In this chapter, we first introduce a picture of the most common varieties of classroom talk—recitation, or the IRE, and lecture. We contrast those with the kind of classroom conversation that can actually support the science and engineering practices, and we describe an approach to productive talk that undergirds many of the activities you will put in place as you engage your students in the intellectual practices at the heart of the NGSS.

The Most Common Forms of Classroom Talk

While many teachers intuitively feel that they use discussion in their classroom, a number of studies have shown that, instead, these teachers are spending most of their class time in an activity that researchers have called group recitation. Extensive research shows that this is the most common and, in fact, is often the default pattern of talk in classrooms throughout the country.

It’s a very familiar scene: The teacher asks a question (typically a question the teacher knows the answer to), a student replies (usually a short reply), and the teacher evaluates (saying, “Right,” “Not quite,” or “Well … who else has an idea?”). Some people have talked about this as a teacher lecture elicited out of the mouths of the students. This is often called the IRE pattern: I for the teacher’s initiating move, R for the student’s response, and E for the teacher’s evaluation—right or wrong.

Teacher (I): “Who remembers one of the kinds of eclipses we talked about?”
Student (R): “Annual?”
Teacher (E): “Well … anyone else?”

The teacher does not have to explicitly say “wrong” to the student; everyone knows that asking for another response in this way means the answer was somehow inadequate. This “talk format” is deeply internalized by most students and teachers throughout the United States and in many parts of the world.

This is not to say that the IRE is intrinsically a “bad” practice. Many have noted that recitation, or the IRE, can be very helpful for reviewing material or checking to see what the students recall, and it does give the teacher a great deal of control over the topic and who speaks. However, in spite of these benefits, the IRE pattern does not support complex reasoning or the building and weighing of arguments. It emphasizes correctness over reasoning, and once the correct answer is offered, the conversation is closed down rather than opened up. The teacher then moves on to a different question and a different student. The conversation proceeds with the teacher holding a series of exchanges with individual students—without crosstalk among the students in which they consider others’ ideas, agree or disagree, and explain their own reasoning. Indeed, in recitation, there is rarely any overt link between the ideas and answers of different students. Moreover, within each IRE segment, the teacher is always positioned as the final authority, the one who has the answer. The student is positioned as the “getter” of the answer in the
teacher’s head. Students are either correct or incorrect and thus are publicly shown to be either right or wrong (which often is interpreted as either smart or not smart). Typically, only a few students (and usually the same few) volunteer to take a turn.

Because of the emphasis on correctness over reasoning, research on student motivation links the IRE pattern to “performance goals” (whereby students act in such a way as to look smart) rather than to “learning goals” (whereby students participate so as to really understand and learn). In short, the IRE format doesn’t create a classroom culture that promotes risk taking or effort, where students work hard at explicating their ideas, requesting clarification from others, responding to or building on the ideas of others, or building and weighing complex arguments with evidence.

The IRE is often used in reviewing material (such as what was done the day before), checking to see what students recall about a topic, or reminding them what they have already learned. It can be useful in these settings. However, there are hidden drawbacks: Students who do not feel confident do not participate, so their understanding is not assessed. Students who give correct answers might have serious misconceptions that are never voiced because their responses are not probed more deeply. Students, especially secondary students, often withdraw from talk in which they feel they are being “used” to make a teacher’s point, or when they fear they might appear as “model students” in the eyes of the rest of the class. Finally, IRE talk reveals answers but it does not reveal students’ knowledge nearly as well as more open-ended talk in which students draw on their prior knowledge to offer predictions or conclusions about a new problem.

And, of course, in middle and secondary school science classrooms, another dominant form of talk is the teacher lecture. While a coherent delivery of complex content can be accomplished, and the lecturer has a great deal of control over the talk (and can “read” from notes or projected slides or recite from memory), much research on human learning suggests that simply “telling” students information is not as effective as it feels. When students listen to a lecture, they are passive, and, typically, they are not making sense of the information as it comes in even if they are taking notes. It is an ineffective talk format if the goal is for students to develop deep and robust understanding and the ability to reason about the material in new contexts.

What Does Academically Productive Classroom Talk Look Like?

In contrast to the teacher lecture and IRE recitation format, academically productive talk involves students working hard to explicate their thinking, with evidence, whether in whole-class or small-group settings. It involves students listening to and responding constructively to the ideas of others, in the service of making progress around an intellectually rich problem, text, or investigation.
Characteristics of productive talk include the following:

- Students listening closely to one another
- Students doing the heavy lifting of
  - explicating their ideas
  - reasoning with evidence and models
  - building on the thinking of others (agreeing, disagreeing, and questioning)
  - making thinking—questions, models, data, arguments, explanations—public and available
- Students and teacher working together to clarify, challenge, and improve the group’s thinking
- Equitable participation
- Risk-taking and opportunities for students to revise their thinking

Productive talk can take many forms, because the talk is always improvisational. There is no way to script academically productive talk because it is always the students, on the spot, who are contributing to the analysis and applying their reasoning to the thinking of others. But the talk is always about important academic content, and it is always focused around a rich problem or task designed to support reasoning and conceptual understanding.

This does not mean that academically productive talk is only student-to-student. The teacher is centrally involved in a variety of ways and formats. In the selection of the problem, task, or framing question, the teacher has a good deal of control. And in following up on and processing students’ contributions, there are a number of strategies or “moves” that reliably help keep the conversation proceeding at a rigorous and productive level. These improvisational but strategic follow-up moves on the part of the teacher help keep the students tuned in to the contributions of others and guide the conversation so that it promotes reasoning with evidence, building toward conceptual understanding of key constructs or big ideas.

KEY COMPONENTS OF ACADEMICALLY PRODUCTIVE TALK

A Belief in the Possibility and Efficacy of This Kind of Talk

This first component is not something that happens in the classroom. It is a belief or mindset on the part of the teacher! For teachers to successfully take on this practice, they must believe two things, even if this entails a bit of a leap of faith at the outset: (1) All my