Students' Coherence-Seeking across Disciplinary Boundaries

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Coherence-Seeking

How can we capture what we value in students' reasoning process?

Coherence-seeking: "trying to form meaningful, mutually consistent relationships between information." [1]

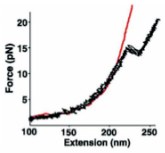
By focusing on scientific constructs present in students' talk, we examine how students:

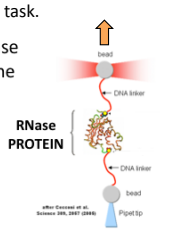
1. Make logically consistent connections between ideas within a model/account,
2. Identify points of contradiction between models/accounts.

Context

- Many science ideas (like energy) span disciplines, but these ideas are often talked about using different languages and constructs across disciplines.
- Our course context [2] invites students to navigate and coordinate these various constructs which creates unique opportunities for examining coherence-seeking.
- Here, **Anya**, **Camille**, **Marge**, & **Hollis** work on a collaborative group problem-solving task.

QUESTION: Is the energy of the **unfolded** RNase protein **smaller** or **larger** than the energy of the **folded** RNase protein?





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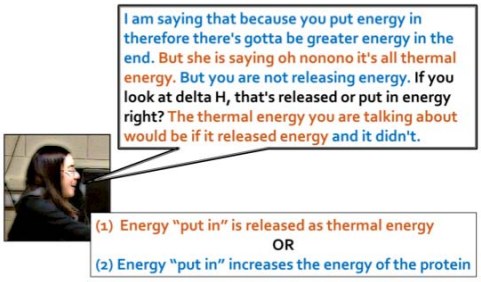
Articulating a Contradiction between models



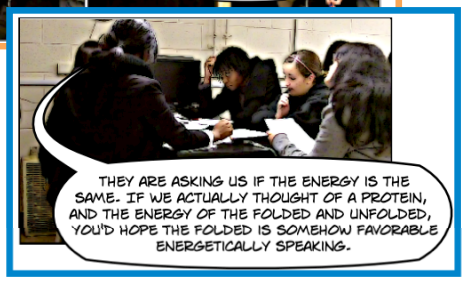
Linked Component Ideas of
Model1: Energy "put in" is released as thermal energy

- Bundled up has higher PE (Seg2)
- This is a three-stage process (Seg2)
- Initially, all of the energy is PE associated with the protein (Seg2, Seg4)
- Then there is kinetic energy (Seg2)
- At the end, the protein has lower energy and some energy was released as thermal energy (Seg4).

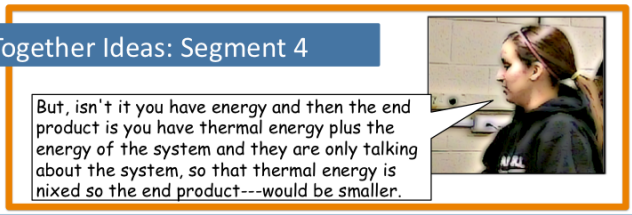
Linked Component Ideas of
Model2: Energy "put in" increases the energy of protein

- Folded should be more energetically favorable (Seg2)
- Energy was added
- Energy has to be put in to break bonds
- In breaking bonds, energy is put in and NOT released
- Delta H tells us if energy has been released or put in during a process.

Piecing Together Ideas: Segment 2



Piecing Together Ideas: Segment 4



Conclusions

Coherence-Seeking across scientific constructs involves students…

(1) Building up logically consistent connections between ideas within a model,
(2) Identifying points of contradiction between competing models.

The component ideas of these models…

(1) draw on ideas unanticipated in the task design,
(2) extend beyond the scope of constructs introduced in our IPLS course
(3) span disciplinary boundaries.

Future work will investigate:
What factors contribute to students' comfort or inclination to draw on and coordinate knowledge from outside this course context?

A Word of Caution

- If educators or curriculum designers try to build specific connections into their curricular tasks "for students" they may actually limit students' opportunities for engaging in coherence-seeking.
- Highly-structured or highly-constrained tasks could push students to only consider what is in front of them at any given time following the stepping stones laid down before them even if the logic between subsequent steps is not intuitive or sensible to them.

References
[1] T. Rose-Sikorski, "Developing an alternative perspective on coherence seeking in science classrooms." UMd PhD Thesis.
[2] For more information on the course see http://goo.gl/sz84h

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