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
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.
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.
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?

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.

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
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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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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.
Why pseudoargumentation?
Practice of Scientific Argumentation
Scientific Argumentation in Classrooms

Classroom Community Framing
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

Typical classroom goals, norms, and ways of interacting

Goals, norms, and ways of interacting of scientific argumentation

Moment-by-moment interactions

Participant framings

Composite Argumentation Practice
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Composite Argumentation Practice
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
The Multimedia Educative Curriculum Materials Project

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

Educative curriculum materials

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

Simon, Erduran & Osborne, 2006; McNeill, 2009; McNeill, Pimentel & Strauss, in press
Teachers need **practical, scalable** support for learning to teach argumentation, a **rich and complex practice difficult to convey in text.**

**The Multimedia Educative Curriculum Materials Project**

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

**Multimedia Educative Curriculum Materials (MECMs)**

- Davis & Krajcik, 2005; Davis, et. al, 2014
MECM Curricular Elements

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

- 28 Videos
- 24 Interactive Reflections
- 3 Podcasts
- 4 Slideshows
- 21 Text Notes
- 4 Graphics
- 7 Student Work Examples
- 1 Rubric
- 1 Argumentation article

1. Target challenge areas
2. Use multimedia representations of practice
3. Support active learning
Video Categories Embedded in Lessons

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<th>Rationale</th>
<th>Approach</th>
<th>Activities</th>
<th>Strategies</th>
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<td><img src="image" alt="Group of People Icon" /></td>
<td><img src="image" alt="Chess Piece Icon" /></td>
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The Argumentation Toolkit
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.
Building a Culture of Argumentation

The Argumentation Toolkit is a collection of resources designed to help teachers understand and teach scientific argumentation.

Learn More
Factors that Influence Framing

Typical classroom goals, norms, and ways of interacting

Goals, norms, and ways of interacting of scientific argumentation

Moment-by-moment interactions

Participant framings

Composite Argumentation Practice
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
Every time a teacher responds (or doesn’t) to a student comment, she is sending a message.
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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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.
Understanding Teacher-Student Interactions

You are capable of this.

I want to understand what you are thinking.

Right now is a time for you to think for yourself.

I want everyone to participate, but what they say doesn’t matter.

The important thing is that you look engaged.

I like that you are connecting to our evidence.

You need to memorize this information.

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

(Russ, under review)
Factors that Influence Framing

- Typical classroom goals, norms, and ways of interacting
- Goals, norms, and ways of interacting of scientific argumentation
- Moment-by-moment interactions

Participant framings

Composite Scientific Practice
Thank you

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