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 5^{th} 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! – Time: It's Like, So Deep*

- Build a more accurate understanding of Earth's history, including the dates of major events and the relative time between them
- Identify common sources of student confusion surrounding deep time, and pick up tips for helping students engage with geologic timespans
- Discover useful references and analogies that can help students relate to geologic dates and timescales
- Discuss strategies to incorporate deep time concepts across multiple content areas

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:

    - Do you feel you have a firm understanding of the order of major events in Earth's history? What about the relative amounts of time between these events?
    - How would you describe the difference between the duration of the age of dinosaurs and the duration of human history to a group of students?
    - Have you observed students struggling to fully comprehend large timescales? If so, how did you approach these issues?

3. **Watch the Episode**: *Good Thinking! – Time: It's Like, So Deep*
    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:

- Comprehending deep time is a challenge for almost everyone. In your teaching experience, have you encountered student misconceptions about distant past? If so, what were these ideas and how did you identify and address them?
- **Option**: Return to the video and re-watch section: **4:19-5:09**. In the clip, Gummerson explains 'threshold concepts' and their importance to learning. What are some other examples of threshold concepts in science education? How can teachers support mastery of these ideas?
- As described in the video, the use of properly supported analogies can help students understand difficult concepts. **Option**: Return to the video and re-watch section: **6:54-7:24**. Do you use any similar analogies that are particularly effective for teaching science concepts?
- Is an understanding of deep time important in science education? How so? How could you incorporate deep time concepts into other content areas such as chemistry or biology?

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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