twig SCIENCE NEXT GEN

LANGUAGE ROUTINES GUIDE

GRADES 6-8



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Language routines guide, Grades 6–8

The aim of the Twig Science Next Gen language routines is to help teachers support students in using and developing their disciplinary language and proficiency with English. These language routines were originally developed by Stanford University's Understanding Language-Stanford Center for Assessment, Learning and Equity (UL-SCALE) team to support teachers with language development in mathematics. Now, Twig Education has partnered with UL-SCALE to reimagine the language routines to support teachers in developing student language in relation to the three dimensions of the NGSS.

These language routines are based on five key ideas:

- Teachers, peers, and texts serve as language resources for learning (Vygotsky, 1978).
- Deep learning of disciplinary content and skills is gained through language, as it is the primary medium of school instruction (Halliday, 1993).
- Through successive and supportive experiences with disciplinary ideas, learners make sense of disciplinary content with their existing language toolkit (Moschkovich, 2012).
- Language is an inseparable part of all human action, so when students are engaged in meaningful activities (projects, presentations, investigations), language develops through perception, interaction, planning, research, and discussion (Van Lier & Walqui, 2012).
- Language routines help focus attention on student language that support in-the-moment teacher, peer, and self assessment (Cazden, 2001).

Why use Twig Science Next Gen language routines?

Within the NGSS, science and engineering understanding and language competence develop interdependently. The language demands of the NGSS are rigorous, and the pragmatic applications in the classroom require attention to both disciplinary content and language. In Twig Science Next Gen, disciplinary content and language are addressed simultaneously, because:

- The common thread of language connects all three dimensions of the NGSS, as students are asked to communicate, evaluate, argue, explain, define, describe, predict, analyze, and question.
- Evidence from cognitive psychology suggests learning occurs when students are encouraged to think deeply about the specific topics in question. Structured, complex conversations in the classroom place a higher cognitive demand on students, making learning more likely.

- Discussion is an effective, but currently underused, form of Formative Assessment, with the potential to engage more deeply with the NGSS and develop scientific literacy.
- This approach is particularly effective when teaching English Learners. The everyday language used by students can drive the process of learning, as they are able to articulate science ideas verbally without the need for "perfection." Informal language can act as a bridge to deeper understanding.
- Scientific terminology needs to be used and practiced, and talking about new vocabulary regularly is an effective way of understanding its meaning.

Basic ground rules when using language routines

1. There are three attributes of good quality conversation that are practical and fairly easy to spot in the classroom. **Note**: These are not appropriate for every language routine.

    - Ensure students take turns effectively.
    - Encourage students to build on previous turns.
    - Encourage students to make sense of the relevant concepts using their own everyday language with the goal of understanding each other.

2. If students have a conversation about phenomena, data from an investigation, or separate sources of information, follow up with a debrief to check their understanding and ensure that your students do not leave your classroom with incorrect ideas. Check student understanding using whole class discussions, drawing/writing answers, or using targeted multiple-choice questions.
3. Make sure your class culture means students are prepared to think out loud without fear of ridicule.
4. If you are pairing students, do it strategically. Many educators suggest no more than a grade level between students is ideal. Students who are one step ahead of their partner can be motivating, but ten steps ahead can be disheartening.

The following sections describe the language routines embedded in Twig Science Next Gen. There are many variations on the routines described—after practicing the routines as written a few times with your students, you may choose to adapt them for your context.

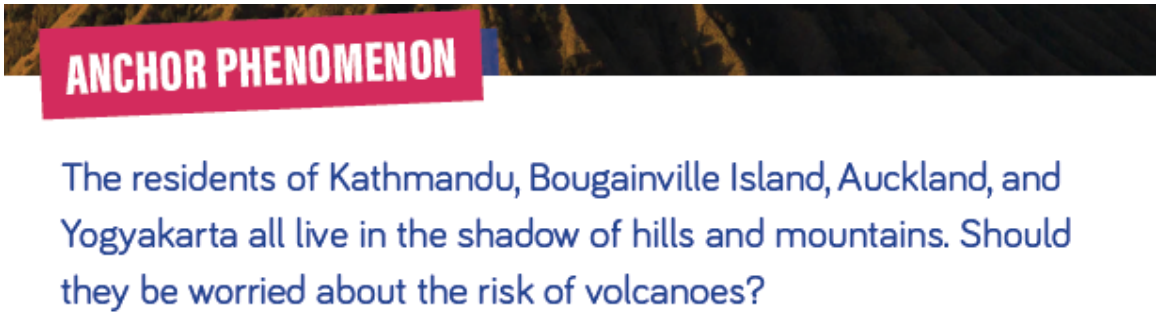
Co-Craft Questions language routine

This routine allows students to experience and express curiosity when they encounter a novel phenomenon or problem without feeling pressure to produce correct answers. It creates space for students to generate scientific questions in their own language based on their curiosity, and use conversation skills to brainstorm and improve questions. Through this routine, students develop meta-awareness of the language used in scientific questions and problems.

Students' self-generated questions are a critical tool that should be leveraged to drive student sense-making and raise awareness of phenomena. The Co-Craft Questions language routine is used in the first lesson to capture students' wonder questions about the Anchor Phenomenon, and at the start of each subsequent lesson to generate further questions based on related Investigative Phenomena. Students record their questions, what they figured out, and how they did so in their digital Phenomena Trackers. Students should be encouraged to frequently revisit their questions and answers, and connect them to their ongoing investigations to make sense of the Anchor Phenomenon. **Note:** This can be supported using the Phenomena Tracker routine detailed in Making Sense of Phenomena with Twig Science 6–8.

The main steps of the Co-Craft Questions language routine are as follows:

a. **Hook:** Students take notes about a situation presented to hook them into an exploration. For example, at the start of each module, students have an immersive experience with the module Anchor Phenomenon or Engineering Design Challenge—either through a hands-on, digital, or video lab, or analyzing data, images, or text.



b. **Students Generate Wonder Questions:** Students write down scientific questions that they have, or that could be asked about the situation on their Wonder Questions chart. These should be questions that they think are answerable by applying their existing understanding, analyzing data, conducting investigations, or designing solutions. Questions could be about: what is likely to happen (predictions); information that might be missing; or assumptions that might be important.
c. **Share Wonder Questions:** Students work in pairs to discuss and compare the questions they generated before sharing their questions with the class. They are invited to revise them, as appropriate, to ensure the questions are scientific. Record and display a list of class questions as students share and revise their responses.
d. **Find Connections and Identify Gaps:** Invite students to review the list of questions and make connections between them. Encourage them to group questions together and think about whether there are any related or missing questions that should be added.
e. **Record Wonder Questions Chart:** Students record their own questions in the Wonder Questions chart in their Twig Journals. Teachers may also choose to record some questions in the class-level digital version of the Phenomena Tracker.
f. **Map Student Wonder Questions to Module:** The teacher completes a mapping document to understand how students' questions connect to the module materials.
g. **Review Wonder Questions:** At the start of each session, review the Wonder Questions chart with the class. Note the journey they have been on so far, and share which question(s) they will be exploring that day.
h. **Review and Record Understanding:** After completing an exploration, students update their Phenomena Trackers to record what they have now figured out. As part of the Phenomena Tracker Routine, they also review what they still need to investigate and record any new questions they have.

Stronger and Clearer Each Time language routine

This routine provides a structured opportunity for students to revise and refine both their ideas and their oral and written output by having repeated paired conversations.

- Discussion Prompt: What happens to our bodies when we get sick?

The main steps of this routine are as follows:

a. **Initial Response:** Students work individually to look at a prompt and write/draw their initial responses about it. You will find an



optional handout for this language routine that helps students organize their thoughts.

b. **Think Time:** Give students a minute to think about what they will say to their first partner to explain their ideas and thoughts.
c. **Structured Pairing:** Use a successive pairing structure. For example, arrange students in groups of six, and have inner circles of three students facing outer circles of three students. Remind students that speaking clearly and explaining their reasoning are important. Even if students are confident in their understanding and their response, one primary goal of this routine is for the listening student to ask questions in order to deeply understand the speaking student's ideas.
d. **In Pairs:** While in pairs, the speaking student should share their ideas. The listening student asks clarifying questions. For example, "Why did you do that?" The speaking student can then respond before the listening student asks further clarifying questions to draw out more detailed language. Pairs should then switch roles so that the speaking student becomes the listening student, and vice versa. They repeat the process, with the new speaking student sharing ideas and the new listening student asking clarifying questions.
e. **Switch:** Once both students have shared their ideas, they switch to new partners and repeat the exercise, strengthening and clarifying their ideas each time. Students should complete the routine with two or three different partners. Think about modeling the types of contributions that students could make during this routine early on. You can direct and structure this routine closely and be explicit about the ideas you want students to think about in each turn. These scaffolds can be removed as students become more experienced using this routine.
f. **Revised Response:** Have students return to their seats and produce their final responses. These can be drawings, diagrams with sentences, or longer written responses. Students can compare their responses to see the impact that talking about a problem or idea can have on their ability to strengthen and clarify their communication.

Productive Discussion language routine with Collect and Display

This routine facilitates rich and inclusive discussions (Zwiers, 2014) that develop students' reasoning skills and deepen their understanding (TERC, 2012) about phenomena, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts. It provides feedback for students in a way that increases sense-making while simultaneously

supporting meta-awareness of language. It also honors the language students are using and developing.

The main steps to this routine are as follows:

a. **Identify Learning Goals:** Take some time to prepare for the conversation. Be clear on the learning goals of the discussion, related to the key concepts, practices, and content. Ask yourself whether this discussion is to help students:

    - Carry out initial, interpretative work or exploration
    - Develop understanding of a process, practice, or concepts
    - Focus on data analysis and more rigorous interpretation
    - Make claims, provide supporting evidence, and provide reasoning for how the evidence and claims connect.

b. **Discussion Prompt:** Select a good prompt to start the discussion. A good prompt is open ended and connects to your learning goals.
c. **Facilitate Discussion Using Talk Moves:** In order to guide the discussion, use "talk moves." Talk moves are helpful in making discussions more focused, equitable and in guiding students toward deeper reasoning.
    - Expand and clarify thinking—the goal here is to support students to verbally share their ideas in ways that will help them to express themselves with a greater level of detail.
    - Deepen reasoning—the goal here is to help students articulate their reasons and evidence, and explain how the two are connected. Guide students to become more sophisticated in their reasoning, in the evidence they use to support their reasoning, and in their explanations of how the evidence strengthens their reasoning.
    - Listen to and reason with others—the goal here is to encourage students to listen to and respond to the ideas of their peers. This can be done by asking students to repeat or paraphrase what others have said, to build on the ideas of their peers, or to challenge those ideas by agreeing or disagreeing and explaining why. This mirrors the types of discussion scientists and engineers have as they share conclusions, test designs, and develop theories.

The following chart provides examples of the talk moves you can use during a discussion related to each of the above categories.

Three Categories of Talk Moves to Support Scientific Discussion[1]
1. Expand and Clarify Thinking • Can you say more about that? • What do you mean by…? • How so? • Can you be more specific? • Can you give an example?
2. Deepen Reasoning • What is your evidence for that? • Why do you think that? • How does your evidence support that? • What are examples from data/models/texts? • Does it always work this way? How do you know? • How did you arrive at this conclusion? • How does your evidence support your thinking?
3. Listen to and Reason with Others • Can you put what they said in your own words? • What are you hearing? • What do we know so far? • Can you build on that idea? • Do you agree/disagree and why? • What are other ideas? • What are our main points so far? • What can we all agree upon?

[1] Adapted for NGSS instruction from COAT – Conversation Observation and Analysis Tool, in *The K-3 Guide to Academic Conversations*, J. Zwiers and M. Hamerla, (2018), pp. 115–116, and Goals for Productive Discussion and Nine Talk Moves in, *Talk Science Primer*, S. Michaels and C. O'Connor (2012), (p. 11) available at www.terc.edu.

d. **Collect and Display Student Language:** The intent of Collect and Display is to stabilize the fleeting language that students use, in order for their own output to be used as a reference in developing their scientific language. The teacher listens for and scribes the language students use during partner, small group, or whole class discussions using written words, diagrams and pictures. This collected output can be organized, revoiced, or explicitly connected to other language in a display that all students can refer to, build on, or make connections with during future discussion or writing.
    - Throughout the discussion circulate to monitor and collect evidence of student language in relation to the science practices, disciplinary ideas and/or concepts that address the goals of the discussion.
    - Display examples of key language and use as a visual bridge for further developing disciplinary language (e.g., vocabulary, conceptual understanding, language related to applying practices).
    - Throughout a module, continue to reference the displayed language as a model, update and revise the display as student language changes, and make bridges between student language and new disciplinary language.