<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Example</th>
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| LP            | Accepting the assumption that student thinking can be characterized by LP level | • She’s a level 4 student. [Aaron, Interview 3]  
• Okay, so everyone on level 3 is associating net force with speed per the table that we looked at earlier. [Ethan, Interview 5] |
| Theory-like   | Expressing the assumption that student thinking is consistent and theory-like (independent of the LP) | Not observed                                                                                                                                 |
| Whole LP      | Treating the LP as if it is made up of columns (i.e., student thinking about small areas within FM is consistent and can be described by levels) | • And if I organize them into question types, it shows me that it’s the no force questions that he struggles with... He’s a solid three across the line. But the reason his probability was way low is because of his no force. [Aaron, Interview 3]  
• Is the student developing, you know, kind of a, I don’t know what the word would be – a bifurcate[d] understanding? Are they understanding a lot about one thing and just not getting it about another thing? [Ethan, Interview 5] |
| LP levels     | Treating the LP as if individual rows are divisible (i.e., each level is comprised of ideas that students may or may not understand) | • Okay, so there must be a piece or component of this that he’s missing if he’s not a level four. So... why don’t I look at some of his level three responses and see why he’s not picking four, maybe. [Julia, Interview 2]  
• Here’s a level 2. It’s not an impetus question, so that’s what I’m seeing is that [impetus] seems to be the largest level 2 problem. Whereas the other level 2 problems, which are if there’s no motion there are no forces acting on it, it seems like that’s not as big of a deal... [Tim, Interview 2] |
| Smaller than LP| Treating the LP as if it is made up of individual cells or units of unidentifiable size (i.e., the conceptual terrain of FM consists of ideas – smaller than levels – that students may or may not understand) | • [Reading an item option] “Speed is decreasing because there’s no force acting on the side of the puck.” We don’t have the frictionless concept down. [Ethan, Interview 2]  
• [The item-level score report] gives me an idea about what the questions are so it allows me to get an understanding of what pieces of the puzzle are missing for the student. [Henry, Interview 2] |
| Misconceptions | Expressing the assumption that student thinking can be characterized by “misconceptions” (specific incorrect ideas that are applied across contexts) | • So he’s thinking that you need a force to keep things moving. [Julia, Interview 3]  
• So this would tell me that overall there seems to be an issue with the impetus idea. [Tim, Interview 2] |
| Context-Dependence | KiP: Expressing the assumption that students have p-prim(s) (diSessa, 1993) that are invoked in different situations | Not definitively observed; however, we noted passages that suggested this perspective |
|               | not KiP: Expressing the assumption that context influences students’ responses (without explicitly identifying a knowledge element that could be identified as a p-prim) | • It looks like they have an easier time applying the theoretical if I take it... out of their experience. If I can say a rocket in space, then, “Oh, well, he said that it’s going to be this, this, and this, so I’m going to apply these rules.” But if I am putting it into something that they’re used to having knowledge about, like pushing a car on a frictionless surface... They’re going to go, “Well, I don’t know if there’s really no frictionless so if I stop pushing the car, it will eventually slow down and come to a stop.” And that’s their life experience. [Aaron, Interview 7]  
• So it’s interesting to me that when it’s on a table... they don’t recognize that gravity is acting on it. But when it’s in the air, they recognize that gravity is acting on it. [Tim, Interview 2] |