Graphing a Flag Hoist
Explore Themes in Student Thinking

In this video, students raise a number of different ideas about how to interpret graphs. Here we highlight two themes that come up repeatedly in the video and that we think illustrate important ways that students attempt to make sense of the relationship between real-world situations and graphs.

Theme 1: Representing the Passage of Time Along the X-Axis
Key to interpreting the graphs in this activity is the idea that as the flag is hoisted the height of graph increases. Closely related to this is another idea — that the passage of time is represented by movement of the graph along the x-axis. Several students seem to recognize this relationship, claiming that Graph (f) does not make sense because the height of the flag increases but no time passes. For example, Jesse says that "it didn't take any time to go up." Later, when discussing Graph (c), Jennifer explains that the flat parts of the graph means that the height of the flag did not change for some amount of time. She states, "the flag stays but time moves a little." These students clearly understand the relationship between the passage of time on the x-axis as it relates to changes in the height of the graph.

Other students in the video may not be as comfortable with this idea, particularly as it relates to Graph (f). Instead, they may believe that a vertical line represents a very short passage of time. Graph (f) is possible then, if the flag is hoisted almost instantaneously. Brian may be thinking of this when he suggests that Graph (f) illustrates a flag hoisted as the boy scout jumps off the top of the flag pole and "pulls [the flag] straight down." This idea isn't quite right though — if the flag were raised instantaneously, the graph would consist of a single point at the final height of the flag, and not as a vertical line. Perhaps graph (f) would represent the passage of time if we were to interpret the time represented on the x-axis as spanning a period of several days. In that case, the time required to raise the flag would be a small fraction of the whole and the corresponding graph might appear to be vertical.

Theme 2: Representing a Physical Situation Graphically
Students in the video make a number of connections between the physical motion of hoisting a flag and the graphs provided. One connection made by several students is that changes in the shape of the graph reflect changes in the speed at which the flag is hoisted by the boy scout. Robin, for example, observes that Graph (b) represents someone who started pulling very fast "because it starts out really steep" and then got tired because "it sort of flattens out." Another connection relates to the relationship between the shape of the graph and the boy scout's hand motions. Several students demonstrate a possible hand-over-hand movement when discussing the motion represented by Graph (c). Similarly, some students discuss the shape of the graph as representing a smooth motion versus a more "jerking it up" kind of motion. In doing so, these students are exploring the meaning of steepness and making important connections between constant and changing slopes.

A different way to connect the graph to the physical motion is to reason about the kind of flag that might be represented in a particular graph. For example, in discussing Graph (f), some students argue that it illustrates a boy scout hoisting a "really long" flag that is "the length of the pole." As John explains, the flag is at "the bottom and the top at the same time." These students

seem to interpret Graph (f) as illustrating a flag that is at all heights at the same time, thus represented by a vertical line. Rather than connect Graph (f) to the motion of the boy scout, these students make sense of the graph by picturing the flag itself.

