Reading Informational Tex in the Science Classroom to Construct Explanatory Models

NSTA 2015 Area Conference

Kansas City

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PROJECT READI

Reading, Evidence, and Argumentation in Disciplinary Instruction

PROJECT READI is a multidisciplinary, multi-institution collaboration aimed at researcn and development to improve complex comprehension of multiple forms of text in literature, history and science.

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Standards Alignment

NGSS

- Science and Engineering Practices
  - SEP2: Developing and Using Models
  - SEP6: Constructing Explanations and Designing Solutions
  - SEP7: Engaging in Argument from Evidence
  - SEP8: Obtaining, Evaluating, and Communicating Information

CCSS for Reading Informational Text

- Key Ideas and Details
  - RI 6.1, RI 6.2, RI 6.3
- Craft and Structure
  - RI 6.4, RI 6.5
- Integration of Knowledge and Ideas
  - RI 6.7, RI 6.8
- Range of Reading and Level of Text Complexity
  - RI 6.10

Drake Elementary School
Chicago Public Schools

-neighborhood school
-South side of Chicago
-pre-K through 8th grade

-430 students

Demographics

- Asian 0.2%
- Black 95.6%
- Hispanic 2.6%
- White 0.9%
- Other 0.7%

Other Statistics

- Low Income 93.0%
- Diverse Learners 15.3%
- Limited English 1.6%
- Mobility Rate 16.7%
- Daily Attendance 94.0%

Literacy Struggles in Urban Classroom With Students of Low SES Backgrounds

- Lacking background knowledge
- Deficits in general science knowledge
- Many students not reading on grade-level
- Low general vocabulary knowledge
- Low science specific vocabulary knowledge
- Lack of literacy supports outside school setting

Why use text-based inquiry?

- Students inexperienced with reading and comprehending scientific information text, including, but not limited to, pictures, diagrams, graphs, and charts
- Need opportunities to make meaning of texts and from texts
- Use learning from reading the texts to build explanatory model(s) of scientific phenomena
- Support reading development of students in content area
- Allow students opportunities for discourse with teacher and peers to construct meaning
- Use text-based evidence to increase understanding by citing evidence, making interpretations, and developing next steps

Implementation in Classroom:

- Develop Essential Question(s) to guide your use of text set with students
- Selection of texts to use as a text set that are aligned to the essential question
- Promote student-to-student discourse
- Teach students how to talk to each other to build knowledge
- Collaborative knowledge building in class on evidence-based ideas presented in small group or class discussion

Choosing an Essential Question(s)

- Essential question(s) is what trying to get students to make meaning of an develop explanatory model around to explain the science content
- Should stimulate thought and provoke inquiry
- Transform instruction in the way teacher approaches instruction with a tex and how students approach a text
- Refer to throughout unit
- Have used 1-3 essential questions for a unit
- For first unit, presented students with Essential Question, but by end of yea as students were comfortable with the process and procedure of this type of instruction, they were able to brainstorm and develop essential questio for the unit

Text Selection for Text Set

- Combination of written texts, graphs, charts, diagrams, pictures, videos
- Text Set overlaid onto curriculum; brought in texts for concepts missing fro curriculum; examine where texts should be used over course of unit
- Text should all help support gathering evidence for the essential question
- Texts should build on one another
- Written text can be shortened
- Seek inter-textual connections so that students will have increased comprehension of texts and/or concept
- Text complexity and number of texts in text set increased over course of year

Text Set Example for Energy Resources Unit

- Text 1: Where Fossil Fuels Come From? (written)
- Text 2: How Much Carbon Dioxide (CO2) is produced when different fue are burned (chart)
- Text 3: Carbon and Global Temperatures (graph)
- Text 4: The Recent Role of the Greenhouse Effect (text)
- Text 5: The Carbon Cycle (diagram)

Promoting Student-to-Student Discourse

- Think-Pair-Share strategy
- Promote collegial conversation between students by practicing partner, small group, and whole group discourse
- Teach students to listen to each other and build on each other's ideas when engaging with text, gathering evidence, and during explanatory model building

Important Components to support Students in Reading Informational Text and Constructing Explanatory Models:

1) Students need to be engaged in iterative cycles of reading complex texts
2) Students need to gather, interpret, and reason with textual evidence
3) Construct, revisit, and revise explanatory models using textual evidence

Component 1: Engage Students in Iterative Cycles of Complex Texts

- Students need multiple exposures to a text to gain greater understanding
- Exposures to text through independent reading with annotations, partner reading, teacher read-alouds, small group readings
- Teach students to persevere through difficult texts
- Second readings of text and sometimes third readings
- Have students seek out connections between texts
- Dig deep into texts with students—know as teacher what evidence is important for students to discover to help gather ideas to support essentia question and explanatory model process

How to Get Students to Read, Engage and Comprehend Complex Text

- Engagement with text more of an inquiry stance
- Annotations for increased student engagement with text
- Students close read and "talk to the text" by making comments, explanations, questionings in written form on the text
- Annotations show how students interacting with text—what's confusing, unknown vocabulary, what seems important, connections they are makin and questions they are coming up with
- Model with students as a teacher think-aloud when students are new to th practice
- Model how to annotate text

Thinking Bookmark

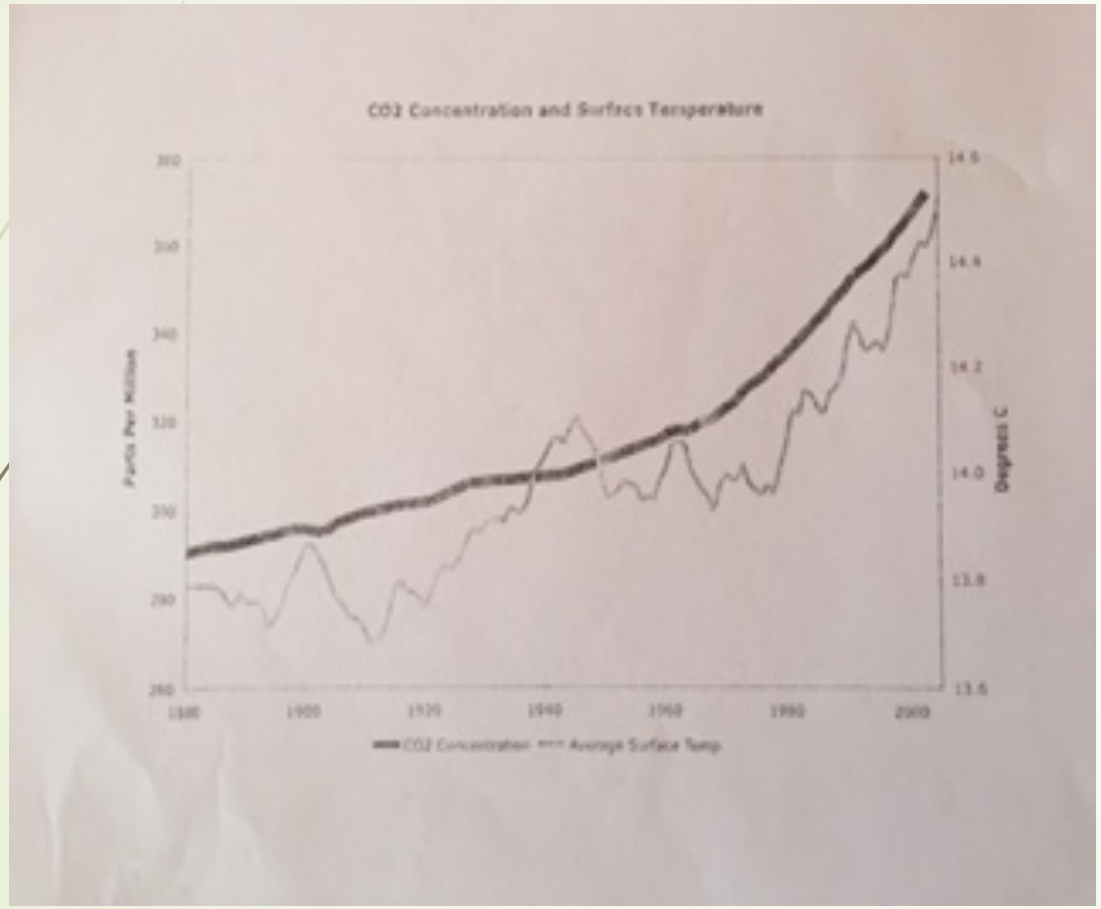
- Used a "thinking bookmark" with students to get them used to the practice of "talking to text" and annotating
- Sentence or comment stems to help phrase their annotations
- Reliance on thinking bookmark over course of year decreased
- Annotations and process of annotating text as student comfort level increased became more natural for students

- Thinking bookmark example
  - Predicting
    - I predict…
    - I think it is…
  - Visualizing
    - I picture… or I can see…
  - Questioning
    - Could this mean…
    - I wonder…
    - Why….?
  - Making connections
    - This is like…. or this reminds me of….
  - Roadblocks
    - I am confused why…
  - Summarizing
    - The big idea here is…

Process for Teacher Modeling of Close Reading, Talking to the Text, and Annotating

- Project text for students to see while each student has their copy of text
- Text copies should afford for written annotations in margin (or post it notes using non-consumable)
- Demonstrate reading the text as teacher and pause to share your thinking out loud when come to part of text you want students to take note of
- Complete annotation on text as students do the same
- Practice with students that talking to the text is writing down what they are thinking in their head while reading in order to solve problems of understanding
- After teacher modeling, give students chance to talk to text and annotate on their own

Engaging Students with Text

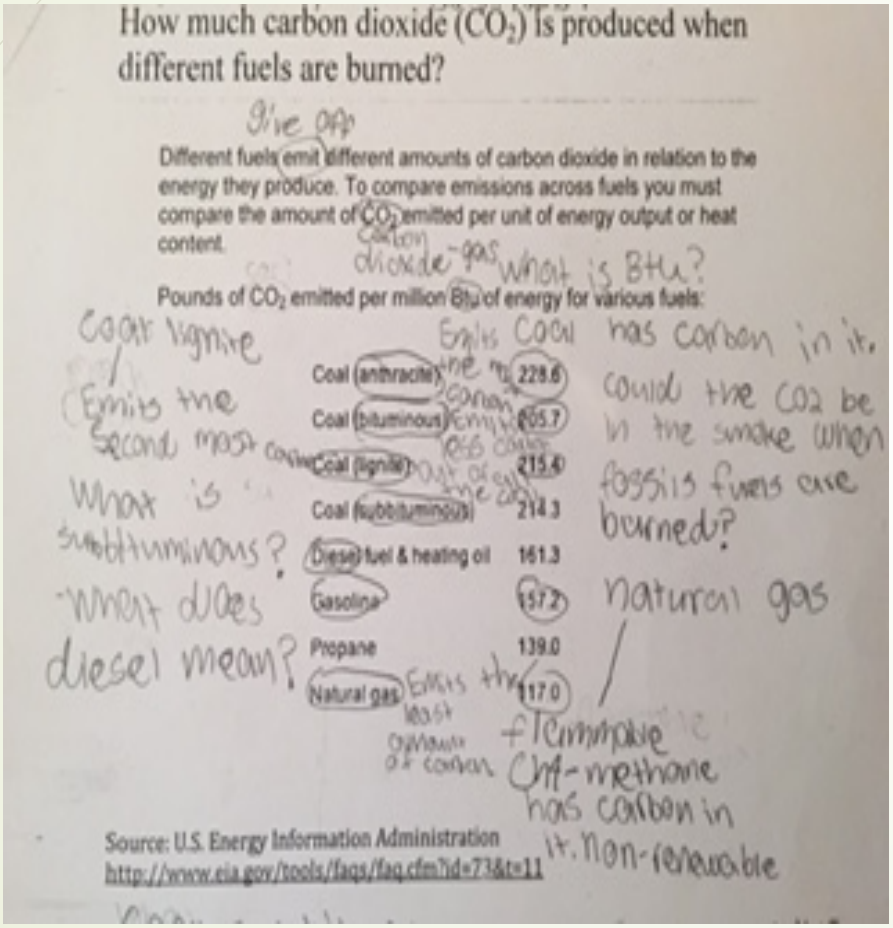


- What do you think the title tells u about the ….?
- How do you read a …?
- Are there words you know or recognize? What are they?
- Are there words you don't know What are they?
- What do you think … means?
- How are we going to find out what …. means?

Using Student Annotations to Promote Understanding

- Using close reading and allowing students the time to annotate text gives you insight as to what and how students are thinking while reading
- Ability to see where student misconceptions lie
- Content or vocabulary that students are still struggling with
- Concepts that students are still confused about or have questions about
- Where students are making connections between texts and/or labs, experiments, and class activities
- Student annotations develop over time—be patient

Examples of Student Annotated Text



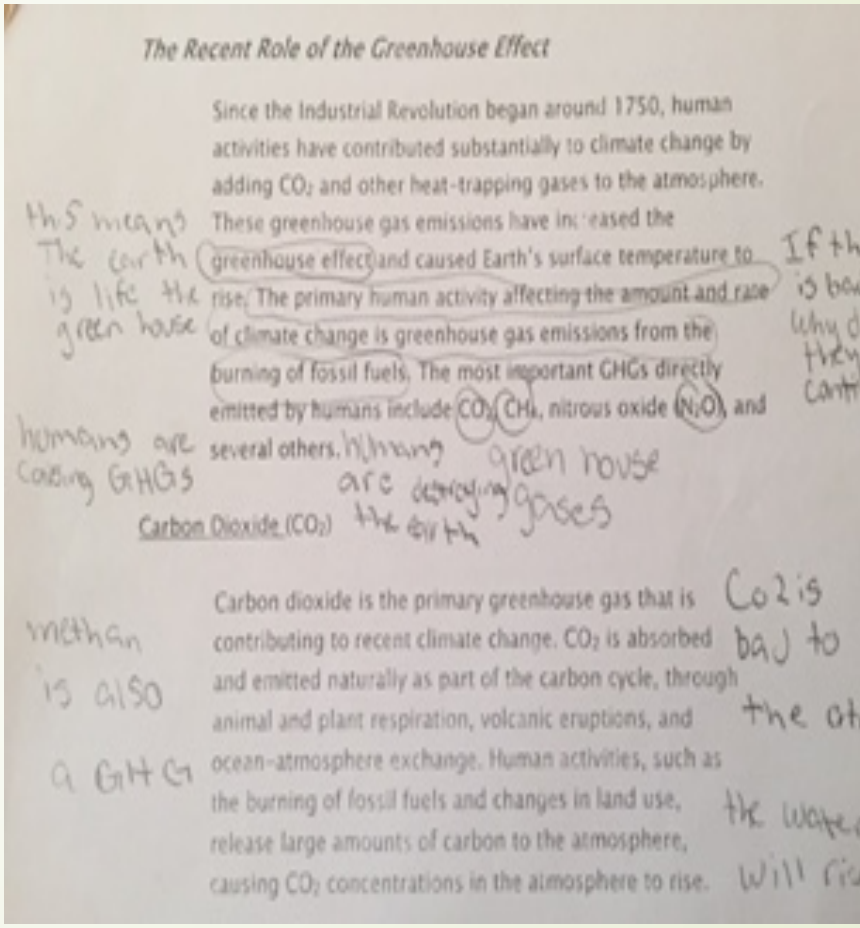
How much carbon dioxide (CO_2) is produced when different fuels are burned?

Different fuels emit different amounts of carbon dioxide in relation to the energy they produce. To compare emissions across fuels you must compare the amount of CO_2 emitted per unit of energy output or heat content.

Pounds of CO_2 emitted per million Btu of energy for various fuels:

Coal (anthracite)	228.6
Coal (bituminous)	205.7
Coal (lignite)	215.4
Coal (subbituminous)	214.3
Diesel fuel & heating oil	161.3
Gasoline	157.2
Propane	139.0
Natural gas	117.0

Source: U.S. Energy Information Administration
http://www.eia.gov/tools/faqs/faq.cfm?id=73&t=11



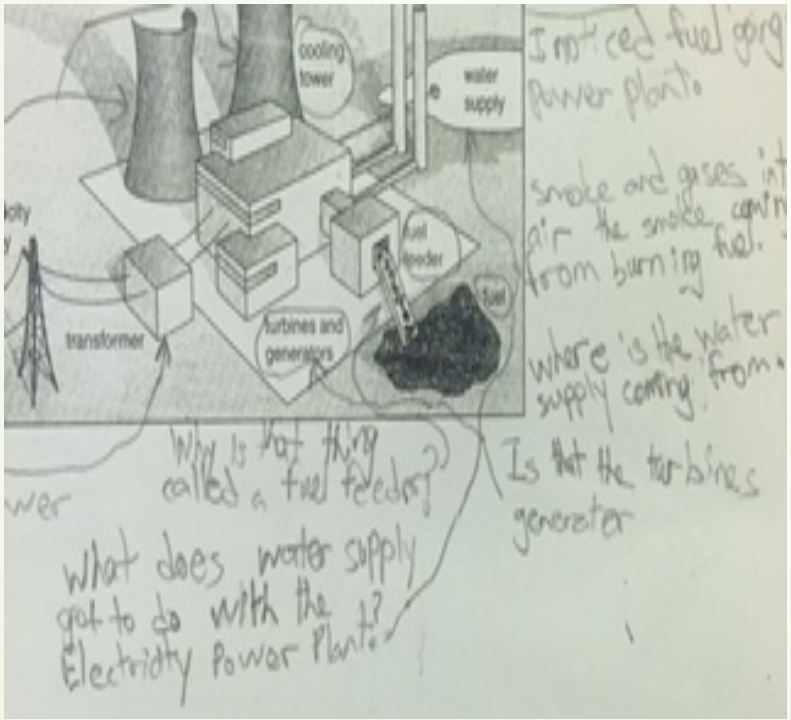
The Recent Role of the Greenhouse Effect

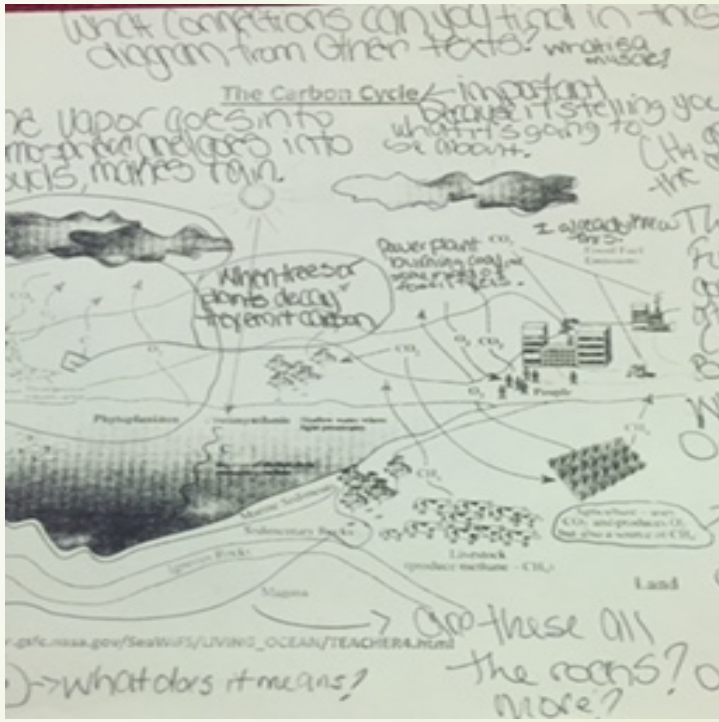
Since the Industrial Revolution began around 1750, human activities have contributed substantially to climate change by adding CO_2 and other heat-trapping gases to the atmosphere. These greenhouse gas emissions have increased the greenhouse effect and caused Earth's surface temperature to rise. The primary human activity affecting the amount and rate of climate change is greenhouse gas emissions from the burning of fossil fuels. The most important GHGs directly emitted by humans include CO_2, CH_4, nitrous oxide (N_2O), and several others.

Carbon Dioxide (CO_2)

Carbon dioxide is the primary greenhouse gas that is contributing to recent climate change. CO_2 is absorbed and emitted naturally as part of the carbon cycle, through animal and plant respiration, volcanic eruptions, and ocean-atmosphere exchange. Human activities, such as the burning of fossil fuels and changes in land use, release large amounts of carbon to the atmosphere, causing CO_2 concentrations in the atmosphere to rise.

Examples of Student Annotated Text





Close Reading Develops into Scientific Close Reading

Close Reading Student Annotation Examples:

- Identifying known and unknown vocabulary
- Paraphrasing and summarizing
- Notes familiar concepts
- Making connections to own knowledge, within a text, or text to text
- Confusions or roadblocks
- Questioning and knowledge building

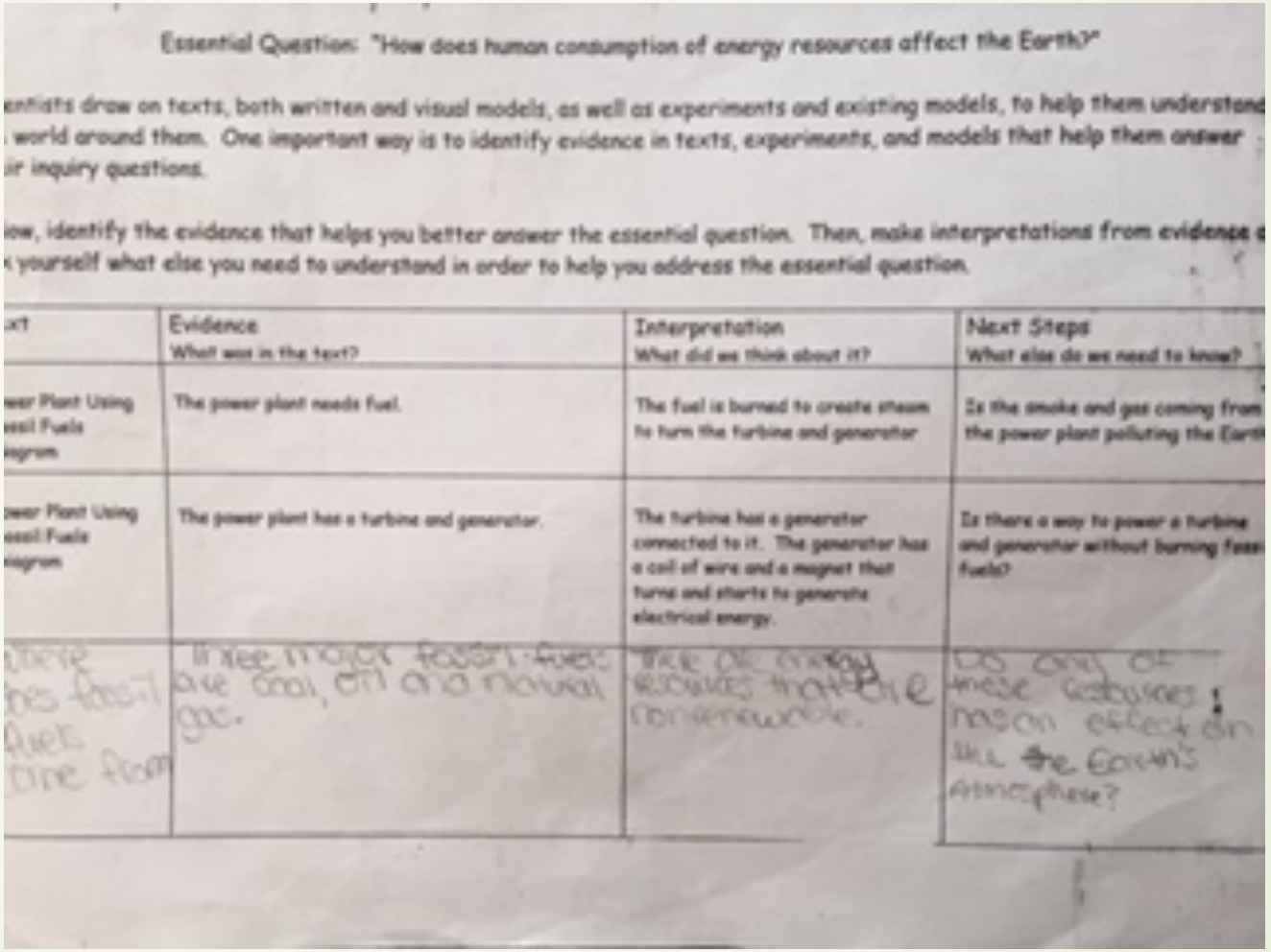
Scientific Close Reading Studen Annotation Examples:

- Attending to phenomena
- Clarifying or inquiring about the phenomena
- Noting elements to add to explanatory model
- Clarifying or inquiring about elements of explanatory model
- Generating with words or pictur an explanatory model

Component 2: Students Need to Gather, Interpret, and Reason with Complex Textual Evidence

- Students have engaged and read text….now what?
- Use of a "note taker" to gather, interpret, and reason with textual evidenc
- Note taker used throughout course of unit with text set
- Students engaged in iterative process of gathering evidence, interpreting and reasoning with evidence
- Gather important text-based evidence that will support essential question
  - Evidence: What was in the text?
  - Interpretation: What did we think about it?
  - Next Steps: What else do we need to know?

Example of Student Note Taker



Essential Question: "How does human consumption of energy resources affect the Earth?"

entists draw on texts, both written and visual models, as well as experiments and existing models, to help them understand
world around them. One important way is to identify evidence in texts, experiments, and models that help them answer
ir inquiry questions.

ow, identify the evidence that helps you better answer the essential question. Then, make interpretations from evidence a
yourself what else you need to understand in order to help you address the essential question.

xt	Evidence What was in the text?	Interpretation What did we think about it?	Next Steps What else do we need to know?
wer Plant Using ssil Fuels agram	The power plant needs fuel.	The fuel is burned to create steam to turn the turbine and generator	Is the smoke and gas coming from the power plant polluting the Earth
wer Plant Using ssil Fuels agram	The power plant has a turbine and generator.	The turbine has a generator connected to it. The generator has a coil of wire and a magnet that turns and starts to generate electrical energy.	Is there a way to power a turbine and generator without burning fossil fuels?
there does not fuels ome from	There are three major fossil fuels are coal, oil and natural gas.	There are many resources that are renewable.	Do any of these resources have an effect on the Earth's atmosphere?

Using Think, Pair, Share to Promote Collaborative Class Discussion

- Allows for deeper understanding, greater collaboration among students and whole class, and metacognition
- Think: Students would go over their texts, reread annotations and notes, and think about the evidence in the text that would help answer Essential Question(s).
- Pair: Students would pair with partner or collaborative group evidence th thought important to Essential Question, their interpretation, and next step
- Share: Discussion as a whole class and recording of evidence, interpretation, and next steps
- Scaffold Students ability to access this process—Think, Pair, Share and then record in note taker moved to Think, Pair, record in note taker, then Share

Component 3: Construct, Revisit, and Revise Explanatory Models Using Textual Evidence

- Construct a consensus model as a class to use as initial model that will be revisited and revised over course of unit as new evidence and learnings c compiled
- After reading a couple texts and gathering and interpreting evidence, have students complete a Think-Pair-Share
- Modeling process is also iterative; students completed 3-4 times over the course of a unit
- Student independence in creating explanatory models increased over course of units and school year

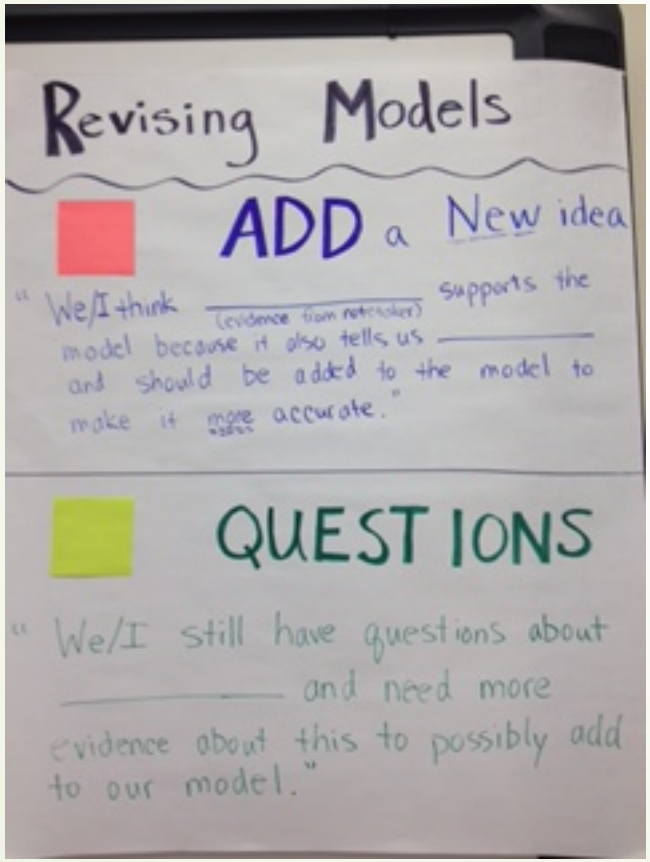
Using Think-Pair-Share in Explanatory Modeling Process

- Allows for deeper understanding, greater collaboration among students and whole class, and metacognition
- Think: Students brainstorm individually using their note taker and annotated texts, the text-based evidence they feel is most important to be included in th explanatory model in order to communicate their claim to their answer of the Essential Question(s)
- Pair: Students share with their elbow partner and or cooperative group the evidence they compiled and would like to add to model. Students need to b able to explain and defend why the evidence they are using is appropriate.
- Share: Students come together as a whole class to discuss ideas that they, th partners or group has to be displayed in the explanatory model. As teacher, compile a list of evidence, and then allow for a class discussion in which students decide what is most important evidence for the explanatory model

Power of Implementing Evidence-Based Explanatory Modeling

- Students take ownership of their thinking
- Allows for evidence from text to be incorporated into their comprehension of explanation for Essential Question(s)
- Iterative process supports deeper conceptual understanding
- Synthesis of evidence from multiple text sources
- Communication of learnings from process of reading text and gathering, interpreting and reasoning with text

Strategy for Revising Models



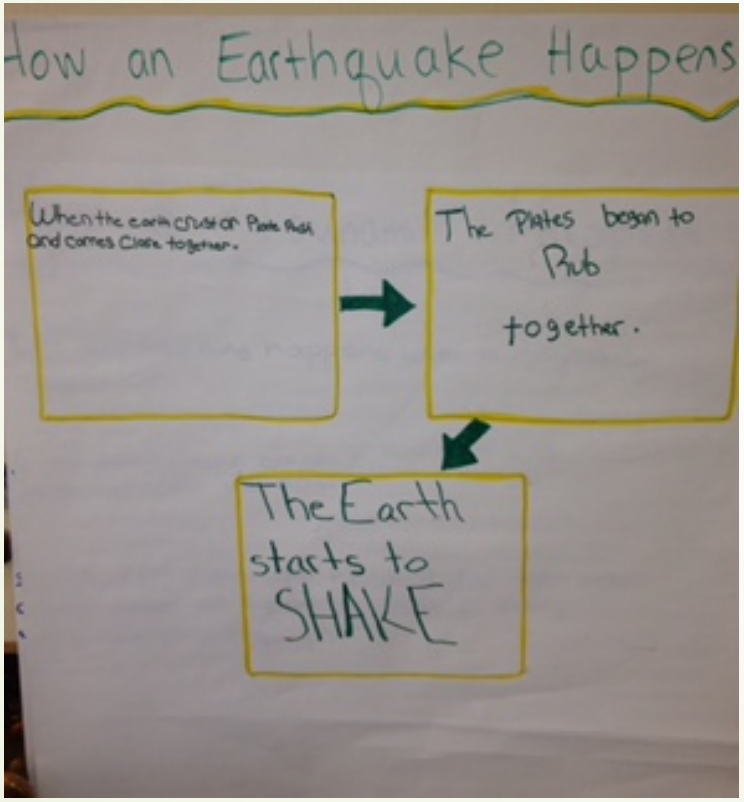
ADD a new idea:

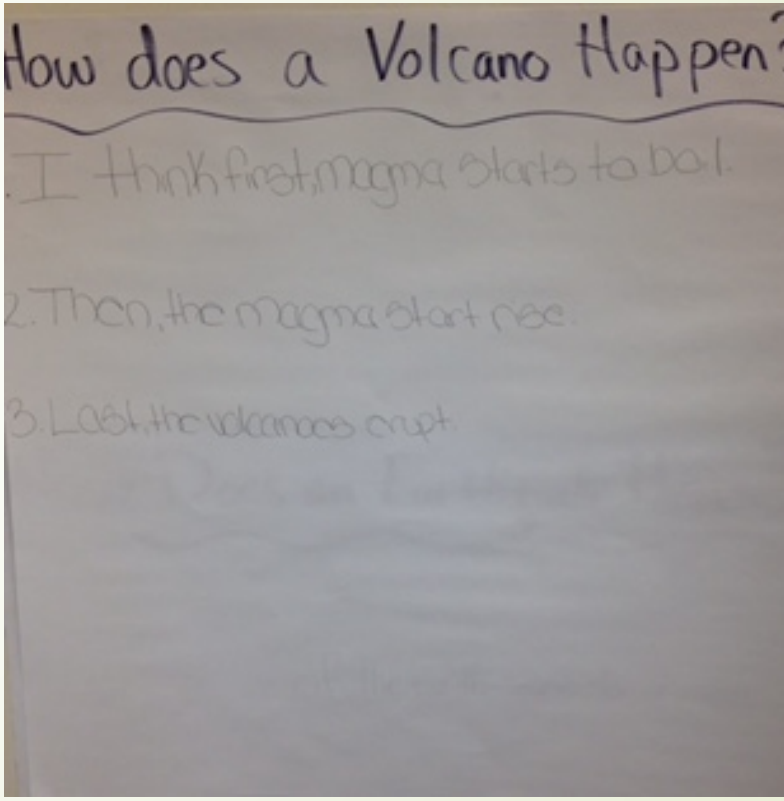
"We/I think _____ supports the model because it also tells us _____ and should be added to the model to make it more accurate."

QUESTIONS:

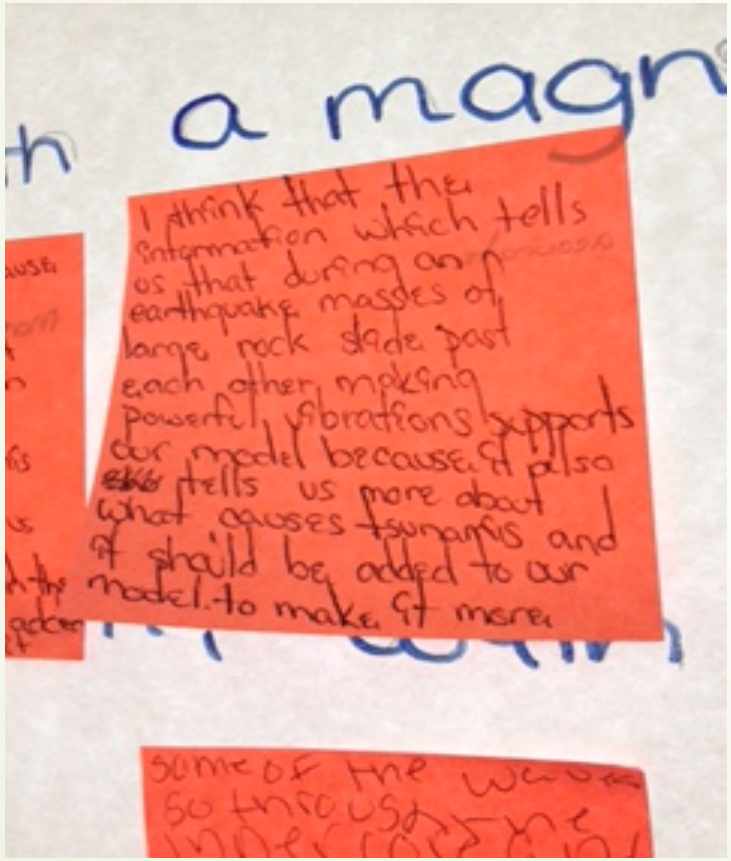
"We/I still have questions about _____ and need more evidence about this to possibly add to our model."

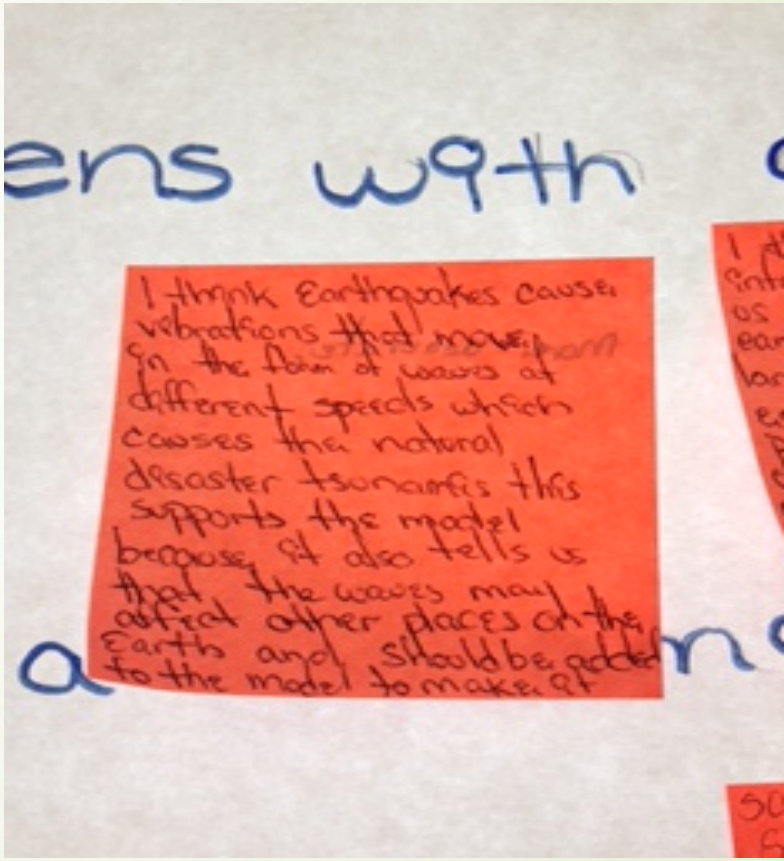
Examples of Explanatory Models





Examples of Revising Explanatory Models





Change in Classroom Practice as Teacher Led to Change in Students:

- Think and read critically
- Knowledgably discuss scientific concepts, questions, and phenomena
- Increased ability to use texts to build academic literacy
- Intellectual engagement through reading information text and class discourse
- Competencies for participation in accessing texts and discussing them
- Continual development of confident, critical, and independent readers and thinkers

Thank You!

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