Supporting Teacher Learning in New Ways

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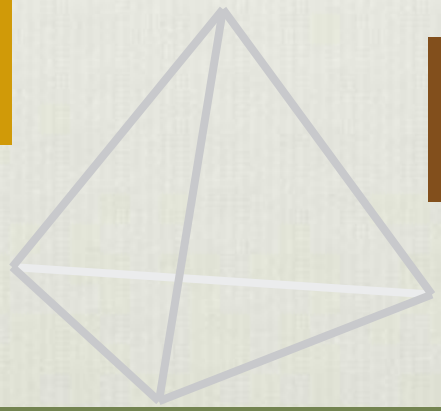
Today's Goal

Identify different areas in which teachers might need support when adopting and adapting the practice of scientific argumentation.

Scientific Argumentation

- One of the Next Generation Science Standards Practices of Science and Engineering



Science and Engineering **Practices**

Crosscutting Concepts

Disciplinary Core Ideas

Scientific Argumentation

- One of the Next Generation Science Standards Practices of Science and Engineering

1. Asking questions
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations
7. **Engaging in argument from evidence**
8. Obtaining, evaluating, and communicating information

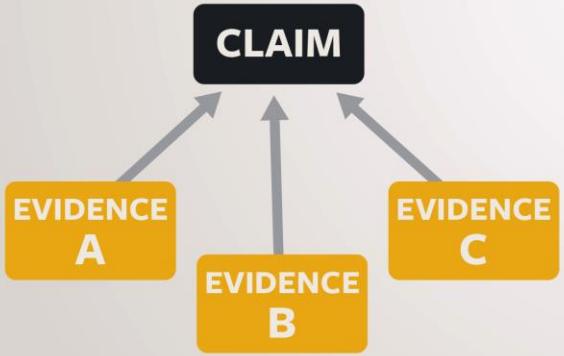
Argumentation Elements

EVIDENCE
Students use high quality evidence to support their claims.

REASONING
Students make clear how their evidence supports their claim.

INTERACTIVE
Students build off of and critique each others' ideas.

COMPETING CLAIMS
Students critique competing claims.

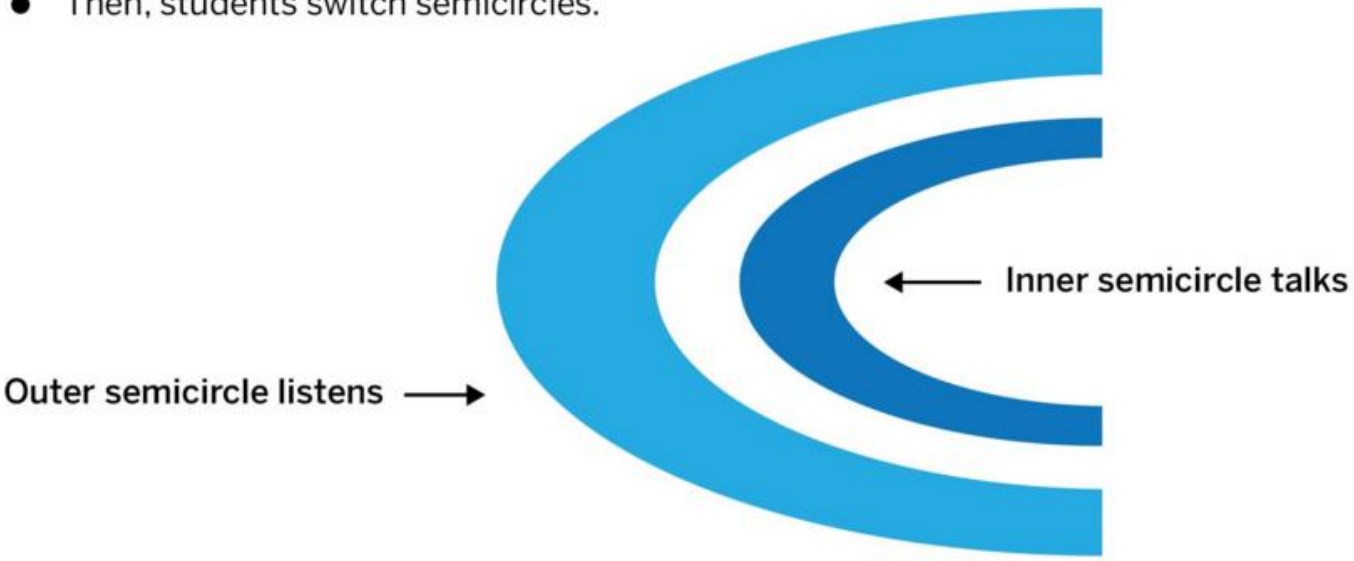


THE ARGUMENTATION TOOLKIT

Classroom Example: Science Seminar

A student-driven evidence-based discussion focused on a science question

- Half the class sits in the inner semicircle.
- The other half of the class sits in the outer semicircle.
- Then, students switch semicircles.



Classroom Example: Science Seminar

How will the Indian Plate be different in 50 million years?

Two different enactments: Ms. Richardson

Ms. Richardson: ok. Marcus.
Marcus: Um, I disagree with Ian and Jose. I see what they are saying. Um. Ian's theory it is still going to the Eurasian plate, because that entire area is still the Eurasian plate.
Tony: But it's also colliding with the – what plate is that?
Several students go over to point to map Tony is holding.
Ms. Richardson: So you're talking about the countries of South Asia and Indonesia. You're saying that forms a different plate?
Tony: Yeah. And it is also colliding with the Indian plate.
Ian: Well, I (inaudible) cause – yes it is going to collide, but right here there's many – there's lots of spreading zone. It is going to get lots of crust – lots of new crust to make the plate bigger
Eduardo: It is also a subduction zone.
Ian: Yeah, but look – the subduction zone has like ¼ of the subduction zone and like 1, 2, 3, 4, 5, 6, 7, 8 – eight spreading zone
Eduardo: But it is really small.
Ian: Yeah but they have 8 that's ¼.
Ms. Richardson: Is there anybody else who would like to join in the conversation with agreeing or disagreeing with um - the ideas that have been presented, or providing more evidence or new evidence? Bill?

McNeill, Gonzalez-Howard, Katsh-Singer, Price & Loper, 2013

What's successful?

- Students talking to each other instead of the teacher
- Referring to evidence
- Genuine disagreement
- Referencing other students' ideas

Two different enactments: Ms. Brennan

Ms. Brennan: Elena why don't you come on up. Ok. And you guys be attentive. Guys this is a little bit different than a presentation where someone – this is, this is um a give and take where you are going to be um listening. The inner circle as well is going to be able to – um as they come up – when they come up they will give their evidence for their part, but we can't clap between speakers. Your engaged and listening. It is like as if you were a grown-up and you were going to a workshop. That is exactly what it is like. Ok. Elena.

Elena: Well, I thought that the um Indian plate would get bigger over 50 million year period because of spreading zones which could easily spread the plates apart and make them wider.

Ms. Brennan: Ok. Alright. (Elena sits down). Ok. I am going to need um – why don't you go ahead. Once this starts, why don't you come on up. Jordan why don't you come next. (Jordan stands up). And I am just going to move this right over here so you guys can go in and out (Teacher moves iPad). Ok.

Jordan: I thought that um that the Himalayans would get taller, because when the plates like started crashing into each other – this one is going in this direction (Jordan points to the map) and it should make it bigger.

Ms. Brennan: Ok. (Jordan sits down). Thank you very much. Another person. Come on up.

McNeill, Gonzalez-Howard, Katsh-Singer, Price & Loper, 2013

What's successful?

- Students are making claims and supporting them with evidence

What's less successful?

- "IRE" structure: teacher-student-teacher
- No student interaction
- There may be disagreement, but can't tell; no referencing of other students' ideas

Ms. Richardson

Ms. Richardson: ok. Marcus.

Marcus: Um, I disagree with Ian and Jose. I see what they are saying. Um. Ian's theory it is still going to the Eurasian plate, because that entire area is still the Eurasian plate.

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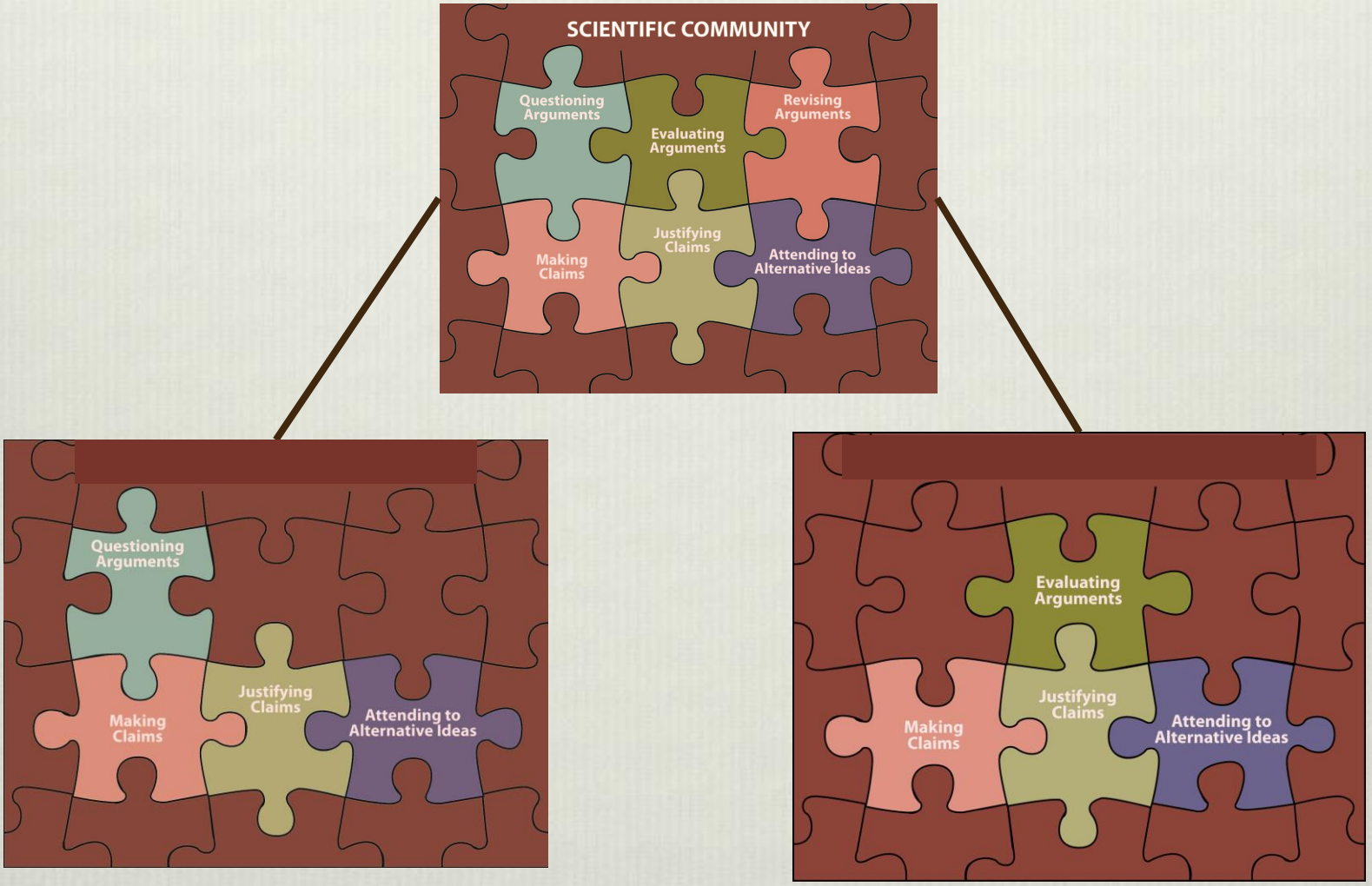
Ms. Brennan: Ok. (Jordan sits down). Thank you very much. Another person. Come on up.

Why pseudoargumentation?

Practice of Scientific Argumentation

Scientific Argumentation in Classrooms

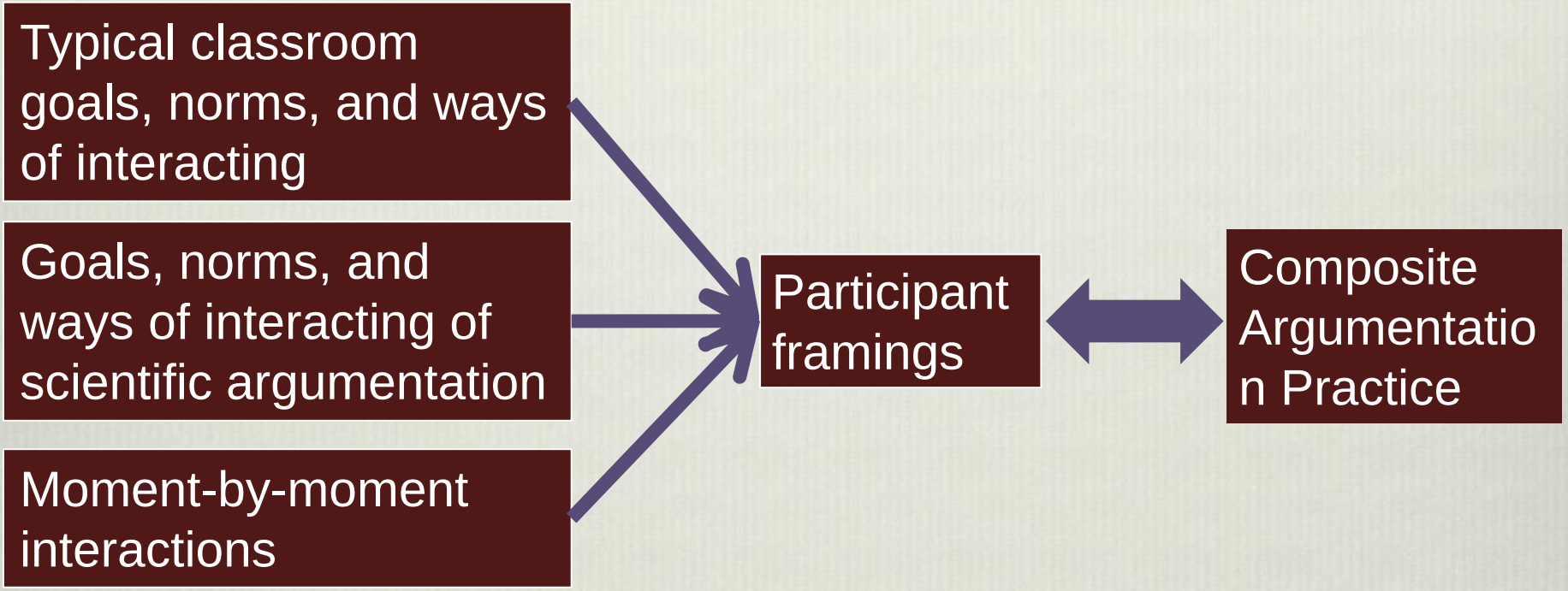
Composite Argumentation Practice



(e.g. Berland, 2011; Berland & Hammer, 2012; Hogan & Corey, 2001; Engle et al, 2002.; Lave & Wenger, 1991)

How can we affect the ways that classroom communities frame scientific argumentation?

Factors that Influence Framing



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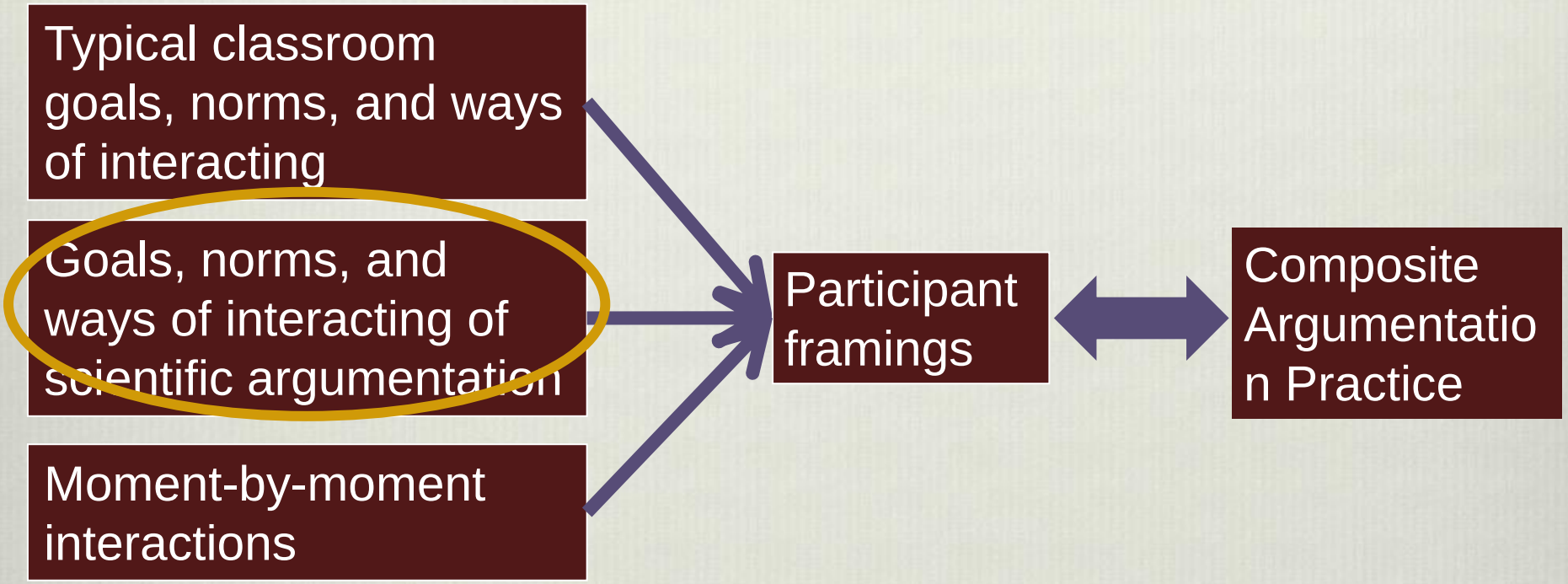

The Multimedia Educative Curriculum Materials Project

- Research and development project funded by NSF grant DRL-1119584
- Collaboration between the Lawrence Hall of Science and Kate McNeill at Boston College

The Multimedia Educative Curriculum Materials Project

- Teachers need support for learning to teach argumentation.

Simon, Erduran & Osborne, 2006; McNeill, 2009; McNeill, Pimentel & Strauss, in press

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- Teachers need practical, scalable support for learning to teach argumentation.

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Educative curriculum materials

Davis & Krajcik, 2005; Davis, et. al, 2014

The Multimedia Educative Curriculum Materials Project

- Teachers need practical, scalable support for learning to teach argumentation, a rich and complex practice difficult to convey in text.

Simon, Erduran & Osborne, 2006; McNeill, 2009; McNeill, Pimentel & Strauss, in press

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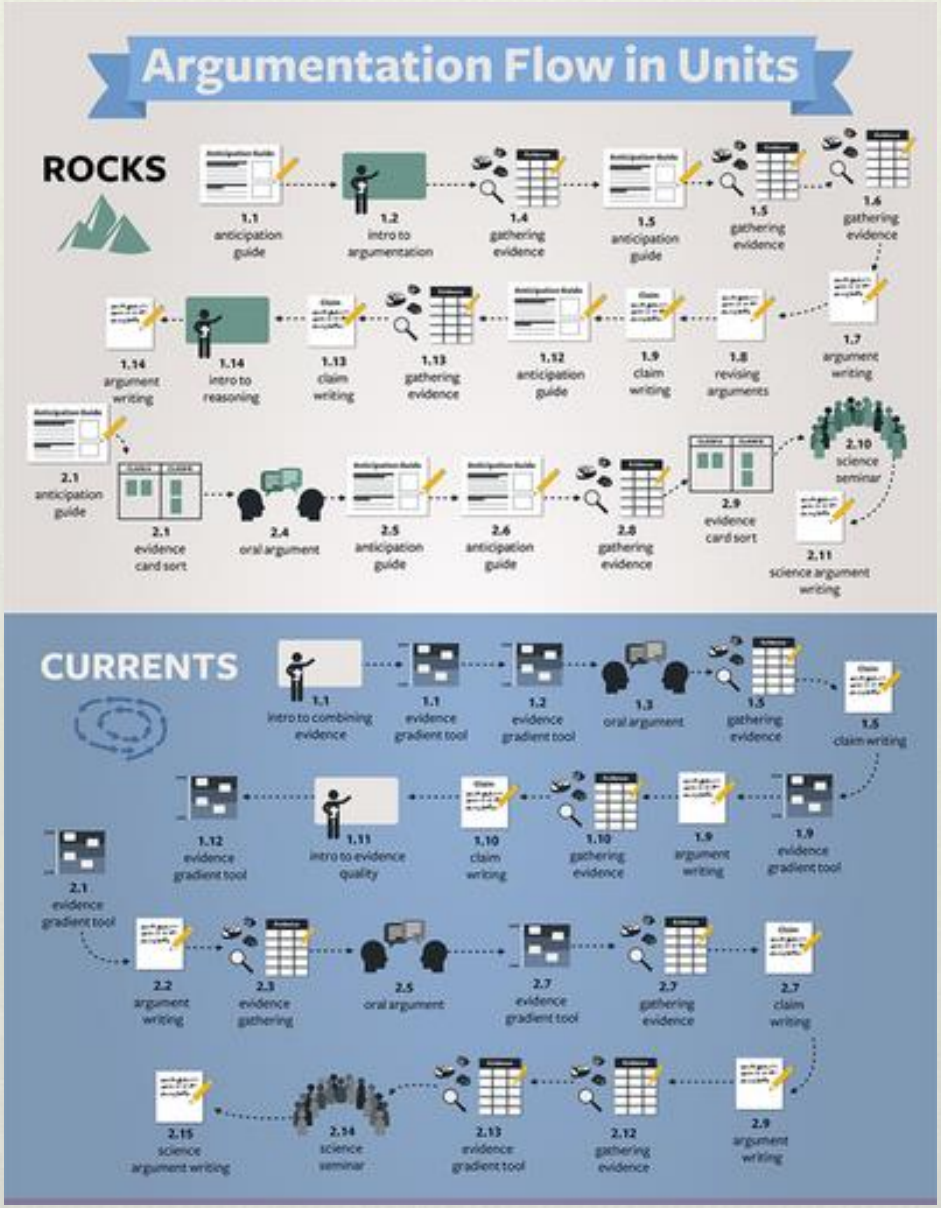
Multimedia educative curriculum materials (MECMs)


Argumentation Flow in Units
ROCKS
1.1 anticipation guide
1.2 intro to argumentation
1.4 gathering evidence
1.5 anticipation guide
1.5 gathering evidence
1.6 gathering evidence
1.7 argument writing
1.8 revising arguments
1.9 claim writing
1.12 anticipation guide
1.13 gathering evidence
1.13 claim writing
1.14 intro to reasoning
1.14 argument writing
2.1 anticipation guide
2.1 evidence card sort
2.4 oral argument
2.5 anticipation guide
2.6 anticipation guide
2.8 gathering evidence
2.9 evidence card sort
2.10 science seminar
2.11 science argument writing
CURRENTS
1.1 intro to combining evidence
1.1 evidence gradient tool
1.2 evidence gradient tool
1.3 oral argument
1.5 gathering evidence
1.5 claim writing
1.9 evidence gradient tool
1.9 argument writing
1.10 gathering evidence
1.10 claim writing
1.11 intro to evidence quality
1.12 evidence gradient tool
2.1 evidence gradient tool
2.2 argument writing
2.3 evidence gathering
2.5 oral argument
2.7 evidence gradient tool
2.7 gathering evidence
2.7 claim writing
2.9 argument writing
2.12 gathering evidence
2.13 evidence gradient tool
2.14 science seminar
2.15 science argument writing

MECM Curricular Elements

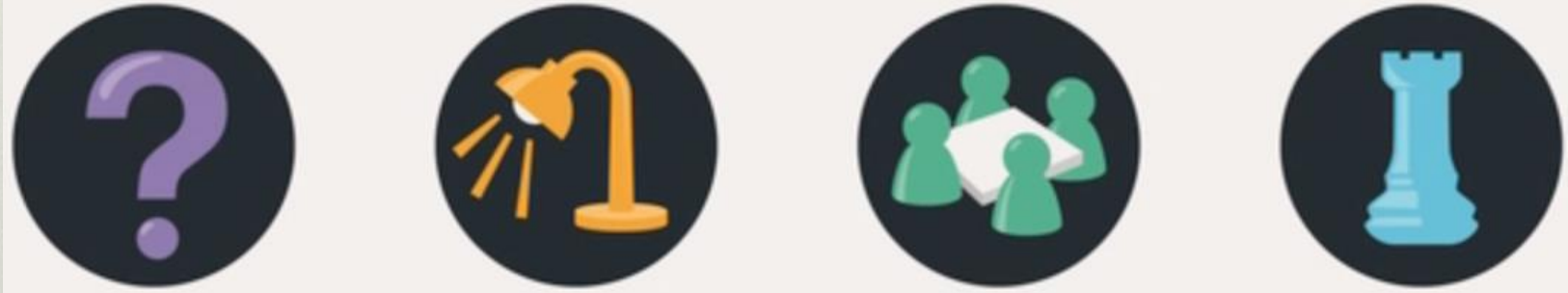
Embedded within 3 middle school earth science units (~60 lessons) educative supports targeting scientific argumentation:

- **28 Videos**
- **24 Interactive Reflections**
- 3 Podc
- 4 Slide
- 21 Tex
- 4 Grap
- 7 Stud
- 1 Rubr
- 1 Argumentation article

1. Target **challenge areas**
2. Use **multimedia representations of practice**
3. Support **active learning**

Video Categories Embedded in Lessons

Rationale **Approach** **Activities** **Strategies**



Research Design

RCT 2014-15 (n=90)

- All teachers received a digital teacher's guide and all student materials
- Treatment teachers received additional MECMs (videos, interactive elements)
- No requirements: use materials as you would normally use them.
- Data collection:
  - Pre- and post-assessment of PCK for argumentation and beliefs about argumentation
  - Back-end data collection on teachers' use of digital curriculum and access of videos.

Argumentation Toolkit

argumentationtoolkit.org

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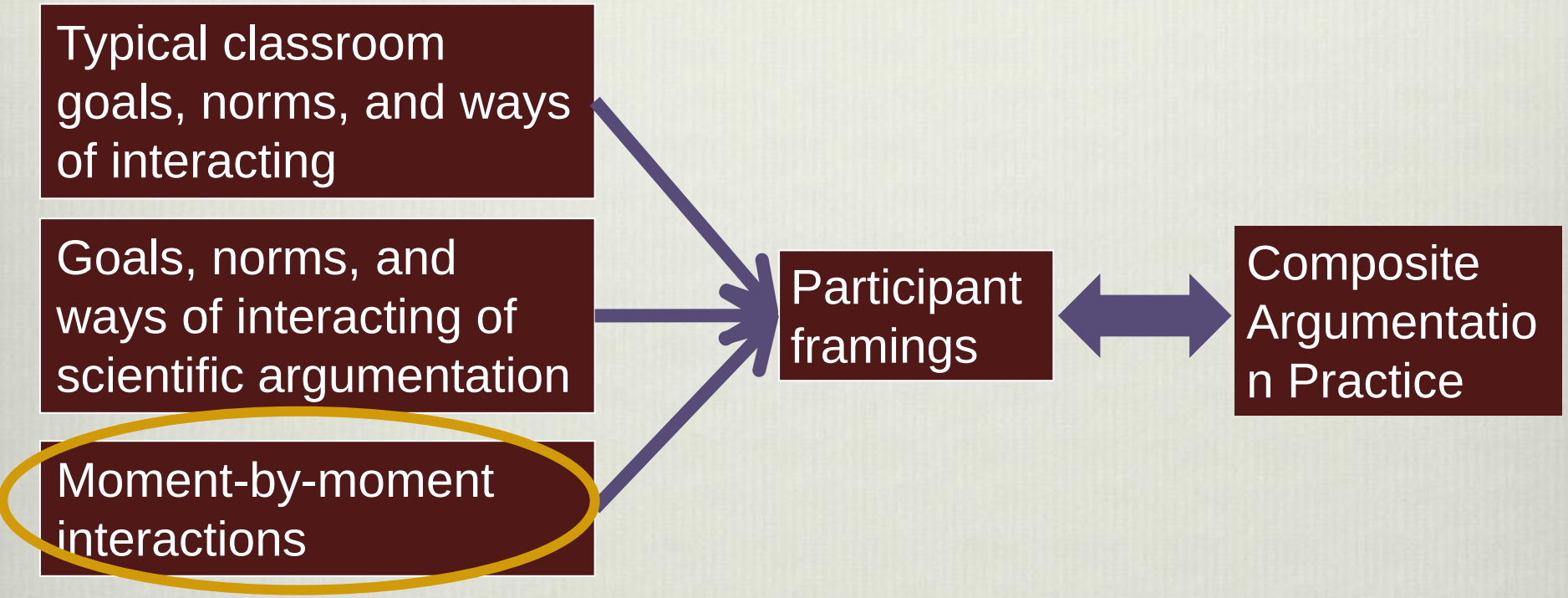
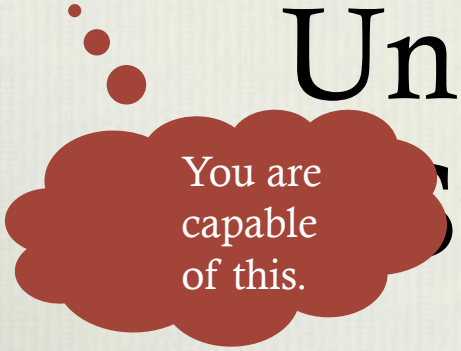
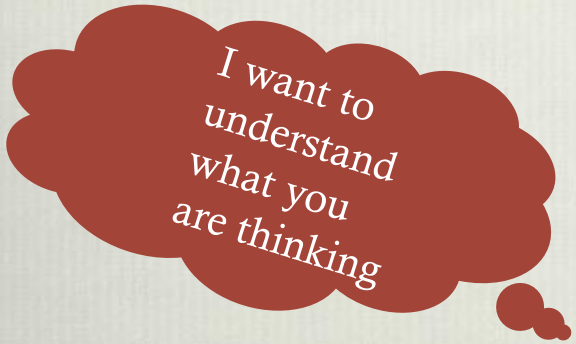


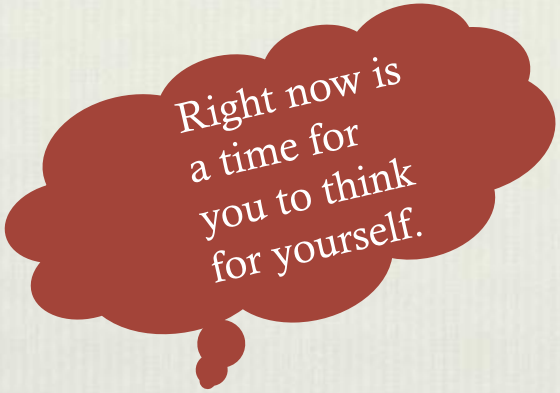
Fostering Pedagogical Argumentation
(teachers arguing about teaching)

- Research and development project funded by NSF grant DRL-1316232
- PIs: Leema Berland, Melissa Braaten, and Rosemary Russ, University of Wisconsin-Madison

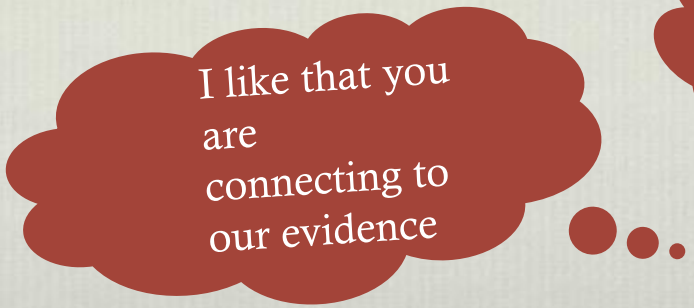
Understanding Teacher-Student Interactions

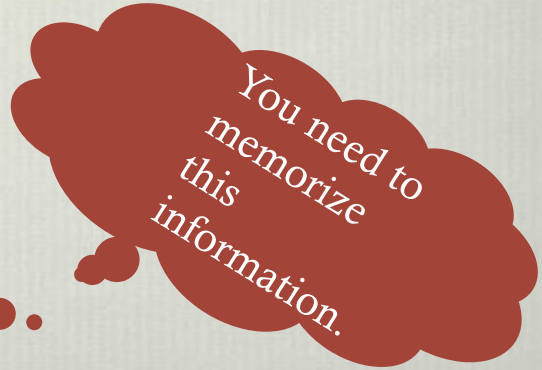






Every time a teacher responds (or doesn't) to a student comment, she is sending a message.





(Russ, under review)

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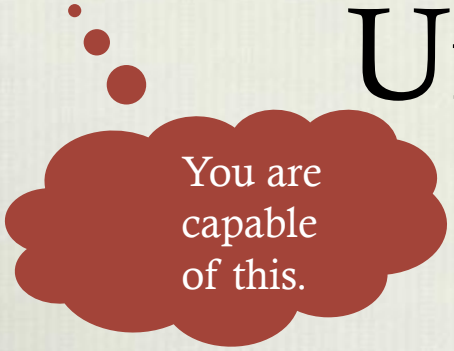
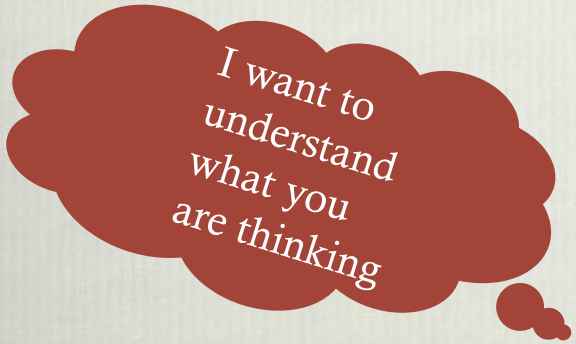
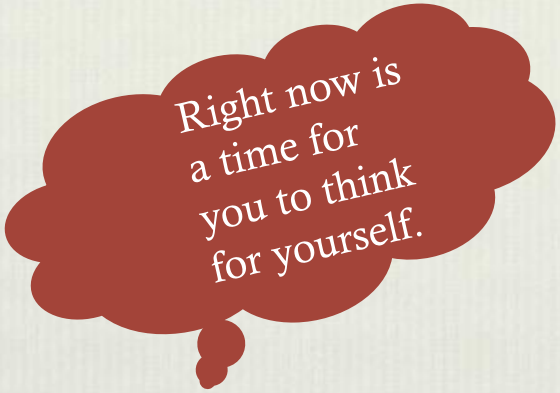
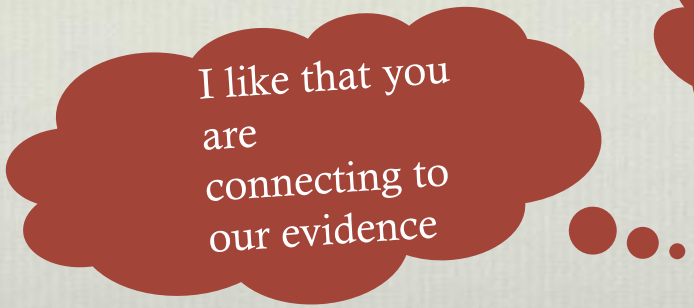
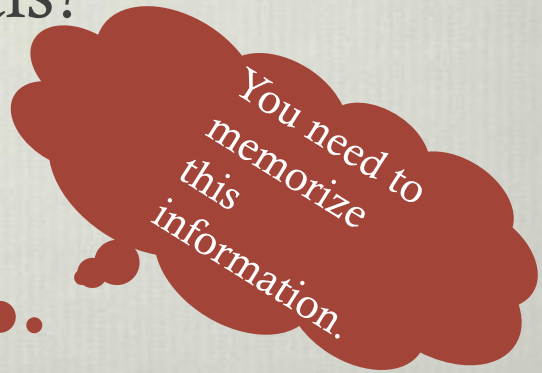






Teachers need to consider these messages: Are they sending messages that are consistent with their goals?





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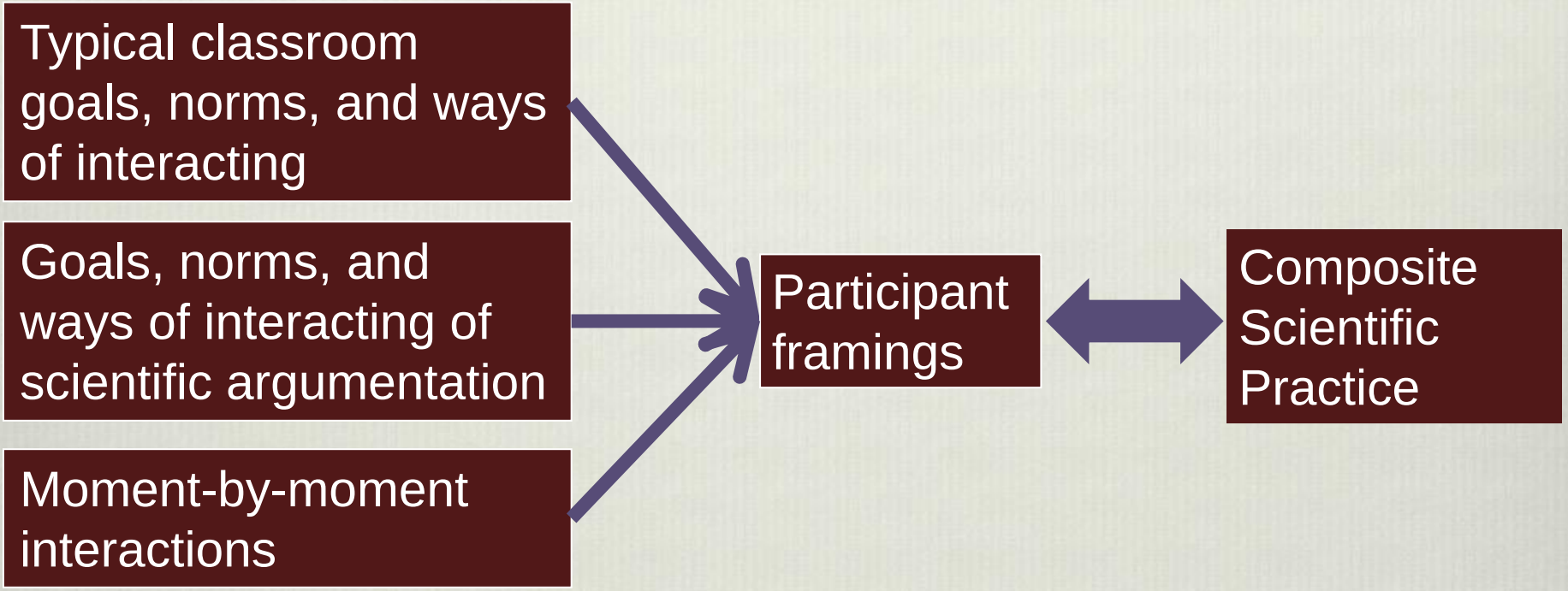

Thank you

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