

# Assessing a Wide Range of Instructional Goals for K-12 Teacher Professional Development

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# Assessment

The Energy Project values  
many instructional outcomes  
that are hard to assess...

...and we want to learn how to  
systematically assess these outcomes.

# Instructional outcomes we value

## Growth in K-12 teacher:

- Responsiveness
- Perception of science as flexible and constructed  
Noticing, interpreting, and responding to/
- Perception of self as participant in scientific community  
Taking up student thinking as part of science
- Energy-related pedagogical content knowledge

# Instructional outcomes we value

Growth in K-12 teacher:

- Responsiveness

Noticing, interpreting, and responding to/  
taking up student thinking as it arises during  
instruction

# Why do we value teacher responsiveness?

- Aligned with a view of science as the “refinement of everyday thinking”<sup>1</sup>
- Aligned with theory about how people learn<sup>2</sup>
- Distributes authority for assessment<sup>3</sup>
- Called for by current science education reforms<sup>4</sup>
- Correlated with student learning<sup>5</sup> and attitudes<sup>6</sup>

<sup>1</sup>D. Hammer and E. van Zee (2006); D. Hammer (2006); Learning Progressions Project (2011).

<sup>2</sup>D. Hammer (2006); J. Pierson (2008).

<sup>3</sup>J. Coffey, D. Hammer, D. Levin, and T. Grant (2011).

<sup>4</sup>AAAS (2001).

<sup>5</sup>J. Pierson (2008); G. Saxe, M. Gearhart, and M. Seltzer (1999); N. Kersting, K. Givvin, F. Sotelo, and J. Stigler (2010); E. Fennema, T. Carpenter, M. Franke, L. Levi, V. Jacobs, and S. Empson (1996); F. Goldberg (2012).

<sup>6</sup>T. Carpenter, E. Fennema, P. Peterson, C. Chiang, and M. Loef (1989).

# Toward assessing responsiveness

How does one identify responsive teaching?

*What does the literature say?*

*Is a synthesis of the literature sufficient to  
characterize all examples?*

*Is the literature specific enough?*

# Literature

The literature suggests that teacher responsiveness:

- Puts student reasoning on display<sup>1</sup>
  - Interprets and extends student thinking<sup>2</sup>
  - Attends to mechanism/plausibility in student thinking<sup>3</sup>
- Connects what is happening in the moment with next pedagogical moves<sup>4</sup>

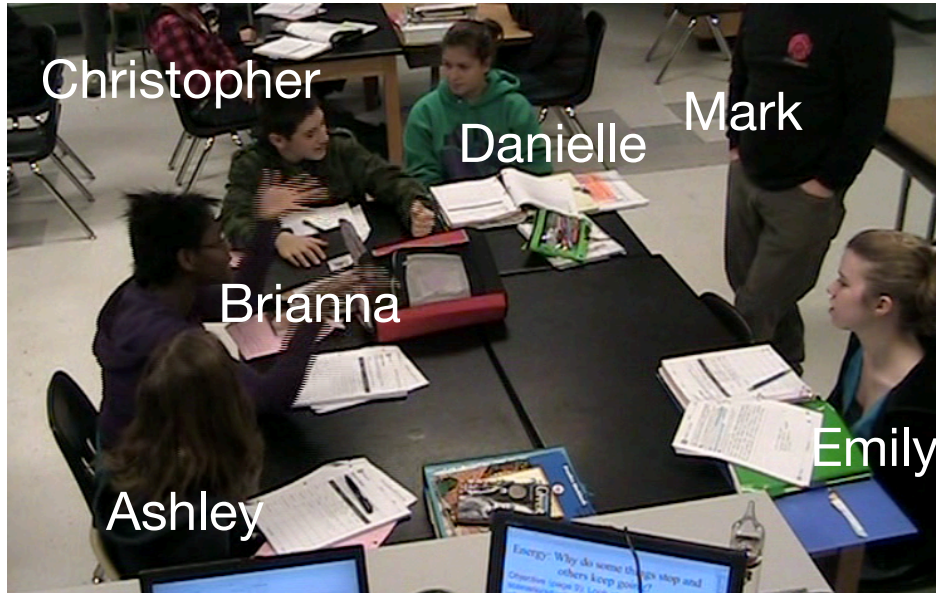
<sup>1</sup>J. Pierson (2008); A. Maskiewicz and V. Winters (2010).

<sup>2</sup>M. Sherin and E. van Es (2005); M. Sherin and E. van Es (2009); E. van Es, (2011).

<sup>3</sup>D. Hammer and E. van Zee (2006).

<sup>4</sup>F. Erickson (2007); E. van Es (2011).

# An example of teacher responsiveness



- Mark's (EP 2010 PD participant) 8<sup>th</sup> grade classroom
- Beginning of iQWST Energy unit

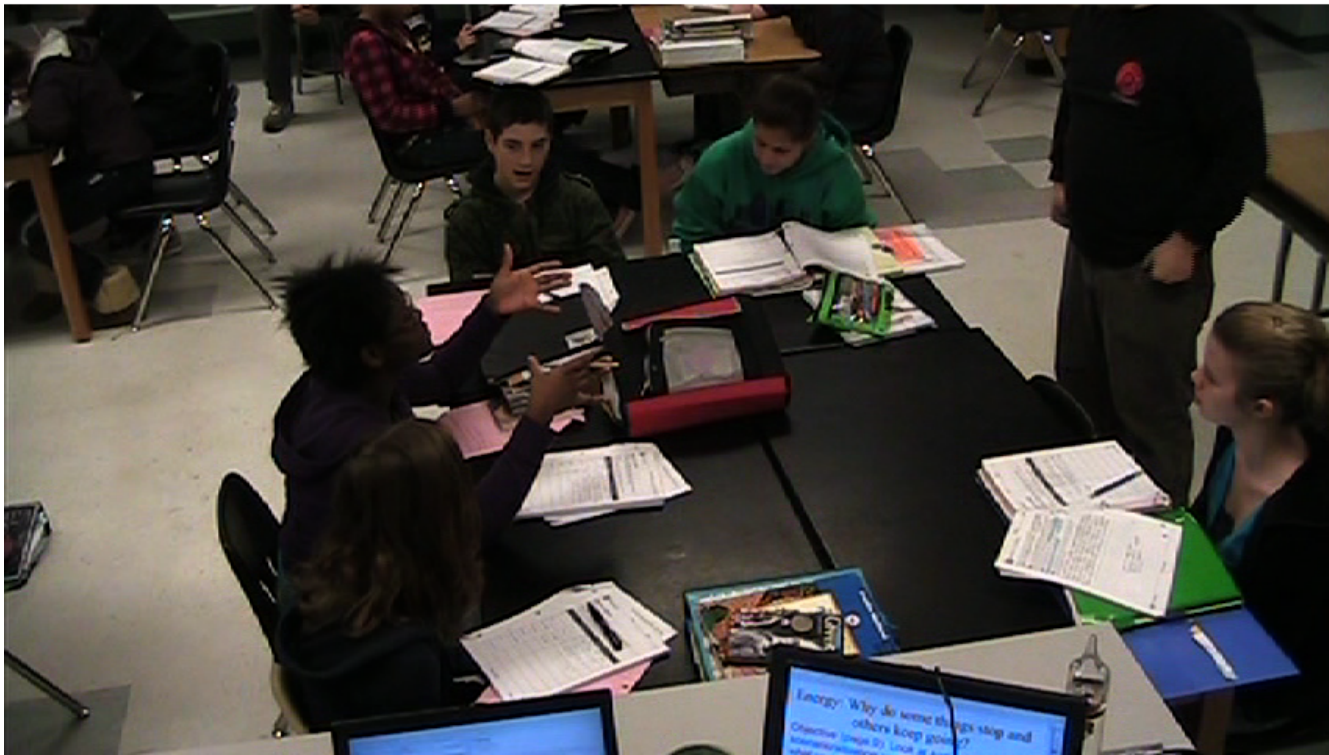
*The students have been discussing whether a bus moving down the street HAS energy, or whether it just USES energy.*



# Interpreting and extending student thinking

Mark: So the bus has energy because it was.

Brianna: Well, does it have energy, or does it just use energy?



# Interpreting and extending student thinking

**Christopher:** Because when you just, like, press the pedal, the whole bus just, like, takes the gas, turns it into, like.

**Brianna:** Well it USES that energy [the gas has.]

**Christopher:** [So it uses YOUR energy] to make the bus move.

**Mark:** So are you saying the, the, like the gasoline is the energy?

**Mark gave voice to meanings that are implicit (and explicit) in student thinking.**

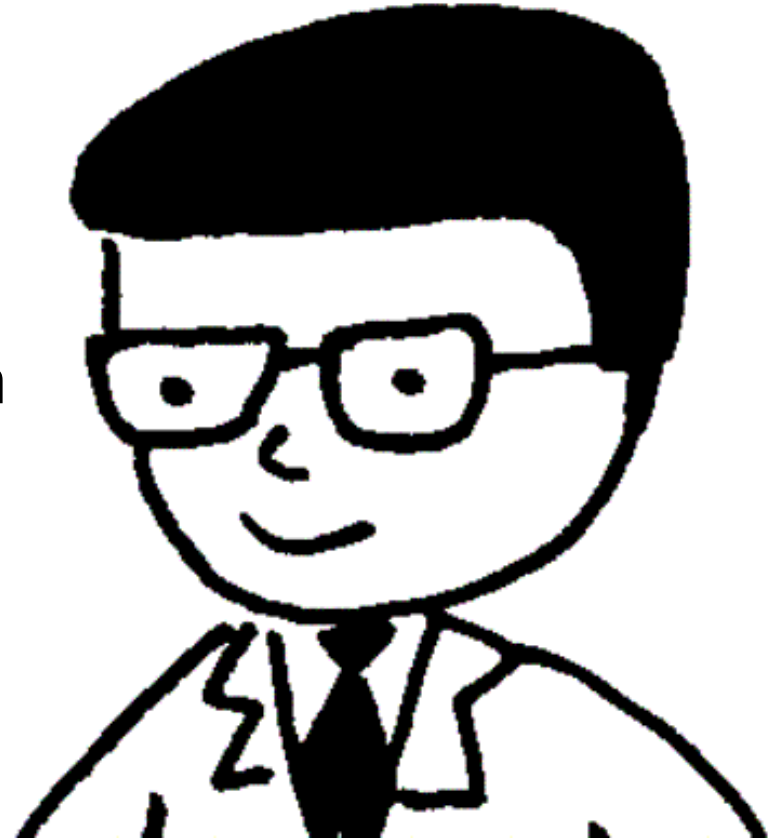
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# Coordinating thinking and next moves

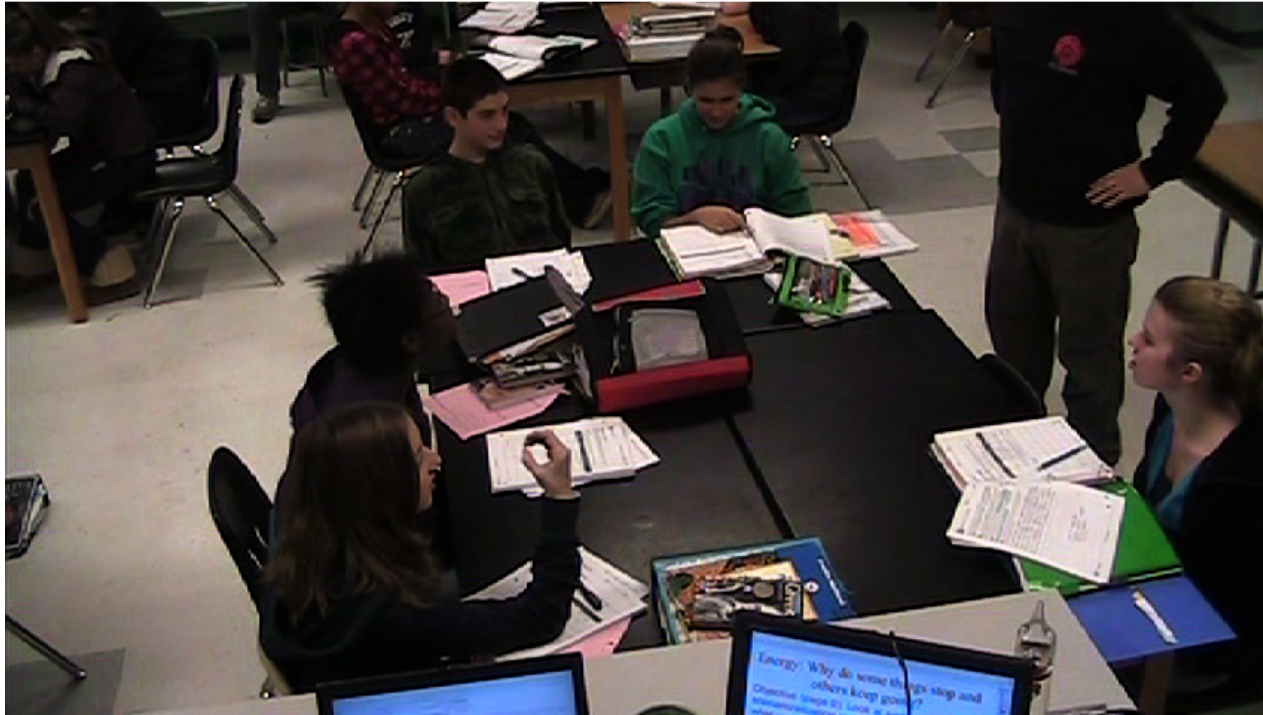
*Changes situation from:*  
Ball pushed and then rolls

*To:*  
Ball set on hill and then rolls down

***Mark's adaptation targets  
the students' question.***



# Attending to the mechanism in student thinking



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# Attending to the mechanism in student thinking

Christopher: You set it down.

Brianna: And then I feel like gravity pulls it down.

Christopher: Yeah, so then there's like another force that helps it.

Brianna: But gravity is a type of energy.

**Mark: So it's just, it's just forces, there's no energy involved?**

**Mark listened to and “*picked out*”  
*the mechanism* in students’ reasoning.**

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# Summary

We have identified concrete examples of K-12 teacher responsiveness and are characterizing their features.

# Next steps

- ❖ Continue to characterize episodes of responsive teaching
- ❖ Provide examples diverse in quality of responsive teaching
- ❖ Determine whether existing literature sufficiently describes responsive teaching

Future plans include *assessing* teacher responsiveness and *figuring out how to help teachers to grow in it.*