Smithsonian
Science Education Center

Good Thinking! The Science of Teaching Science

Professional Development Discussion Guide

About *Good Thinking!*

Good Thinking! is an original animated series developed by the Smithsonian Science Education Center (SSEC) and FableVision Studios as a professional development resource for K-12 science educators. The series brings viewers into the classroom of science educator Isabella Reyes as she explores "the science of teaching science." Drawing from peer-reviewed research in science, cognition, and pedagogy, *Good Thinking!* distills valuable findings from hard-to-access journal articles to reveal common student misconceptions and promote effective classroom practices.

How to use this guide:

This format was designed to flexibly fit into PLC meetings, PD workshops, or any time that you and your colleagues can meet to absorb some new ideas and discuss your experiences as educators.

The students in the *Good Thinking!* classroom were designed as 5th graders, but research has shown that student ideas about major topics in science are remarkably similar across K-12 grade levels, mainly due to common misconceptions being inadequately addressed or unintentionally reinforced during formal education. While the content of the series is relevant to all levels of instruction, teachers working at the oldest and youngest ends of the K-12 range may need to include additional discussion during the post-viewing conversation that addresses the implications of the videos for their specific grade level.

Requirements:

- Access to a strong internet connection for streaming video
- A screen large enough for group viewing
- Copies of this guide for each participant

Discussion objectives: *Good Thinking! – Chemical Reactions in Action*

- Investigate common student misconceptions about chemical reactions
- Improve questioning strategies to better elicit student ideas about chemical changes
- Pick up tips for modeling chemical reactions in the classroom using relatable concrete examples
- Acquire strategies to help students account for chemical reactants in a given chemical system

Procedure

1. Establish ground rules to create an environment conducive to professional development:
    a. Introduce yourself to any participants you may not know. In a large group it may be helpful to select one individual to serve as the facilitator for the session.
    b. Agree upon a brief outline of session length, goals and structure. This module is designed to promote exchanges of knowledge between a group of peers, so it may be helpful to divide participants into smaller subgroups by similar academic levels or content area.
    c. Establish guidelines for productive participation and distribute writing materials to each participant.

2. **Before Viewing** – Each participant should take some time to respond to the questions below on their paper. The amount of time needed to answer these questions may vary, but thorough responses are encouraged, as they will be helpful to the discussion later in the session:

    - How would you describe a chemical reaction to a group of students in simple terms?
    - How would you explain the difference between an atom and a molecule?
    - Why is mastery of basic chemistry concepts important to success in other branches of science?

3. **Watch the Episode**: *Good Thinking! – Chemical Reactions in Action*
    Streaming video links available via:
    a. YouTube
    b. Smithsonian Science Education Center
    c. PBS LearningMedia

4. **After Viewing** – Once you have finished watching the episode, begin a discussion using the following questions as a framework. For larger groups, it may be helpful to have the PD facilitator read the prompts aloud and actively manage the time and flow of the conversation:

- Have you experienced misconceptions about chemical reactions in your teaching practice? If so, what were these ideas, and how did you identify and address them?
- Using real world examples can help reinforce more abstract concepts for students. **Option**: Return to the video and re-watch section: **1:03-1:40**. Ms. Reyes used the example of a rusted bicycle in her lesson, what are some other real world examples of chemical reactions you have used in your science classroom?
- **Option**: Return to the video and re-watch section: **3:08-3:53**. In the clip, Ms. Reyes encourages Amar to consider oxygen from air around the bicycle as a reactant. What strategies can teachers use to help students think about chemical reactions in terms of the system in which they occur?
- **Option**: Return to the video and re-watch section: **3:08-3:53**. In the clip, Bunsen explains that all physical models have limitations. Reflect on the models you have used in your classroom. What were their limitations, and how did you address them? What are the possible implications of relying on only one type of model to teach a given concept?

5. **After the Discussion** – Once your group has finished discussing the prompts and exchanging experiences, give a brief recap of the major takeaways from the conversation. For larger groups, it may be useful for the facilitator to collect one or two salient points from each subgroup's discussion to share on a large sheet of paper. Conclude the session by highlighting any suggestions for effective practices that were shared by the group.

Thanks for tuning in to Good Thinking! We hope you found this session to be informative, and appreciate the contribution of your experience, time, and ideas.

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