# Leveraging Students' Intuitions: An Exploration of the Progress of Student Thinking about Mechanical Waves Lisa M. Goodhew<sup>\*</sup>, Amy D. Robertson<sup>†</sup>, Paula R.L. Heron<sup>\*</sup>, Rachel E. Scherr<sup>†</sup> \*University of Washington, Seattle, WA †Seattle Pacific University, Seattle, WA

## How might students' conceptual resources contribute to the progress of their thinking?



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When we asked this question to many introductory physics students (N=446), we found **two prevalent resources**:

> Treating a pulse as a macroscopic object moving through a medium whose properties determine its speed.

Treating a pulse as a propagating local disturbance.

*"If the string were a bunch of humans,"* because we're doing a wave in a stadium, if none of the people are ready to do the wave... there's a time it takes to communicate the idea that...we're doing a wave now, so it kind of goes slowly."

"An 'un-tense' road is kind of wavy. You're gonna slow down at the turns. If you add tension, the road becomes straighter and you can just

"If we look at everything really, really, small...a string that is not completely tense will have points where it's just kind of floating there, and it will take more energy to move those than something that's kind of ready to move."

"Now to try and explain that without any, without music, because music seems to be a really easy answer, how that works, um...okay! Let's use

Reconciles her initial intuition about flicking the string harder with her answer that the tension affects the speed: when you flick a string "harder," you actually pull back and increase the tension, which is why the pulse moves faster.



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"If you're doing a wave while holding hands with a bunch of people, um, you don't know they're pulling on your hand until they're actually doing their side of the wave...unless you guys are all stretched out and you can clearly feel every time a person moves just a bit, because you've got nothing else, nowhere else to go, but move with them."

> "[One piece of the string] is moving up so I [another piece of the string] need to move up also. But, there's a bit of a delay, and the delay is larger because the string is relaxed, because the connection's bad. Like, they're not as tightly connected."

### **After this excerpt:**

Resources are integral to the student's thinking throughout the interview and play a role in the development of her ideas during the course of the interview.





#### **Resources play a role in:**



 Voicing intuitions about pulse propagation and the role of tension.

 Articulating a mechanism by which tension affects the speed of a pulse.

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