Exploring Ways to Integrate Science and Literacy Learning

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(note the three e’s)
How have you integrated science and literacy learning in your own context?
Our context is a laboratory-based physics course for prospective elementary and middle school teachers. We use an open-source textbook by Emily van Zee and Elizabeth Gire:

*Exploring Physical Phenomena:*
*What happens when light from the Sun shines on the Earth?*
[http://open.oregonstate.education/physicsforteachers](http://open.oregonstate.education/physicsforteachers)

Unit 4: Considering the Influence of Light and Thermal Phenomena on Global Climate Change
In integrating science and literacy learning, our emphasis is on helping students learn how to:

• speak clearly
• listen closely
• write coherently
• read thoughtfully
• create and critique media
How do you help students learn how to speak clearly and listen closely in your context?
We facilitate many small group conversations and whole group discussions in every session.

**Question 4.8 What is the greenhouse effect in the context of the entire Earth?**

To consider the greenhouse effect in the context of the entire Earth, each group will need: a large white board as well as a white board marker and eraser for each student.

- With your group members, talk about the greenhouse effect on a global scale.
- On a large white board, draw a diagram to represent your group's initial ideas about what is happening to the energy that enters the Earth's system when light from the Sun shines on the Earth:
  - Where does this energy go?
  - What changes does it undergo while on Earth?
  - How does it leave the Earth?
- Plan and practice briefly what each group member will say when presenting your group's diagram to the whole group.
- Share your ideas and their representation on a whiteboard with the whole group:
  - What patterns do you notice in these presentations?
  - How are the groups' ideas similar? How are they different?
  - How do they help you think about the greenhouse effect on the Earth?
How do you help students learn how to write coherently in your context?
Students make notes on physics notebook pages in class and write many essay responses on homework and exams.

Example: Homework #8 included reflecting upon students’ exploration of the impact of ice melting on land or in the ocean:

During class we modeled the rising sea levels as a result of melting ice on land. To do this, we took two bowls and put rocks in one and left the other one empty. The rocks were meant to represent the land on Earth. In each bowl, we placed the same amount of ice cubes. In the empty bowl, the ice cubes were on the bottom. In the bowl with the rocks, the ice cubes were on top of the rocks. We then filled each bowl to the top with room temperature water. We predicted that the bowl without the rocks would not overflow because the ice had already displaced the water with enough room for the resulting melted ice. We also predicted that the bowl with the rocks would overflow because the ice had not displaced the water with enough room for the resulting melted ice. After all the ice had melted, we observed that our predictions were accurate. The bowl without the rocks didn’t overflow and the bowl with the rocks did overflow. This model represents how melting sea ice does not add to the rising sea levels but melting land ice does.

Physics Student, Spring 2020
How do you help students learn how to read thoughtfully in your context?
We suggest before, during, and after reading strategies

• Example After Reading Strategy: Ask yourself: what do I now understand that before I did not? What new information do I have about this topic? (Winograd and Devitt, 2009)

• Example reflection: On the Intergovernmental Panel on Climate Change’s website, I found their National Greenhouse Gas Inventories task force was dedicated to developing methods for calculating greenhouse gases in the atmosphere, as well as their removal...I was not aware of the Intergovernmental Panel of Climate Change, let alone that they have specific task forces to tackle various issues within climate change.

Physics student, Spring 2020
How do you help students learn how to create media in your context?
Our students create a children’s book about a course topic of their own choosing

*The Greenhouse Effect* by a physics student, Spring 2020
How do you help students learn how to critique media in your context?
We engage students in exploring and critiquing websites both in class and for homework

Example Homework Question:

• What are you curious about global climate change? Formulate and state several questions you could explore through the resources on the Internet.

• Select one question.

• Identify and list URLs, titles, and authors/agencies for at least four websites relevant to the question you are asking. Use some we explored in class and/or others you find on your own.

• Explore the website that seems the most helpful

• Summarize the information provided on this website.

• Critique the website: Why did you choose this one? How was it helpful in beginning to find out about your question? How not helpful?
Students make connections to Next Generation Science Standards in class, homework, exams.

Example students’ reflection on engaging a friend in exploring her carbon footprint:

• The NGSS standard that goes with this is engaging in argument from evidence and we did a little bit of this because at first, she didn’t think that the melting of the ice would be affecting her and through my argument from evidence of warming, I was able to teach her that it wasn’t true. I also used cause and effect because we could see the effect that our carbon footprint and global warming was causing these huge ice shelves to melt in Greenland.

Physics Student, Spring 2017
Teaching friends and/or family members provides ways for students to practice integrating science and literacy

• (My Dad) helped me complete our carbon footprint...we were very surprised by the results ... I enjoyed teaching my dad about global climate change by showing him evidence of the melting glaciers in Montana and talking to him about the experiment we did in class with the ice and rock and plastic dishes. I learned that evidence for any topic is a good component to have when you are teaching because it gets people talking and asking questions.

Physics 111 student Spring 2020
We also emphasize reflection with exit tickets:

• What was most interesting about what you learned today?

Climate change cannot completely be reversed, but we can work to slow its progress.

• What are you still wondering?

What can I do to reduce my carbon footprint?
Thank you for coming!

What was most interesting about what you learned today?
What are you still wondering?

I would be delighted if you would respond in the chat
or email me at vanzeeee@oregonstate.edu
(note the three e’s)