Expansive Explanations

How do we support students in engaging in sensemaking activities such as the evidence tracker and wondering wall, so students can construct their own explanations? How do we offer choice and help students engage in building robust ideas that move beyond right and wrong answers?

"Over the course of a unit, students accumulate many experiences, new language, and new ideas. But stockpiling knowledge is not the goal of Ambitious Science Teaching; instead, we want students to develop more robust understandings by pulling together different ideas and bodies of evidence, in order to advance their current explanations and models. These resources include records of their thinking and activity, ideas from their peers, lists of hypotheses, mathematical tools, drawings, metaphors, vocabulary, and of course, canonical science information. Thus, our title for this core set of practices is a play on words – the "drawing together" refers to students both synthesizing ideas from recent learning experiences, and also inscribing on paper their final models and explanations." -*Ambitious Science Teaching* (p. 215)

Two strategies to support explanations are Evidence Trackers (also called Summary Tables) and Gotta Have It Checklists. **Excerpt from**: Windschitl, M., & Thompson, J. J. (2013). The modeling toolkit: Making student thinking visible with public representations. *The Science Teacher, 80*(6), 63-69.

- "Gotta-have" explanation checklists. The "gotta-have" checklist is a set of ideas students think must be included in the final explanatory model. This may start with very simple statements or even just terms, but students should add to the list over time as they engage in cycles of reading, activity, and connecting with their everyday experiences. If students miss key elements of the final causal explanation, the teacher should modify instruction to address these missing pieces.
- The gotta-have explanation checklist is not a list of vocabulary words. As the checklist is developed, lesson by lesson, it needs to be composed of ideas or relationships that students believe are important to a final explanation. Figure 8 (p. 68) is an example developed by students during a unit on gas laws with the imploding railroad car as anchoring phenomenon.

FIGURE 8

"Gotta-have" checklist for explaining the imploding tanker car (Gas Laws unit).

Include in your explanation:

- How molecules cause pressure.
- How conditions inside and outside the tanker change in each phase.
- How heat energy affects different parts of the system.
- How changes in the pressure of a container affect volume.

Evidence Trackers help students **keep track of the storyline** and **how ideas are changing** as evidence is gathered. In SPS, we post the chapter or investigation questions and three columns: What We Did (activities, readings, etc.), What We Figured Out (key concepts), and How this Helps Us Figure Out [unit phenomenon]. This trackers remind students of the **evidence** collected to build the **final model/explanation** and provides guidance to write/record a **final explanation**. They can also acknowledge **wonderings** and track if the class discovered answers to questions. **Read more about Evidence Trackers here.** **(files in Teams)**

Expansive Explanations

Choice 1: Read the table describing the practice of constructing explanations (excerpted from Appendix F). These are the components of students are expected to master at the end of each grade band. Discuss: What do you noticed about the components of this practice? How might you support students to engage in this practice?

"The goal of science is the construction of theories that provide explanatory accounts of the world. A theory becomes accepted when it has multiple lines of empirical evidence and greater explanatory power of phenomena than previous theories."(NRC Framework, 2012, p. 52)

Grades K-2	**Grades 3-5**
Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.	Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.
Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.	Construct an explanation of observed relationships (e.g., the distribution of plants in the back yard).
	Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.
	Identify the evidence that supports particular points in an explanation.
Use tools and/or materials to design and/or build a device that solves a specific problem or a solution to a specific problem. Generate and/or compare multiple solutions to a problem.	Apply scientific ideas to solve design problems. Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

Adapted from: Appendix F: Science and Engineering Practices https://www.nextgenscience.org/resources/ngss-appendices

Expansive Explanations

Choice 2: Amplify provides grade-band guidelines for Scientific Explanations (and Arguments). This provides a starting checklist for students to make sense of how they might construct an explanation. As teachers, we can build on this to support students in expansive explanations.

Read the Scientific Explanation Guidelines from Amplify. Then, discuss:

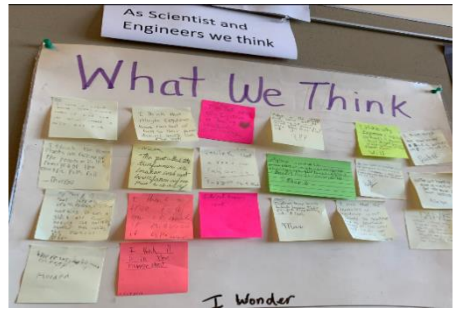
- How might you work with your students to expand their understanding of what counts as an explanation?
- What prompts might you use to orient students to their own and their peers' ideas and experiences?

What Is a Scientific Explanation?

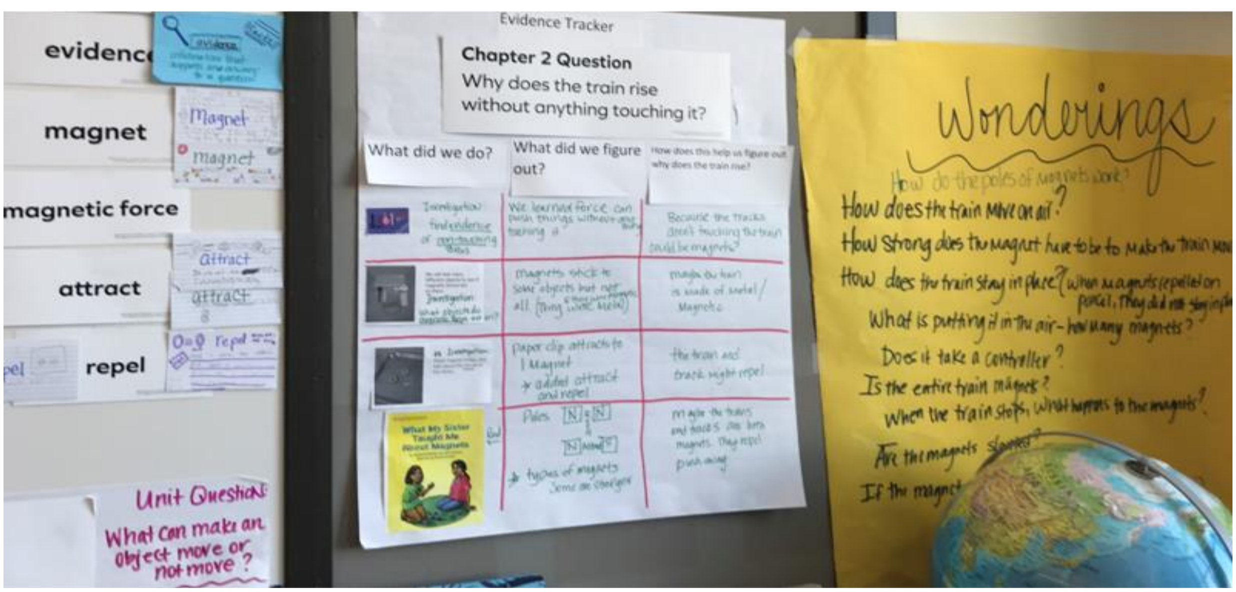
1. It answers a question about how or why something happens.
2. It is based on the ideas you have learned from investigations and text.
3. It is written for an audience.
4. It describes things that are not easy to observe.
5. It uses scientific language.

Expansive Explanations

Choice 3: Look at the examples of Evidence Trackers/Science Walls and student work. Then discuss, how can we use the Evidence Tracker and other strategies (e.g., Wondering Wall, Gotta Have It Check Lists, Evidence cards, etc.) to support students in engaging in sensemaking activities and in constructing their own expansive explanations?



Science Wall: The Science Wall, which includes the Wondering Wall and Evidence Tracker should be crafted and owned by students. **Read more about Evidence Trackers here.** **(files in Teams)**

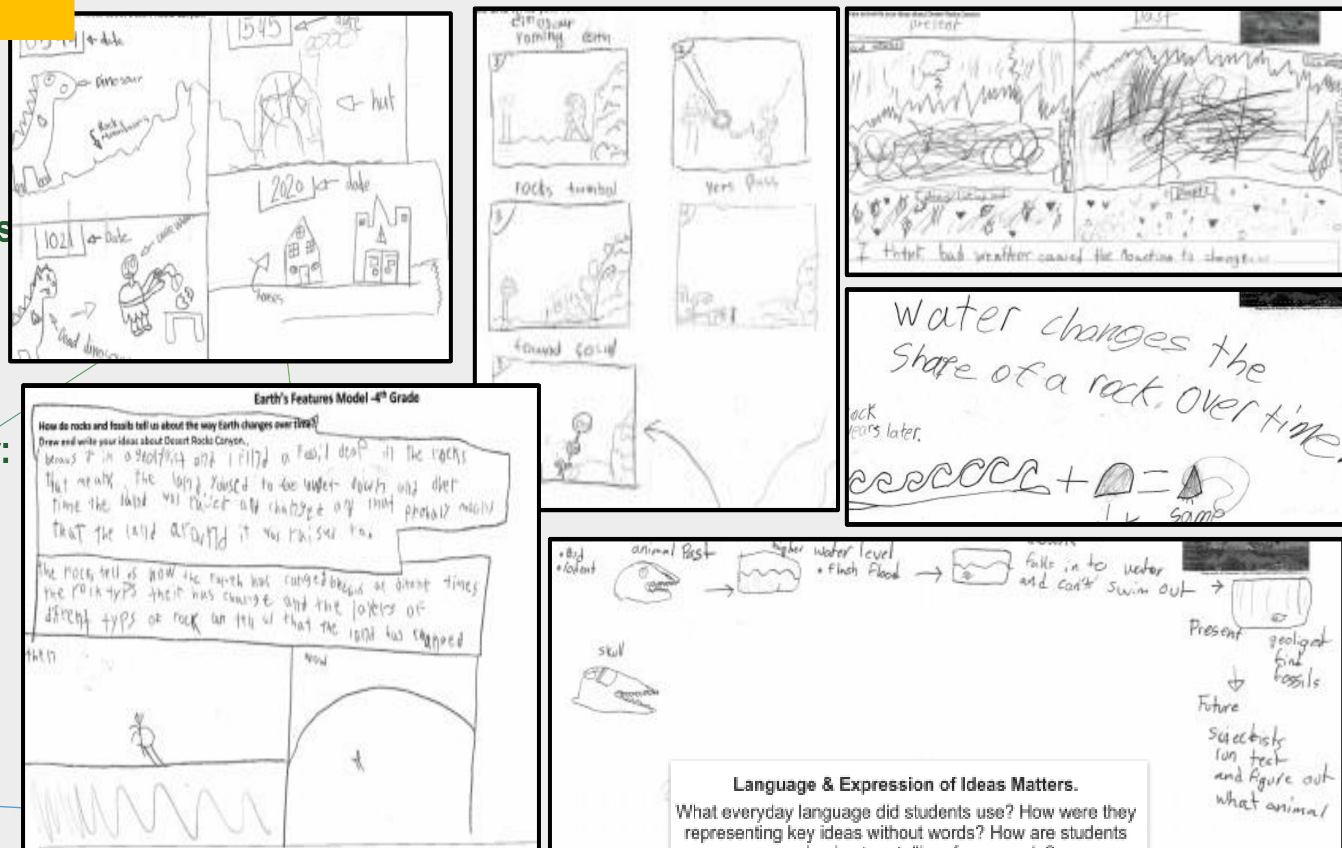


Expansive Explanations

4th grade Earth Features
How do rocks and fossils tell us about how Earth has changed over time?

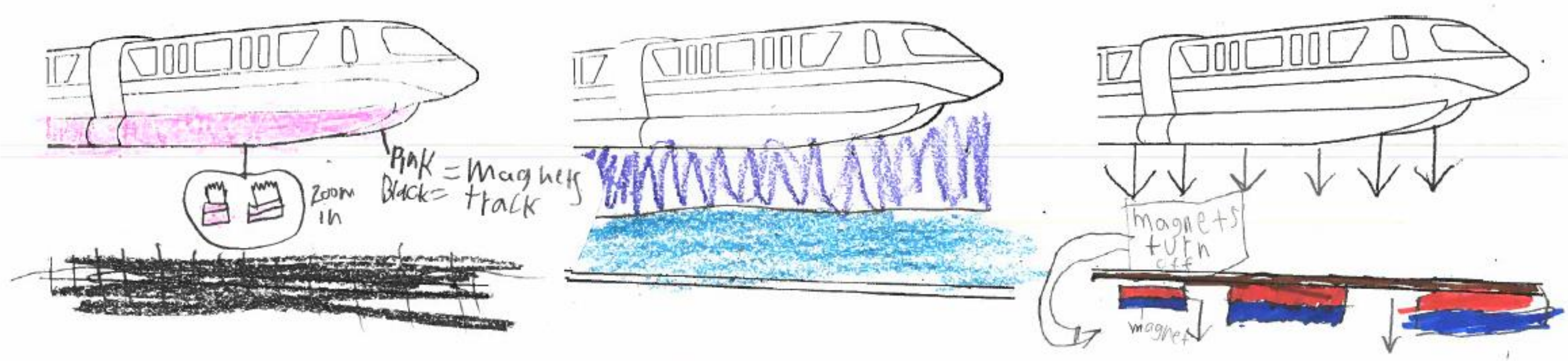
STUDENTS' REPERTOIRES: MULTIPLE VISUAL MODALITIES FOR IDEA SHARING

- Conventions
- Comic:
- Timeline:
- Before/After:
- Sections:
- Symbolic:



Language & Expression of Ideas Matters.
What everyday language did students use? How were they representing key ideas without words? How are students engaging in story-telling, for example?

Expansive Explanations



Name: Èlias   Date: 1/17   Version: 2

How Does the Floating Train Work?

Directions: Draw, label and write what you think is happening about what we can see and what we can't see.

How does the train **rise**?

How does the train **float**?
Challenge Question: How does the train **move forward**?

How does the train **fall**?

How does the train rise?
The train rises because there are electromagnets in the train + the track

How does the train float?
because there are balcned forces.

How does the train fall?
gravity pulls the trian down. I think both gravity and magnit forces that is what I think.

Evidence Cards:

Other people's Experience
Experiencias de otras personas

Facts from a video
Ideas de un video

Personal Experience
Experiencias personales

Facts from a text
Ideas de un libro

Experiments
Experimentos

Other people's experiments
Experimentos de otras personas