REASONING ABOUT A GRAPH OF MOTION AND A STORY: HOW MULTIPLE RESOURCES MEDIATE INTERPRETATIONS OF HORIZONTAL SEGMENTS

William Zahner, Judit N. Moschkovich, and Tamara Ball
University of California, Santa Cruz

This study builds on previous work on student interpretations of graphs (Bell & Janvier, 1981; Leinhardt, Zaslavsky, & Stein, 1990). We use a sociocultural perspective on mathematical reasoning to describe how four pairs of eighth-grade students interpreted horizontal segments on a distance versus time graph (see Figure 1) using a story about a bicycle trip. While students shifted between two interpretations (moving and not moving) of the three horizontal segments above the $x$-axis (segments $a$, $c$, and $g$), pairs consistently interpreted segment $e$, located on the $x$-axis, as representing the biker not moving (with one exception).

1) This graph shows the distance a biker went during a bike trip. Tell the story of this bike trip. What happened during the trip?
2-3) When is the biker making the most (least) progress or covering the most (least) distance? How do you know?
4) When does the biker stop? How do you know?
5-6) When is the biker going at a slow (fast) and steady speed? How do you know?

Figure 1: The graph and some of the questions students answered. Designed by J. Moschkovich using Investigations (TERC, 4th grade, Graphs) and questions from Connected Mathematics Project.

The analysis draws on recommendations made by Smith, diSessa, & Roschelle (1993) for analysing student conceptions as valid and context-dependent rather than as misconceptions. Following these recommendations, we examine how students shifted among alternative interpretations of the horizontal segments depending on the affordances and constraints of the mediational means and describe how the location of segments on the graph and the order of the written questions in the problem mediated student interpretations.

References