

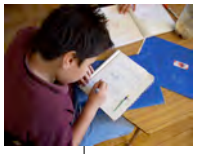

Supporting Students in Science Thinking and Writing

Workshop #3: Teaching Strategies & Assessment

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Agenda

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- Activity - Discuss Teaching Strategies
- Discussion - Lessons Learned & Questions
- Presentation - Video of Classroom Talk
- Activity - Analyze Transcripts
- Presentation - Developing Assessment Tasks

Dinner

- Activity - Assess Student Writing
- Presentation - Providing Student Feedback
- Complete Post Survey
- Logistics
- Sinking and Floating Demonstration

Activity: Discuss Teaching Strategies

- Work in the Grade Level and Content groups from the previous workshop
- Share samples of student writing
- Discuss the writing and the lesson:
  - What teaching strategy did you use?
  - What went well during the lesson?
  - What challenges arose?
  - What were the strengths and weaknesses of your students' writing?
  - What did you learn that you hope to address or apply in using CER in the future?

Discussion: Lessons Learned and Questions

- What did you learn that you hope to address or apply in using CER in the future?
  - Challenges? Successes?
- What did you learn from your discussion with your colleagues?
- What remaining questions do you have?

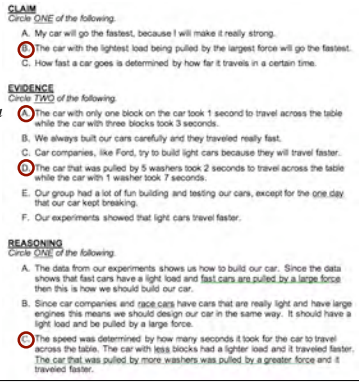
Classroom Talk

- Science is a way of knowing - writing, talking, doing, thinking and reasoning (Michaels et al, 2008).
- Scientific inquiry requires students to play an active role and engage in science talk (Duschl et al., 2006)
- Traditionally science classrooms have been dominated by teacher talk and in an IRE pattern (Crawford, 2005).
  - I = Initiate (Teacher)
  - R = Respond (Student)
  - E = Evaluate (Teacher)
- Creating a classroom culture around CER where it becomes part of the norms of classroom talk supports students in producing stronger science writing (McNeill, 2009).

Classroom Talk - 5th Grade

Question:

How can you design a car to go the fastest?



CLAIM
Circle ONE of the following.

A. My car will go the fastest, because I will make it really strong.
B. The car with the lightest load being pulled by the largest force will go the fastest.
C. How fast a car goes is determined by how far it travels in a certain time.

EVIDENCE
Circle TWO of the following.

A. The car with only one block on the car took 1 second to travel across the table while the car with three blocks took 3 seconds.
B. We always built our cars carefully and they traveled really fast.
C. Car companies, like Ford, try to build light cars because they will travel faster.
D. The car that was pulled by 5 washers took 2 seconds to travel across the table while the car with 1 washer took 7 seconds.
E. Our group had a lot of fun building and testing our cars, except for the one day that our car kept breaking.
F. Our experiments showed that light cars travel faster.

REASONING
Circle ONE of the following.

A. The data from our experiments shows us how to build our car. Since the data shows that fast cars have a light load and fast cars are pulled by a large force then this is how we should build our car.
B. Since car companies and race cars have cars that are really light and have large engines this means we should design our car in the same way. It should have a light load and be pulled by a large force.
C. The speed was determined by how many seconds it took for the car to travel across the table. The car with less blocks had a lighter load and it traveled faster. The car that was pulled by more washers was pulled by a greater force and it traveled faster.

Classroom Talk - 5th Grade

Activity: Analyze Classroom Talk

- Read the two examples of classroom talk
- Which discussion do you think would provide the students with more support for CER writing?
  - Why? What are the characteristics of the discussion that make it different?
- What are some challenges in supporting students in science talk?
- What are some strategies to support students in science talk?

Creating Assessment Tasks

- Step 1: Identify and unpack the content standard
- Step 2: Select scientific explanation level of complexity
- Step 3: Create learning performance
- Step 4: Write the assessment task
- Step 5: Review assessment task
- Step 6: Develop specific rubrics

Step 1: Identify and Unpack Content Standard

- Select standard that targets the key science concept
- Break down into different ideas
  - Identify the different concepts
  - Clarify the different concepts
  - Consider how each concept is related to the other concepts
- Consider common student misconceptions
  - Identify possible misconceptions
- *The unpacking process can clarify what key ideas to include in the assessment as well as what common student misconceptions you may want to incorporate*

Step 2: Select scientific explanation level of complexity

Level of Complexity	Framework Sequence
Simple	Variation #1 1. Claim 2. Evidence 3. Reasoning
	Variation #2 1. Claim 2. Evidence • Appropriate • Sufficient 3. Reasoning
	Variation #3 1. Claim 2. Evidence • Appropriate • Sufficient 3. Reasoning • Multiple components
Complex	Variation #4 1. Claim 2. Evidence • Appropriate • Sufficient 3. Reasoning • Multiple components 4. Rebuttal

Step 3: Create Learning Performance

- Develop Learning Performance
  - Combines both the science content and the CER framework

Content Standard	Practice	Learning Performance
A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the amount of the sample (NRC, 1996, B:1A/ 5-8).	Develop…explanations… using evidence. (NRC, 1996, A: 1/4, 5-8) Think critically and logically to make the relationships between evidence and explanation. (NRC, 1996, A: 1/5, 5-8)	Students construct a scientific explanation that includes a claim about whether two items are the same substance or different substances, evidence in the form of density, melting point (boiling point), solubility, color and hardness of the substances, and reasoning that different substances have different properties.

Step 4: Write the Assessment Task

Learning Performance

Students construct a scientific explanation that includes a claim about whether two items are the same substance or different substances, evidence in the form of density, melting point (boiling point), solubility, color and hardness of the substances, and reasoning that different substances have different properties.

Assessment Task

Examine the following data table:

	Density	Color	Mass	Melting Point
Liquid 1	0.93 g/cm^3	no color	38 g	-98 °C
Liquid 2	0.79 g/cm^3	no color	38 g	26 °C
Liquid 3	13.6 g/cm^3	silver	21 g	-39 °C
Liquid 4	0.93 g/cm^3	no color	16 g	-98 °C

Write a **scientific explanation** that states whether any of the liquids are the same substance.

Step 5: Review Assessment Item

- Is the knowledge needed to correctly respond to the task?
- Is the knowledge enough by itself to correctly respond to the task or is additional knowledge needed?
- Is the assessment task and context likely to be comprehensible to students?

(George Deboer, Project 2061)

Step 6: Develop Specific Rubric
Example below is the Base Rubric

Component	Level		
	0	Varies from 1-5	
Claim A statement that answers the original question/problem.	Does not make a claim, or makes an inaccurate claim.	Makes an accurate but incomplete claim.	Makes an accurate and complete claim.
Evidence Scientific data that supports the claim.	Does not provide evidence, or only provides inappropriate evidence (Evidence that does not support claim).	Provides appropriate, but insufficient evidence to support claim. May include some inappropriate evidence.	Provides appropriate and sufficient evidence to support claim.
Reasoning Using *scientific principles* to show *why data count as evidence* to support the claim.	Does not provide reasoning, or only provides reasoning that does not link evidence to the claim.	Provides reasoning that links the claim and evidence. May include some scientific principles, but not sufficient.	Provides reasoning that links evidence to claim. Includes appropriate and sufficient scientific principles.

Dinner!

Activity: Assess Students' Writing

- Score the four student responses using the specific rubric. For each student give them a separate score for:
  - Claim - 0, 1 or 2
  - Evidence - 0, 1, 2, 3 or 4
  - Reasoning - 0, 1, 2, or 3
- Provide feedback and strategies
  - What feedback would you provide this student? Why would that feedback be helpful?
  - What strategies might you use to help this student construct a stronger explanation?

Student Example A

Yes brine shrimp are living things.

My brine shrimp are living things because the brine shrimp eat the yeast when I put it on the slie. They do a lot of locomotion insider the water. They grow bigger day by day. When we got them they were like sand. When we use a flashlight sine at the water all of the brine shrimp swing towards to the flashlight.

All of the living things will do these acting. If not that means that things is not a living things.

Student Example B

I think brine shrimp is a living thing.

I think brine shrimp is a living thing because it can swim around on the salt water. The brine shrimp can eat their own food that is dyed yeast and they get bigger and bigger.The brine shrimp respond the light in the dark.

The three evidence is true because when a thing is a living thing it should have a life cycle like the brine shrimp and it was a egg and it hatched to a brine shrimp and it lay eggs to make the next generation that is a life cycle.

Student Example C

They are living thing.

If they don't move or eat they are not living thing.

The brine shrimps swim and fly in the water. They can move and eat.

The evidence that the brine shrimps can see and herir or smell if the can fell and taste the water they can see the water a hear the water sound and eat the red yeast. We learn the we see the brine shrimp.

Student Example D

I thing the brine shrimp is living thing.

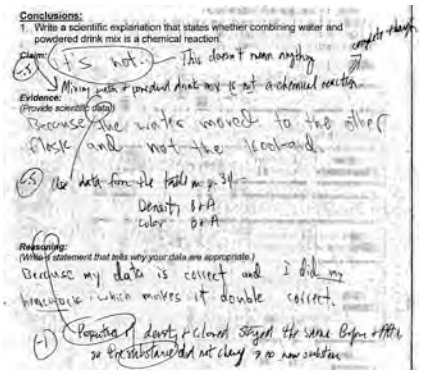
I think the brine is living thing because I put the brine shrimps in microscope is small 0.1mm and then after three day the brine shrimp is big 1.9mm. I observed the brine shrimp heal the brine shrimp sloune the brine shrimp to eat the red dyed yeast after the brine shrimps head is red and the brine shrimp see the light it respond swim to the dark.

When the brine shrimp is a living thing because the data is the brine shrimps put in the microscope is small after one week is big and then I put the brine shrimps in the dark use light shine the brine shrimps. The brine shrimp see the light has respond swim to the light on the dark.

Providing Students Feedback

- What to Comment on:
  - Inclusion and quality of the claim, evidence, reasoning and potentially rebuttal
  - Accuracy and thoroughness of the science content
  - Holistic quality of the scientific explanation
- How to Comment:
  - Explicit and clear feedback
  - Point out strengths and weaknesses
  - Provide suggestions on how to improve
  - Ask questions to promote deeper thinking

Providing Students Feedback



Conclusions

- Make the CER framework explicit
- Identify places in your curriculum where it makes sense to include CER and design learning tasks.
- Incorporate different teaching strategies
- Include CER in your science talk to make it a part of your classroom culture.
- Use rubrics to evaluate student writing
- Provide students with explicit and clear feedback

Logistics

- Complete Post Survey
- Sign and hand in stipend form
- Hand in samples of student work
- Receive PDP certificate

- One Last Activity
  - Sinking and Floating Demonstration

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