

Investigating the influence of assessment questions on student epistemological resources in physics

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A Challenge for Physics Assessment

When students complete assessments, they often do so in ways that seem absurd...

... from the perspective of instructors and researchers.

P. Hutchison, D. Hammar (2009)

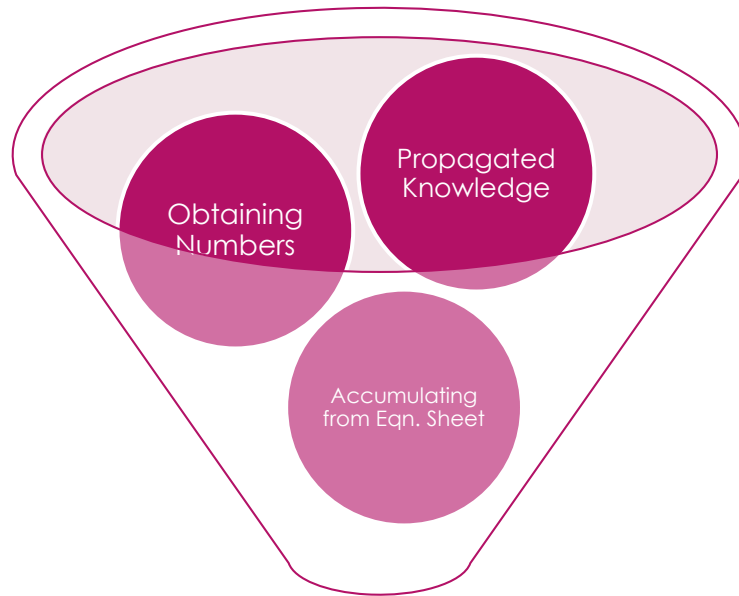
Our Hypothesis

Students are sensibly engaging in the assessment based on their understanding of what they are supposed to be doing.

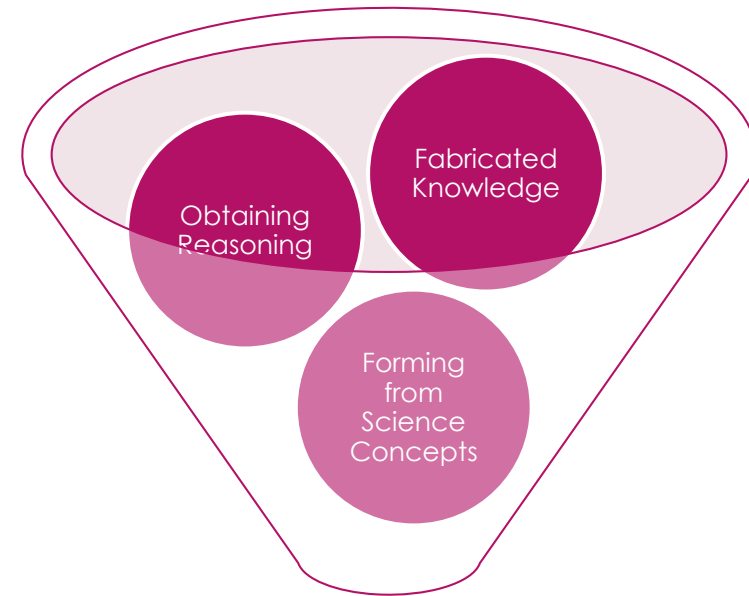
We refer to this as “epistemic framing.”

Example: Restaurant Frame

Theoretical Framework: Resources and Frames



Epistemic Frame X



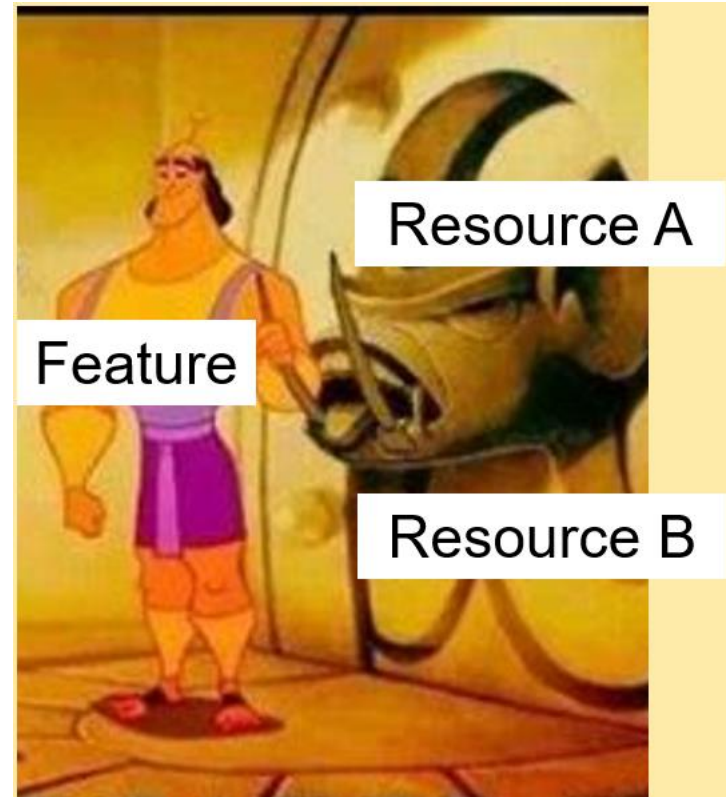
Epistemic Frame Y

Using Epistemic Framing

- ▶ Instructors send messages about what epistemic resources are appropriate to use (S. Rosenberg (2006))
- ▶ Activities are most productive when students are framing the activity as intended by the instructor (P. Hutchison, D. Hammer (2009))
- ▶ **We may be sending inappropriate epistemological messages with our assessments**

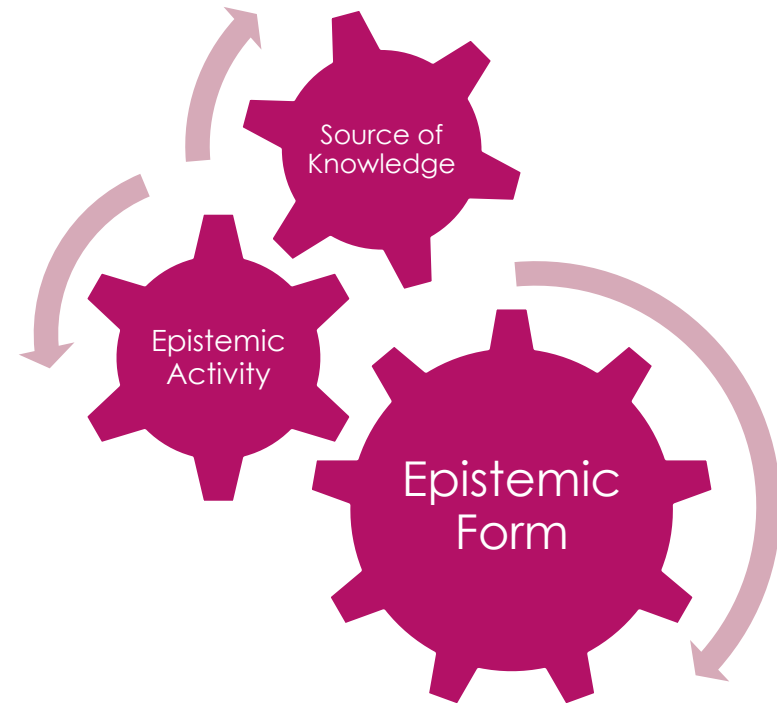
Our Theoretical Claims

1. Assessment features send epistemological messages about which specific knowledge building resources are appropriate to use.



Our Theoretical Claims

2. This shift in resources can result in a shift of frame.



Testing Our Claims

“...Assume the Ferris wheel is rotating with angular **velocity ω** and the **diameter of the wheel is D** . At what point in the motion does the rider feel ‘heaviest’ and ‘lightest?’”



Assessment Feature:
No numbers

Results- Lisa

Statement- Lisa	Resources
Consider a Ferris Wheel... a nice colored picture, wow. A Ferris Wheel is this thing. The seat can freely rotate. Assume the wheel is rotating. At what point in the motion does the rider feel heaviest and lightest? Um... (picks up equation sheet) Where's centripetal force? (Writes down centripetal force equation) Hm... (looks at problem)	Nature of Knowledge: Propagated Source of Knowledge: Problem and Equation Sheet Epistemic Activity: Accumulating Epistemic Form: Number
...not given any numbers. It's just weird to me because it seems like nothing is changing. I mean, this is just going to be D over 2. The mass of the person isn't changing. Angular velocity is not changing. Um... (Looks at equation sheet) All I'm thinking about is that your potential energy is going to be the highest when you're at the top, lowest at the bottom, so I think those are going to be the points at which you're going to be feeling heaviest, and those are the points... I don't know why I'm thinking this but I just keep thinking of a clock and a pendulum swinging or anyone being on a swing and your... the points where you feel like you're accelerating the fastest are the ones where you're crossing this vertical axis. But I couldn't tell you why.	Nature of Knowledge: Fabricated Source of Knowledge: Self Epistemic Activity: Forming Epistemic Form: Reasoning

Shift in Frame

Shift in Resource

Results- Jack

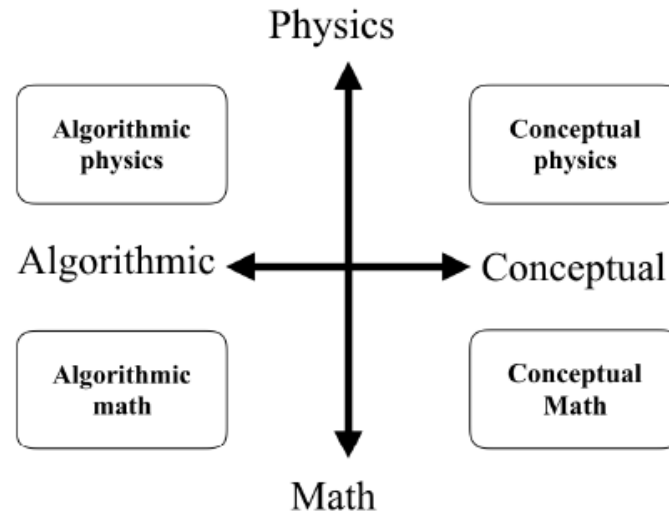
Statement- Jack	Resources
We'll see, the angular velocity equation. I should look for the angular velocity equation. I should, yeah. (Flips through equation sheet) It's this one. Moment of inertia. Um, it doesn't tell you the mass.	Nature of Knowledge: Propagated Source of Knowledge: Equation Sheet Epistemic Activity: Accumulating Epistemic Form: Number
So, I guess because this is a conceptual question. I am going to guess, for that, um, okay, so the greatest force you would be feeling (points upward) since you're going up, that means you would feel the lightest at the top, and the heaviest at the bottom. Because, like, you're going, accelerating faster at the bottom, and your mass is the same, so like the force would be greater at the bottom than it would be at the top. Because you're accelerating faster at the bottom than at the top. So, yeah, that's my answer.	Nature of Knowledge: Fabricated Source of Knowledge: Self Epistemic Activity: Forming Epistemic Form: Reasoning

Shift in Frame

Shift in Resource

Future Work

- ▶ Find more assessment features that activate resource shifts
- ▶ Better define frames (D.N. Chari et. Al. 2017)



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