Building Academic Literacy Through Science & Mathematics: Inquiry, Talk, & Text

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2016 Proyecto EL SMED Conference
Texas Tech University

Handouts: **http://aldnetwork.org/page/Feb13**

Objectives *from* Today

	 SPEAKING	 CONVERSING
Increase Quantity	# of students # of minutes	# of students # of back-n-forth conversations
Increase Quality	Strength Clarity	Co-Construction & Collaborative Arguing of Ideas; CC Skills

Overhauling the Teaching of Diverse Students

LESS

Individual accumulating of right answers, "paying" for points, & playing school

MORE

Collaborating, understanding, building, using, & communicating whole ideas

Developing Academic Language with Oral Output & Conversations

1. **Oral Output** is one-way, one-time, clear & strong communication of ideas & thinking.

Think-pair-shares, Answering teacher questions, Jigsaws, Gallery walks, Oral presentations

2. **Conversations** are back-and-forth interactions in which participants build on one another's ideas to build up ideas that weren't in their minds before talking.

Developing Oral Output
with

TRANSITION IMPROV Activities

Transition Improv (For-Against)

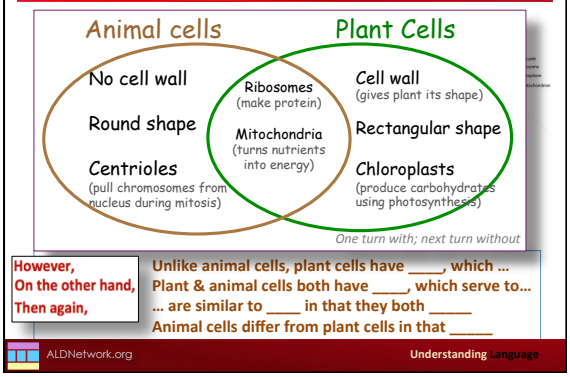
Topics: Adding lime to soil to lower pH, fracking, genetic engineering, nuclear energy, stem cell research, human-caused climate change, wolf reintroduction, de-extinction, zoos, preserving wetlands, corn as fuel, extraterrestrial life,

Transitions: **However,**
On the other hand,
Then again,
~~**but**~~

PC Frames:	**One reason for … is … For example, …** **Evidence that supports … is… because…** **A reason against … is … For example, …** **Evidence that does not support … is … because …**

A & B, Lean?

Transition Improv (Similar-Different)



However,
On the other hand,
Then again,

Unlike animal cells, plant cells have ____, which …
Plant & animal cells both have ____, which serve to…
… are similar to ____ in that they both _____
Animal cells differ from plant cells in that _____

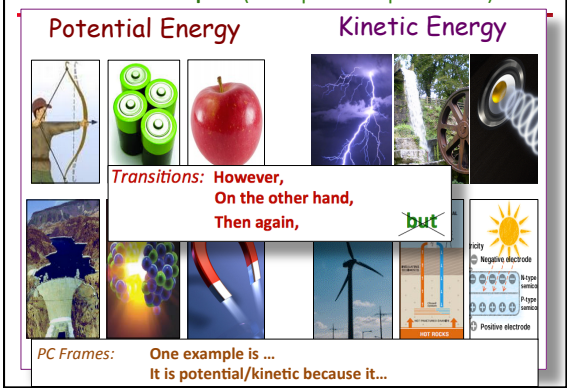
Transition Improv (Examples & Explanations)

Topic: Kinetic and Potential Energy

Transitions: **However,**
On the other hand,
Then again,
~~but~~

PC Frames: **One example is …**
It is potential/kinetic because it…

Transition Improv (Examples & Explanations)



PC Frames: **One example is …**
It is potential/kinetic because it…

Assessment of Oral Output (Teacher, Peer, Self)

Sample checklist for oral output

- ❑ I included information needed and *expected by listeners* *(not too much and not too little)*
- ❑ I used two or more connected sentences
- ❑ I supported my idea with strong evidence and/or reasoning
- ❑ I explained how the evidence and/or reasoning supported the main idea
- ❑ I used academic words and terms

Developing Oral Output
with

"STRONGER Y CLEARER EACH TIME" Activities:

Stronger-Clearer Grid

Designing "Stronger & Clearer Each Time" Activities

1. Prompt for an **original response** (e.g., explanation, long answer, opinion, idea, etc.).
2. Each student says idea to successive partners, listens, and then **borrows and uses the language, ideas, and evidence** of others each time they talk.
3. Responses become **stronger** (often longer) with better supporting evidence and examples.
4. Responses become **clearer** with more precise terms and linked, organized, complete sentences.
5. Scaffolds **are reduced during** the activity.

II. "Stronger & Clearer Each Time" **Grid**

Name	**It takes Lisa, by herself, 10 hours to plant trees on an acre of land. It takes Liz 15 hours, by herself. How long would it take if they work together? Explain & justify your solution idea.**
Me	(just two or three key words, if any)
1.	
2.	
3.	
Me	

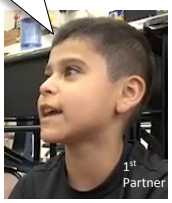
(Teacher can have listeners ask clarifying and supporting questions)

"Stronger & Clearer Each Time" Grid (Math)

I think to draw it. Then cut it up and count.

Take one or two-word notes and switch partners!

I do three pieces, big pieces. Then, I don't know, cut up into four. That's it.



Leo bought a pizza and ate a third of it. Then he split the rest evenly between 4 friends. How much did each friend get? Explain how to solve.

"Stronger & Clearer Each Time" Grid (Math)

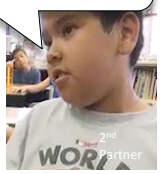
I think to draw it. Then cut it up and count.

Take notes & switch partners! Remember to say "because" to justify your steps

I do three pieces, big pieces. Then, I don't know, cut up

I want to draw it and cut it into tres pedazos. Then cut it up into four. Wait. Primero se quita un pedazo, then cut. Like this.

Se quita one third cuz he ate it, right? Then split el resto con los four friends. So like this. Four halfes of a third.



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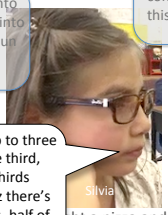
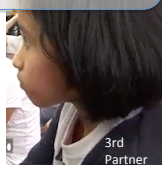
I want to draw it and cut it into tres pedazos. Then cut it up into four. Wait. Primero se quita un pedazo, then cut. Like this.

Se quita one third cuz he ate it, right? Then split el resto con los four friends. So like this. Four halfes of a third.

First I draw it. Then I cut it up to three pedazos, pieces. Se quita one third, because he eat it. Now two thirds here. Cut cada una in half cuz there's four friends. So, each piece is..half of third.





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Me	(just two or three key words, if any)
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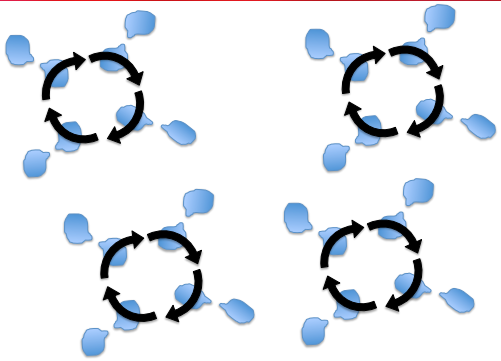
2.	
3.	
Me	

(Teacher can have listeners ask clarifying and supporting questions)

Practically Speaking: Interaction Mini-Circles



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Me	(just two or three key words, if any)
1.	
2.	
3.	
Me	

(Teacher can have listeners ask clarifying and supporting questions)

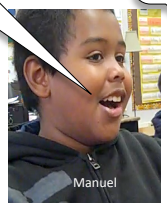
"Stronger & Clearer Each Time" Grid (Science)

I think the sun gets further away so it makes it winter.

Switch partners!

I think it's like when the teacher moved that ball around the light. It was tilted and got less light.

I think the sun moves out far in winter and close in summer.



What causes the seasons to change?

Student Model of "Stronger & Clearer Each Time"

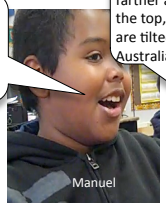
I think the sun gets further away so it makes it winter.

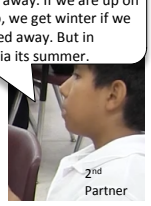
Switch partners!

I think it's like when the teacher moved that ball around the light. It was tilted and got less light.

Maybe seasons come from the world going around the sun. And we move away in winter and close in summer.

I don't think the earth goes farther away. If we are up on the top, we get winter if we are tilted away. But in Australia its summer.





What causes the seasons to change?

Student Model of "Stronger & Clearer Each Time"

I think the sun gets further

I think the sun moves out far away in winter and close in summer.

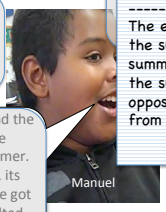
I think it's like when the teacher moved that ball around the light. It was tilted

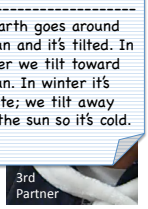
I don't think the earth goes

summer.

The earth goes around the sun and it's tilted. In summer we tilt toward the sun. In winter it's opposite; we tilt away from the sun so it's cold.

The earth is tilted and goes 'round the sun. We are on the top, so we are tilted toward the sun, so it's summer. But in the south, like in Australia, its opposite. Its' winter. I thought we got more far away, but we are just tilted.





What causes the seasons to change?

Engage and Explore

1. Hold the end of the paper strip just under your lip and let it extend out and curve down.

2. Tell a partner what you think will happen if you blow out above the paper. Explain why.
3. Blow above the paper and notice what happens to it.
4. Think of questions about what happened and share them with your partner.

Explain the Phenomenon

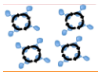
The paper was lifted up, even though the air was not coming from down below it. Think of the clearest possible explanation for what you saw. You can include other examples or applications of this phenomenon.

Write two or three key words in the first row of your Stronger & Clearer Idea Grid to remind you.

Elaborate: **Stronger & Clearer Idea Grid**

Name	**What was happening with the paper?**
(Me)	(Just two or three key words, if any)
1.	(two or three words from this person that will strengthen or clarify my answer)
2.	(two or three words from this person that will strengthen or clarify my answer)
3.	(two or three words from this person that will strengthen or clarify my answer)
Me	(My final written explanation)

Due to the …, the paper is lifted up…
When you blow above the paper, you create …



More than a Shift: Constructive Conversations

"Why do I have to talk with a partner? I already know the answer!"

"Just wait. She'll tell us the answer at the end."

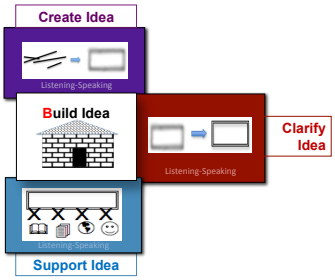
"I got the answer—that's all that matters!

Fostering Conversations
with

Constructive Conversation Skills, Icons, & Motions

Constructive Conversation Skills for "Build 1" Mode

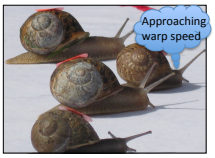
Goal: Students collaboratively (but w/o teacher) build an idea (e.g., claim, answer, solution, interpretation), **using the following skills:**



Math Paired Conversation Protocol - PRACTICE

Snail Race

Draw two lines to represent a 30-inch race course for snails. Show where all four snails are when the first one crosses the finish line.



Snail A goes 4 inches in 12 minutes
Snail B goes 7 inches in 20 minutes
Snail C goes 2 inches in 4 minutes
Snail D goes 11 inches in 25 minutes

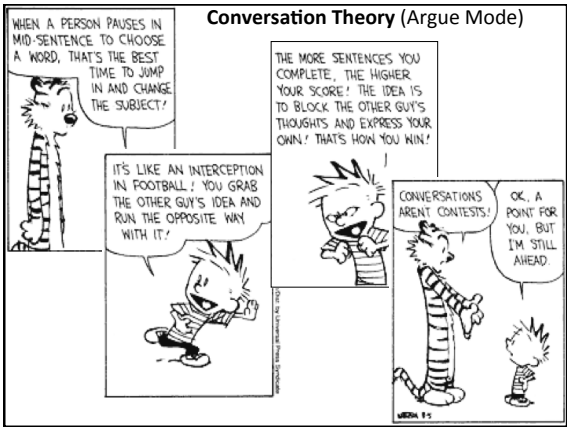
Constructive Conversation Excerpt - Math

B: I think we draw each inch and how many minutes.
A: What do you mean?
B: So Snail A goes 4 inches in 12 minutes. That's 3 minutes per inch.
A: OK, you put 12 over 3. So Snail B is 20 over 7, 2 and 6/7?
B: So that is the speed, right, of A and B. C is 2, and D is 2 and 3/11
A: So what's the fastest?
B: A cuz it's 3.
A: But wait. 3 minutes to go an inch. The others take less time.
B: So it's the smallest? So D is the fastest. We're done.
A: No. Look. We gotta find how long D takes to go 30 inches.
B: Why?
A: To find out where the others are.

Arguing in Science

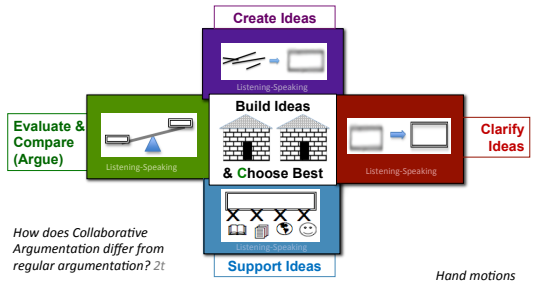
"In the science classroom, argument often becomes a monologue – a one-way conversation where the pupils cannot engage in genuine questioning of the teacher because they lack the resources to challenge his or her assertions. As a result, the world is portrayed as a set of absolutes, characterized by 'right' and 'wrong' answers, with the origins of scientific ideas, the warrants and data for their belief, and any element of uncertainty simply excised." (Osborne, et al., 2001)

Conversation Theory (Argue Mode)



Conversation Skills for "Build >1 & Choose (Argue)" Mode

Goal: Students collaboratively (but w/o teacher) **build claims & ideas and then choose one of them, using the following skills:**



How does Collaborative Argumentation differ from regular argumentation? 2t

Hand motions

Assess a Conversation – 4th gr. Science

A: I think all cars should be electric.
B: Why?
A: Cuz gas cars pollute the air.
B: How do you know?
A: I read it.
B: Read what?
A: Gas cars makes our planet get hotter.
B: Oh yeah, like something like gases and a greenhouse.
A: What's a greenhouse?
B: Like a glass house that gets hot cuz its all glass. Plants grow in it.
A: What about the other side? It's gas cars are OK.
B: They go more miles.
A: What do you mean?
B: Electric cars don't go as far as gas ones, like/
A: /And filling up with gas is less time than to recharge.
B: And it's easier to find gas stations than recharge stations.
A: So one is better for the world, and one is easier for us. Which?

Assessing Conversation Skills: Conversation Analysis Tool

Turns build on previous turns to build up a relevant idea(s)

_____ Students create or choose a relevant initial idea(s) that is focused on learning objective(s)

_____ Students clarify idea(s) (by paraphrasing, defining, elaborating)

_____ Students support ideas (using evidence, examples, explanations)

If there are two or more competing ideas (i.e., an argument),

_____ Students evaluate the strength/weight of the evidence of each idea

_____ Students compare the strengths/weights and choose the "strongest/heaviest" idea

_____ Students explain (and/or negotiate) final decisions

What feedback would you give?

Samir: Why did that happen?
Delia: The magnet made electricity.
Samir: Yeah, it made electricity.
Delia: So, now what?

Lisa: So, why do the plates move?
Edgar: They move and make earthquakes.
Lisa: I felt an earthquake once. It was crazy.
Edgar: Yeah, I saw a movie and the buildings fell down.
Lisa: Was it true?
Edgar: I think it happens for real, yeah.

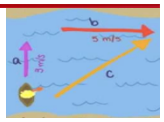
Feedback

Laura: I think air has weight. Remember the balloon?
Eli: I disagree because I can't feel it.
Laura: I respectfully disagree with you.
Eli: Then we just agree to disagree, right?

Asha: I think there are different ways to solve it.
Juan: So? Just do what the book example did.
Asha: But why do you turn the fraction over?
Juan: Who cares? Just turn it over.
Lisa: OK.

$$\frac{3a}{3c-6} \div \frac{9ab}{c^2-4} =$$

Conversation Sample - Math



A: What do we need to find?
B: How far the boat goes down the river.
A: So, how?
B: Maybe figure out the time to cross it, like straight, like this (a).
A: I think we should just add the speeds together.
B: OK, that's 5 plus 3 equals 8. Then what?
A: We need to use the other number, 30. So divide?
B: Why not. OK, so 30 divided by 8 is 3.75.
A: 3.75 what?
B: Meters, I think, but that doesn't look right.
A: No, so what do we do?
B: I don't know.

Conversation Sample - Science

Elia: So, how do animals evolve? *(prompt on the board)*
Alex: To live.
Elia: What's an example? *(prompt on board)*
Alex: Sharks.
Elia: What's another example?
Alex: Turtles.
Elia: What's another example?
Alex: Giraffes. They got long necks.
Elia: Why?
Alex: To reach up into trees.
Elia: OK, let's write these down.

Fostering Conversations & Their Skills

with

Argument Balance Scale

Scaffold for Collaborative Argument Conversations: *Argument Balance Scale*

Is the evidence for the claim strong enough to weigh it down more than the evidence for the opposite of the claim?

Claim **vs.** **Opposite or Different Claim**

Claim/Position	Which side does the evidence best support?	Claim/Position
Magnets attract all metals		Not so

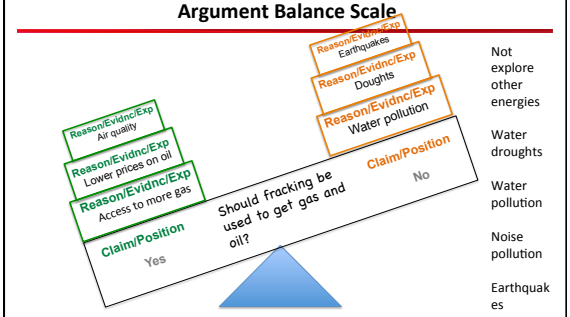
"Constructive Conversations" Activity for All 4 Skills: Argument Balance Scale

Access more gas and oil
Air quality
Decrease depndency on foreign oil
Lower prices and taxes
Most cars need oil

Reason/Evidnc/Exp Air quality
Reason/Evidnc/Exp Lower prices on oil
Reason/Evidnc/Exp Access to more gas

Claim/Position	Should fracking be used to get gas and oil?	Claim/Position
Yes		No

"Constructive Conversations" Activity for All 4 Skills:
Argument Balance Scale



"Constructive Conversations" Activity for All 4 Skills:
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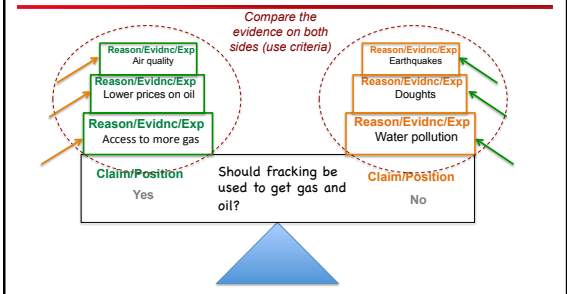

"Constructive Conversations" Activity for All 4 Skills:
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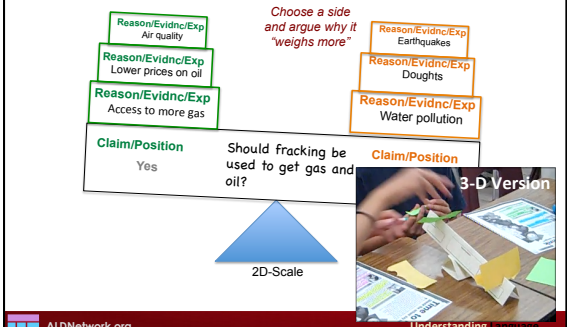

HW: Write a Model Conversation

Think of an upcoming (or past) lesson and write a conversation between two students that shows their learning.

A:

B:

A:

B:

Objectives from Today: How did we do?

	 SPEAKING	 CONVERSING
Increase Quantity	# of students # of minutes	# of students # of back-n-forth conversations
Increase Quality	Strength Clarity	Co-Construction & Collaborative Arguing of Ideas; CC Skills

CONTACT INFORMATION

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Handouts: http://aldnetwork.org/page/Feb13
MOOCs: www.NovoEd.com

References

Zwiers & Soto-Hinman (2016, in press) *The discourse effect: Using conversations to develop academic language and literacy*. Corwin.

Zwiers, O'Hara, & Pritchard (2014) *Common Core Standards in diverse classrooms: Essential practices for developing academic language & disciplinary literacy*. Stenhouse.