



Teaching and Learning with the Science and Engineering Practices: Analyzing Data & Mathematical Thinking

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Agenda

- Overview
- Discussion – Share Lessons Learned
- Activity 1: Discuss Synthesis Documents from last session
- Activity 2: Watch video from Achieve about Science Practices
- Activity 3: Watch high school video of data analysis and mathematical thinking

BREAK

- Activity 4: Create diagram of similarities and differences between practices 4 and 5

- Homework – NGSS@NSTA website resources

PowerPoint at: <http://www.katherinemcneill.com>



Goals for 5 Meetings

- Develop a deeper understanding of the 8 science practices in NGSS
 - Clarifying definitions of each practice
 - Explore the relationships between the 8 practices
- Develop strategies to adapt existing curriculum to align more closely with the science practices
 - Identify challenges around adapting (both student challenges and lesson design challenges)
 - Develop strategies for designing lessons



Share Lessons Learned

- With your group. Share your Lessons Learned from either *Asking Questions/Problems* or *Investigations*.
- Discussion
 - What teaching strategies/activities would you recommend for adapting current science lessons?
 - What challenges did your students have with the science practice?
 - What challenges did you have adapting a lesson to target a specific science practice?



Activity #1 – Synthesis from Last Meeting

- With your Group:
 - Look at the 2 synthesis documents for the practices of – *Asking Questions* and *Planning & Carrying out Investigations*.
 - Consider an audience that is new to the 8 science practices
 - Do these help someone understand what does and what does not count as one of these practices?
 - What are the strengths?
 - What are the weaknesses?

Activity #2: Watch Video on Science Practices

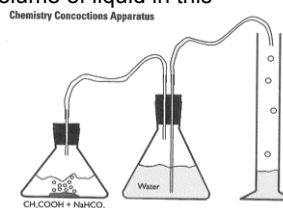
- This video was produced by Achieve and Teaching Channel - <https://www.teachingchannel.org/videos/science-engineering-practices-achieve>
- Discussion Questions:
 - How is their discussion of science practices similar and different from your own thinking?
 - How is this vision of science practices similar and different from what is currently in science curriculum?
 - What specific science practices did you see in this video? Why?

Activity 3: Video of data analysis and mathematical thinking

- Analyzing and interpreting data
 - *Analyzing and interpreting data includes making sense of the data produced during investigations. Because patterns are not always obvious, this includes using a range of tools such as tables, graphs and other visualization techniques to make sense of the data.*
- Using mathematics and computational thinking
 - *Mathematical and computational thinking involves using tools and mathematical concepts to address a scientific question.*

Context for Video #1: Chemistry Concoctions WCI Project

- This project focused on how the gas produced from the reaction of sodium bicarbonate (baking soda) and acetic acid (vinegar) could be used to displace a specific volume of liquid in this apparatus →



Context for Video #1: Chemistry Concoctions WCI Project



- Student groups brainstormed what could be done in terms of technique or equipment to change the observed results
 - Each group chose a variable to test, for which they became “experts” and later on presented their findings to the whole class
- Group 2 varied the volume of the acetic acid that was added to a constant mass of sodium bicarbonate

Video #1: Chemistry Concoctions WCI Project

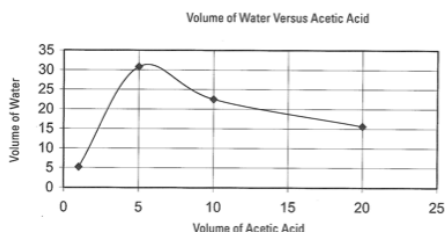


- Video Whole Class Inquiry
 - DVD 1 → Chapter 2 → CHECO3. 24:02 – 25:20
- Discussion Questions
 - Are there instances where you saw students engaged in *analyzing and interpreting data*?
 - Are there instances where you saw students engaged in *using mathematics and computational thinking*?

Context for Video #1: Chemistry Concoctions WCI Project



- Graph from Group 2's Presentation



Video #1: Chemistry Concoctions WCI Project



- Video Whole Class Inquiry
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Context for Video #2: Solutions WCI Project



- The purpose of this project was for students to calculate the percentage (by mass) of each component of a mixture containing sodium carbonate and potassium iodide. The only other chemical they had to use was 0.5 M of calcium chloride
- Lab included each group:
 - Taking one of the six solid mixtures of potassium iodide and sodium carbonate and reacting it with a calcium chloride solution
 - Filtering out the calcium carbonate and using its mass to help determine the mass of each of the original solids

Context for Video #2: Solutions WCI Project



- After each group conducted their lab, students gathered in the front of class to discuss their lab calculations
- Sandy had a template for group calculations on the front board

Video #2: Solutions WCI Project



- Video Whole Class Inquiry
 - DVD 1 → Chapter 5 → SOLN-2B. 12:05-17:00
- Discussion Questions
 - Are there instances where you saw students engaged in *analyzing and interpreting data*?
 - Are there instances where you saw students engaged in *using mathematics and computational thinking*?

BREAK



Activity #4: Similarities and Differences between Practices 4 and 5



- On a large chart paper with your group create a representation that illustrates:
 - How are *Analyzing and Interpreting Data* and *Mathematical and Computational Thinking* similar and different from each other?
 - What are the key similarities?
 - What are the key differences?
- Resources
 - 3 Handouts - Appendix F. BSCS definitions, Science Practices Leadership definitions

Next Time: Explore NGSS@NSTA before May 13



- Before our next meeting on May 13, we would like you to explore the NGSS@NSTA resources:
 - Planning sheet that identifies the target practice and a "lessons learned" (e.g. lesson challenge, student challenge, strategy).
 - Lesson artifacts – Bring in something to share to illustrate the "lesson learned" such as a powerpoint to illustrate a strategy or student writing to illustrate a challenge.
 - *If you were comfortable, we would like to collect the planning sheets and artifacts to help us synthesize the lessons learned.*

Contact Information



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<http://www.katherinelmccneill.com>

- Workshops
 - Has the powerpoint
- Teaching Resources
 - Links to other webpages (e.g. argument assessments, lessons, etc.)