Supporting Student Sensemaking: Developing & Using Models and Constructing Explanations

Purpose

This tool is designed to assist teachers with planning for and reflecting upon student sensemaking when engaging in the science and engineering practices of Developing and Using Models and Constructing Explanations. It can be used in conjunction with the Planning Guide for Science Instruction and other curriculum-specific student work analysis tools to annotate high-quality science curricula.

Supporting Background for Educators

The Framework for K-12 Science Education emphasizes the need for students to "learn science in large part through their active involvement in the practices of science[1]" (pg. 283). When educators effectively support and encourage engagement with the practices, they provide an entry point for science learning and build agency for all students. "Modeling and forming explanations are two critical ways that scientists build knowledge and then test, critique, and revise that knowledge. They are tools that scientists use to help them make sense of the world[2]."

Shifts in Writing and Drawing for Sensemaking

The following chart reflects key shifts in writing and drawing for sensemaking. This chart, along with the reflection questions, can be utilized by educators when annotating high-quality instructional materials during planning.

Less of a Focus On	More of a Focus On
Writing/drawing only for students to show what they know	Writing/Drawing for students to figure things out and build an understanding of phenomena and scientific ideas
Writing/drawing for recall, fact recognition, copying down notes or images, or procedural writing	Writing/drawing to make sense of investigations, readings, and experiences to help synthesize learning and/or communicate to others
Decontextualized science vocabulary work	Using science vocabulary when students need it and building on their existing understanding and language repertoires

Less of a Focus On	More of a Focus On
Privileging final form only (e.g. reports, written arguments, final models, etc.) over the process of sensemaking	Prioritizing different forms of writing/drawing that support student sensemaking of phenomena and scientific ideas across the unit
Single, disconnected writing/drawing tasks	Writing/drawing as a continued practice to aid in sensemaking of phenomena

Planning for Supporting Students

When annotating high-quality instructional materials, the following reflections should be considered:

- How are students building upon their modeling throughout the sensemaking process?
- How are students using what they learn through modeling to support the process of constructing explanations of a phenomenon?
- Where are crucial sensemaking moments during the lesson/unit and what instructional strategies could support student access?

Instructional Strategies for Supporting Students in Writing and Drawing

The following strategies can assist teachers in planning supports for students with writing and drawing for sensemaking. It can be used in conjunction with the Planning Guide for Science Instruction to annotate high-quality instructional materials for teachers who wish to take a deeper dive into strategic planning for student support in developing and using models and constructing explanations.

Initial Student Supports	Supports for Deeper Reflection
Talk out loud: Have students say their ideas out loud before writing and drawing. This can be done either to themselves, a classmate or in a small group.	***Characteristics:*** Discuss or identify characteristics or structures of a specific form of writing or drawing (e.g. an argument includes CER while an explanation must include the "how" and "why" of a phenomenon).
***Sentence Stems/Image Starters*:** Provide sentence stems or images starters to help students start writing or drawing.	***Evaluate Examples:*** Examine examples (student-generated or provided in HQIM) to jointly establish an understanding of key characteristics, identify similarities and differences or evaluate strengths and weaknesses.

Initial Student Supports	Supports for Deeper Reflection
Select from options: Provide different options (e.g. different claims, different ways to draw a part of a model) and ask students to select an option to use in their writing or drawing.	***Checklist:*** Have students use a checklist to determine whether the goals were met in writing or drawing. Special attention should be given to co-designing the checklist with students and ensuring that students understand this is a guide and not an exhaustive list.
Graphic Organizer: Use a graphic organizer or template to help students organize their ideas to inform their writing or drawing.	***Self-evaluate:*** Have students self-evaluate and/or revise their writing and drawing with specific goals or questions. Students should be provided multiple opportunities to practice this throughout a unit.
Work together: Have students work together to plan and engage in writing or drawing in small groups or partners.	***Provide feedback:*** Teachers or peers provide specific feedback including strengths in writing and drawing to support revisions.

[1]National Research Council. 2012. A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Washington, DC: The National Academies Press.https://doi.org/10.17226/13165.

[2]Learning in Places Collaborative. (2020). Framework: Modeling and Forming Explanations. Bothell, Seattle, WA & Evanston, IL: Learning in Places.