PRESENTER: **Lisa M. Goodhew**

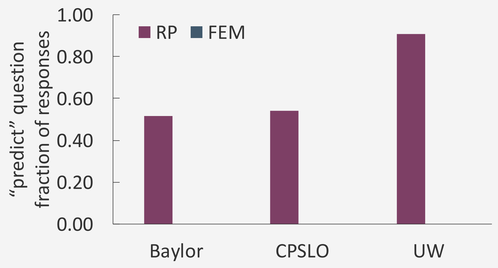
MOTIVATION

Resources theory [1-3] predicts that student thinking is context-sensitive, but does not tell us what features of the context matter for activation of particular resources.

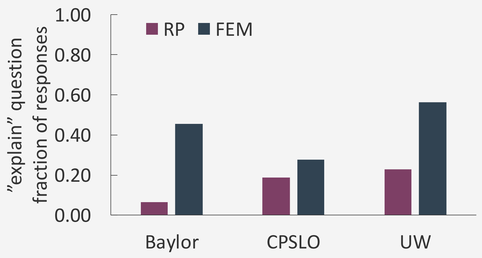
RESULTS

Question style is an important feature of the context for resource activation:

A question that asks students to ***predict*** the outcome of an experiment elicits ***rules or procedure-based resources.***



A question that asks students to ***explain*** a phenomenon elicits ***rules & procedures*** and resources for ***force, energy, and motion.***



METHODS

We constructed and iteratively refined a coding scheme to characterize the different kinds of conceptual resources for superposition and reflection students used to answer two questions about mechanical pulse reflection.

IMPLICATIONS

Assessments using only "predict" may not give students ample opportunity to demonstrate their ability to use the fundamental physics ideas of force, energy, and motion to sense-make.

A predict-style question about pulse reflection elicits rule-like responses, whereas an explain-style question elicits both rule-like *and* mechanism-like responses.

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Students' context-sensitive use of two kinds of conceptual resources for mechanical wave reflection

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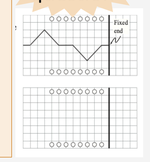
QUESTIONS

"Predict" question

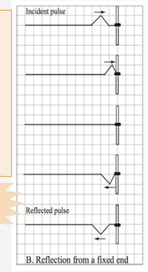
Which cups will be knocked over during reflection? Explain your reasoning.



The *cups* question.

"Explain" question

Why do pulses reflect on the opposite side of the spring at a fixed end?



The *reflection mechanism* question.

The third cup from the right side is knocked down because the 1st pulse is inverted after a fixed end and has superposition with the 2nd pulse to do.

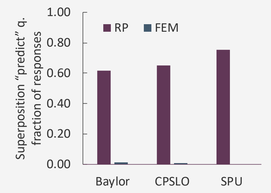
From adding the blocks up (positive = + and negative = -, like 2+2=4 and -2+-2=-4 blocks)

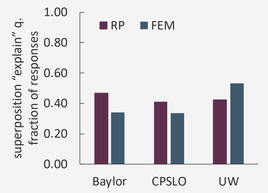
Because the string is attached to the wall, it pushes on the wall once the wave reaches it. The wall pushes back on the string with an equal and opposite force, which causes the wave to be reflected on the other side…

The pulse on a string with a fixed end transfers the energy from the pulse into the…fixed end. The energy that remains is sent through a reflected pulse on the opposite side (creates the potential for a standing wave).

As a pulse reaches a fixed end and tries to move the end in the direction of transverse displacement, there is a large acceleration in the opposite direction, initiating a pulse on the opposite side of the string.

Preliminary analysis suggests that similar patterns emerge in other wave mechanics contexts:





REFERENCES:
[1] D. Hammer, A. Elby, R. E. Scherr, and E. F. Redish, Resources, Framing, and Transfer (Information Age Publishing, Greenwich, Connecticut, 2005).
[2] D. Hammer, Am. J. Phys. 68, S52 (2000).
[3] B. Harrer, University of Maine, 2013.

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