“A responsive classroom is guided in part by the ideas, questions, and everyday experiences that students relate to the subject matter. …the expert practitioner is becoming defined, in part, by the ability to turn over the intellectual work to students by having them consider, respond to and challenge each other’s ideas (Lampert, 1990, van Zee, 2000).”

“All major teacher organizations and all recent National Research Council consensus reports emphasize the need to involve students actively in ‘communication’ about their thinking and investigations, and to encourage them to use evidence to support their claims, conjectures, predictions, and explanations (NCTM, NSTA, NRC reports).”

“Researchers have found that teachers dominate classroom talk” and that this is found mainly in “classrooms with high numbers of students living in poverty, classrooms with English-language learners, and classrooms with low-achieving students.”

“From an equity perspective, teacher moves such as eliciting students’ ideas… (have) led to engagement with the content and to sophisticated reasoning by learners who do not typically participate in the academic life of the classroom.” (Atwater, 2000; Duschle & Duncan, 2009; Chapin & O’Conner, 2004; Cobb, Boufi, McClain, & Whitenack, 1997; Lampert, 2001; Lee, 2001)

From Ambitious Science Teaching, Eliciting student ideas and adapting instruction


Sample Norms and Expectations

1. **Classroom Sample #1**
   - Listen carefully to each other
   - Show you are listening by looking at the speaker
   - Build on each other’s ideas (try not to repeat what somebody already said)
   - Give evidence for your ideas
   - Give people time to think

2. **Classroom Sample #2**
   - Listen to each other and look at the speaker
   - Speak loudly enough so everyone can hear
   - Everyone needs to participate
   - Connect your ideas to others, (explain, add to, respectfully disagree)
   - Explain your ideas
   - Ask questions when you are confused or can’t hear

3. **Classroom Sample #3**
   **Student Rights**
   1. You have the right to make a contribution to an attentive, responsive, audience.
   2. You have the right to ask questions.
   3. You have the right to be treated respectfully.
   4. You have the right to have your ideas discussed, not you.

   **Student Obligations**
   1. You are obligated to speak loudly enough for others to hear.
   2. You are obligated to listen for understanding.
   3. You are obligated to agree or disagree (and explain why) in response to other people’s ideas

Mason School Discussions

My responsibilities during discussions

I agree that I will
- Explain my ideas
- Listen to others and show that I am listening
- Ask questions when I am confused or can’t hear
- Connect my ideas to others’ (explain add to, respectfully disagree)
- Participate because all ideas lead to learning (speak loud and clear)

Signed ________________________

The Inquiry Project: Bridging Research & Practice
Supported by the National Science Foundation
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Talk Activities Flowchart
Which talk activities can I use with my students?

What is the purpose of the talk activity?

To get students to critique and get feedback on science models

To get students to revise their thinking

To reach consensus

To get students to explain their thinking

Where are students in their completion process?

They are working on models

They have completed models

How will students think about this phenomenon best?

Through Written Language

Through Images

Are you going to moderate discussion?

No: this is a chance for them to "work out" their ideas

Yes; I am curious what they're thinking

Beginning

Middle

End

Where are you in the unit?

Try:

Try:

Try:

Try:

Try:

Try:

Try:

Try:

Try:

Try:

Try:

Try:

Try:

Try:

Try:

Agree-Disagree Line
Teacher poses a question for students to agree or disagree with and they move their bodies to respond.

Three Stay-One Stray
One person "strays" from each group and acts as a critic of another group's models while the three remaining write their criticism.

All-Day Post-Its
Student models are left out all day for students in other class periods to critique with post-its — and maybe other teachers, too.

Four Quadrants
Print four statements on a paper and students at each table "vote" by placing an object on the statement they agree with and explain why.

Discussion Diamond
Students write their ideas in each corner of the same paper, share merits of their ideas, and their consensus in the middle.

Share-Trade
Students observe a phenomenon, write, share with a partner, then trade and share again.

Claim-Pass
Students write a claim at the top of a piece of paper and pass the pencil. Each adds a piece of evidence or experience and passes pencil to the next person.

Write and Pass
Students write their ideas and pass them around to their tablemates, who add comments to their ideas. Then students write a revised statement.

All-Class Science Talk
Teacher poses a question for students to answer with data and reasoning, encouraging students to talk to each other.

Idea Coaching
In a pair, one student "coaches" while the other explains. Then switch.
## Checklist

Goals for Productive Discussions and Nine Talk Moves

<table>
<thead>
<tr>
<th>Goal One</th>
<th>Help Individual Students Share, Expand and Clarify Their Own Thinking</th>
<th>Notes/Frequency of Use</th>
</tr>
</thead>
</table>
| 1. Time to Think | - Partner Talk  
- Writing as Think Time  
- Wait Time | |
| 2. Say More: | “Can you say more about that?”  
“What do you mean by that?”  
“Can you give an example?” | |
| 3. So, Are You Saying…?: | “So, let me see if I’ve got what you’re saying. Are you saying…?”  
(always leaving space for the original student to agree or disagree and say more) | |

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<tr>
<th>Goal Two</th>
<th>Help Students Listen Carefully to One Another</th>
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| 4. Who Can Rephrase or Repeat? | “Who can repeat what Javon just said or put it into their own words?”  
(After a partner talk) “What did your partner say?” | |

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<tr>
<th>Goal Three</th>
<th>Help Students Deepen Their Reasoning</th>
<th></th>
</tr>
</thead>
</table>
| 5. Asking for Evidence or Reasoning | “Why do you think that?”  
“What’s your evidence?”  
“How did you arrive at that conclusion?” | |
| 6. Challenge or Counterexample | “Does it always work that way?”  
“How does that idea square with Sonia’s example?”  
“What if it had been a copper cube instead?” | |

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<tr>
<th>Goal Four</th>
<th>Help Students Think With Others</th>
<th></th>
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</thead>
</table>
“What do people think about what Ian said?”  
“Does anyone want to respond to that idea?” | |
| 8. Add On: | “Who can add onto the idea that Jamal is building?”  
“Can anyone take that suggestion and push it a little further?” | |
| 9. Explaining What Someone Else Means | “Who can explain what Aisha means when she says that?”  
“Who thinks they could explain why Simon came up with that answer?”  
“Why do you think he said that?” |
### Checklist

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Resources: Student Discourse

Resources/Learn More

- Talk Science Primer
- Checklist for Productive Discussions and Nine Talk Moves

Note: Add “Inquiry Project TERC” when searching for the checklist.

Resources/Learn More

- The Inquiry Project
- STEM Teaching Tools (Practice Brief 35)
What Is The Issue?

Talking is integral to human learning. The science and engineering practices described in the NRC Framework for K-12 Science Education highlight that scientists and engineers routinely communicate through talk—not merely to share their final form products—but to make sense of their work and to gather feedback and refine their ideas as the work unfolds. Learners benefit from such accountable talk as well, but it can be tricky to scaffold and manage productive discourse in the classroom.

WHY IT MATTERS TO YOU

Teachers should routinely support students in “sense-making” talk to help them work through their understanding while engaging in the science and engineering practices.

District staff and PD providers should provide models of productive talk in PD and as an integral part of enacting curriculum materials.

School leaders should observe productive science talk in classrooms and provide support to teachers as they develop talk facilitation skills.

How can I get my students to learn science by productively talking with each other?

BY RICH BACOLOR, TAMMY COOK-ENDRES, TIFFANY CLARK & ANNIE ALLEN | NOVEMBER 2014

STEMteachingtools.org/brief/6
Things To Consider

• The science and engineering practices in the NRC Framework are deeply social and require that students communicate. They involve reasoning with others and seeking a shared understanding of science phenomena. The goals of productive talk include: (1) sharing and clarifying one’s own thinking, (2) listening to one another, (3) deepening one’s own reasoning, and (4) thinking together.

• Talk makes student thinking explicit and public—so that it can be engaged with, interpreted, built upon, and refined. Student ideas can then become resources for learning.

• I-R-E (initiation, response, evaluation) is the dominant discourse pattern of classroom interactions, and it needs to change. In order to engage students in science and engineering practices, they need access to and experience with discourse-rich sensemaking conversations. Breaking the I-R-E pattern and integrating productive talk may require practice, preteaching, and scripting student roles and language. (STEM Teaching Tools #35 and #48 may be helpful.)

• Students should be supported to make sense of complex natural phenomena. Rich discourse among students should be encouraged through thoughtful lesson sequences and skilled facilitation that position them as collaborative constructors of knowledge.

Attending To Equity

• Broadening participation—beyond the youth who raise their hands in classroom discussions—is an important equity issue. At the same time, different students have different levels of comfort participating, and there need to be many ways to participate in reasoning together. Sometimes silence and listening are fine. It is also crucial to support the involvement of English learners.

• Scientific talk is deeply cultural. Children’s home experience with discourse is quite varied. Classroom norms should support talk, help students use their home discourse practices in the classroom, and provide a safe place for sharing and refining ideas.

Recommended Actions You Can Take

• Routinely focus instruction on student talk related to making sense of phenomena and their ideas. Read about making thinking visible through talk and argument, including how to establish classroom norms and use talk moves to cultivate learning conversations. Review the Talk Science Primer and use the Talk Move Checklist.

• These classroom videos and supporting discourse primer highlight the use of different talk moves. Learn more about different approaches to managing classroom talk.

Refelction Questions

What do you think productive classroom talk looks like? What is your role in supporting that talk at different phases of student investigations?

What explicit and implicit social norms are at play in your classroom, and how can you effectively shift these to support productive talk?

What cultural styles of talk and sensemaking are present in your community of students that you should make room for in science learning conversations?

“In order to process, make sense of, and learn from their ideas, observations, and experiences, students must talk about them.... Talk forces students to think about and articulate their ideas. Talk can also provide an impetus for students to reflect on what they do—and do not—understand.”

— Ready, Set, SCIENCE!

“We suggest that trying to present science [communication] in a culturally neutral way is like trying to paint a picture without taking a perspective.”

— Doug Medin, psychologist

Also see STEM Teaching Tools:

#17 Beyond Written C-E-R
#35 Talk Activities Flowchart
#47 Equitable Argumentation
#48 Guiding Student Conversation

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STEMteachingtools.org/brief/6
What Is The Issue?

Learning happens through talking. And yet, student talk typically makes up less than 20% of the time spent in science class, and of that small amount of time, very little is focused on student sensemaking. However, specific instructional approaches—or ‘talk activities’—can be used to support students’ three-dimensional science learning. Our Talk Activities Flowchart, this tool highlights those talk formats and explains when, how, and why to use each talk format in support of student investigations.

WHY IT MATTERS TO YOU

- **Teachers** should think carefully about discourse in their classrooms. Do students frequently talk about their thinking, or do they simply share “answers” to teacher questions?
- **District Staff & PD Providers** should support teachers in developing more strategies to support student sensemaking talk.
- **School Leaders** should consider their walkthrough protocols and measures of teacher growth. To what extent does instruction prioritize student sensemaking through talk?
Things To Consider

• In many classrooms, teacher talk takes up the majority of class time, and student talk is primarily used for correctly answering teacher questions. In this “guess what the teacher is thinking” approach, teachers know the answers to most of their own questions, and student talk is only used to verify they know the “right answer.”

• This classroom pedagogy style of teacher questioning/students answering has some merits, but it can marginalize students from non-dominant backgrounds who have less experience with this kind of adult-moderated instruction with a known answer.

• Alternatively, many studies have shown that student talk is a very productive class activity and that it results in deep sensemaking for many kinds of students. One key to building more student-focused pedagogy is developing an authentic curiosity about student thinking. Studies have shown that students learn and respond in very lively, scientific ways when asked open-ended questions, given agency for their learning, and use scientific criteria for knowledge claims.

Recommended Actions You Can Take

There are easy ways to support student thinking through talk:

• Student-to-student talk has distinct advantages over whole-class discussion, especially for English language learners. When students talk to each other to share their thinking, they are more likely to: (1) connect to their personal and cultural sources of knowledge, (2) take risks with new language, and (3) use community-based linguistic practices to support their science learning.

Our Student Talk Flowchart can help you plan activities so that students’ talk is more equitable, scientific, and focused on sensemaking.

Each ‘talk activity’ links off to additional info on how to use it for specific purposes: (1) to get students to explain their thinking, (2) to get students to critique and get feedback on their models, (3) to get students to revise their thinking, and (4) to reach consensus.

• Teacher-student talk: Use the ideas in the Talk Science Primer and the Science Discourse Primer to guide your whole-class discussion. They support a classroom culture focused on curiosity and learning.

Attending to Equity

• All students should routinely engage in sensemaking talk to support their learning. The lower stress of peer-to-peer conversation supports linguistic risk-taking and this makes it especially fruitful for students who are language learners.

ALSO SEE STEM TEACHING TOOLS:

#6 Productive Science Talk
#17 Beyond the Written C-E-R
#25 Cultural Argumentation
What Is The Issue?

Teachers need ways to encourage opportunities for all learners to engage routinely in sensemaking talk. Teachers can also use student talk to learn about student ideas and thinking. However, it is often challenging to facilitate productive conversations, especially with students who are not accustomed to talking in their science classes. Teachers can use tools to scaffold student science talk. They can then reflect on what they have learned from students to inform next steps in their instruction.

WHY IT MATTERS TO YOU

- **Teachers** should learn strategies for asking questions, responding to student thinking, and scaffolding student conversations in an effort to broaden equitable opportunities for students to engage in classroom talk.
- **District Staff & PD Providers** should work with teachers to support and reflect on classroom conversations.
- **School Leaders** should learn the ways talk can be organized to foster science learning opportunities for students and support teachers in orchestrating such conversations.
Things To Consider

- Chapter 11 from the NRC Framework outlines a vision for quality science education for every student. Classroom talk fosters shifts in participation, and, as a result, opens opportunities for learning in the science classroom. Student talk also helps educators consider how to connect young people’s everyday languages with language common in the scientific community.

- Strategies for fostering classroom talk are important for facilitating sensemaking in the classroom. Engaging students in science classroom talk makes student thinking public and available for discussion, clarifies ideas, deepens reasoning, and helps students relate their thinking to others’ ideas (see related research). Students should engage in talk as they participate in each of the science and engineering practices of the NRC Framework vision.

- Teachers can engage in informal formative assessment by engaging students in classroom talk which involves eliciting, recognizing, and attending to student ideas during classroom talk.

Recommended Actions You Can Take

- Center your instruction around the idea that the person doing the talking is the person doing the learning. Use whole class discussion sparingly. Focus more on scaffolding small group discussion.

- Use our Talk Resource Tools to foster shifts in science classroom talk practices: The Talk Resource Cards and Partner Conversational Supports expand productive classroom talk during conversations, while the Pre- and Post-Talk Writing Supports can be used to bookend classroom conversations to improve students’ sensemaking and science communication practices.

- Use classroom talk to collect formative assessment information, and consider how that knowledge can be used to serve students’ individual needs to equitably engage them in science learning.

- Try strategies laid out in the Talk Science Primer and the Accountable Talk Sourcebook by yourself, with teacher colleagues, or with others in your network.

Attending to Equity

- All students should have opportunities for processing their thinking through talk. By promoting opportunities for student voice, teachers signal that the ideas students have are valued and importance.

- All students should have access to productive discussions that allow them to sharpen their critical reasoning and analytical abilities while developing their science communication practices.

- Teachers need to ensure that the discourse environments they create promote science learning for students who bring many different perspectives and histories to the classroom.

Also See STEM Teaching Tools:

#6 Productive Science Talk
#16 Informal Assessment
#35 Science Talk Activities
TWO STARS AND A WISH

- PLEASE NAME TWO THINGS YOU LIKED ABOUT THE SESSION. THIS CAN BE SOMETHING ABOUT THE PRESENTATION OF THE CONTENT, OR THE CONTENT ITSELF. **(2 STARS)**

- WHAT IS ONE THING YOU THINK COULD HAVE IMPROVED THIS SESSION, OR ONE THING YOU WOULD LIKE TO LEARN MORE ABOUT? **(A WISH)**