverse; table; axis; mapping.