

**Table 1***Codes Used to Describe Teachers' Treatment of Student Thinking*

<b>Code</b>	<b>Description</b>	<b>Example</b>
LP	Accepting the assumption that student thinking can be characterized by LP level	<ul style="list-style-type: none"> <li>• <i>She's a level 4 student.</i> [Aaron, Interview 3]</li> <li>• <i>Okay, so everyone on level 3 is associating net force with speed per the table that we looked at earlier.</i> [Ethan, Interview 5]</li> </ul>
Theory-like	Expressing the assumption that student thinking is consistent and theory-like (independent of the LP)	Not observed
Whole LP divisible	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)	<ul style="list-style-type: none"> <li>• <i>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.</i> [Aaron, Interview 3]</li> <li>• <i>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?</i> [Ethan, Interview 3]</li> </ul>
LP levels divisible	Treating the LP as if individual rows are divisible (i.e., each level is comprised of ideas that students may or may not understand)	<ul style="list-style-type: none"> <li>• <i>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.</i> [Julia, Interview 2]</li> <li>• <i>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.</i> [Tim, Interview 2]</li> </ul>
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)	<ul style="list-style-type: none"> <li>• <i>[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.</i> [Ethan, Interview 3]</li> <li>• <i>[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.</i> [Henry, Interview 2]</li> </ul>
Misconceptions	Expressing the assumption that student thinking can be characterized by "misconceptions" (specific incorrect ideas that are applied across contexts)	<ul style="list-style-type: none"> <li>• <i>So he's thinking that you need a force to keep things moving.</i> [Julia, Interview 3]</li> <li>• <i>So this would tell me that overall there seems to be an issue with the impetus idea.</i> [Tim, Interview 2]</li> </ul>
Context-Dependence	<b>KiP:</b> Expressing the assumption that students have p-prims (diSessa, 1993) that are invoked in different situations	Not definitively observed; however, we noted passages that <u>suggested</u> this perspective
	<b>not KiP:</b> Expressing the assumption that context influences students' responses (without explicitly identifying a knowledge element that could be identified as a p-prim)	<ul style="list-style-type: none"> <li>• <i>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.</i> [Aaron, Interview 7]</li> <li>• <i>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.</i> [Tim, Interview 2]</li> </ul>