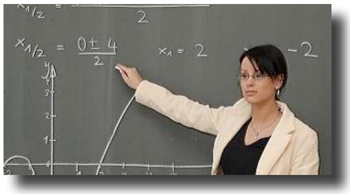
A Primer on Productive Classroom Conversations

Accomplished musicians and master science teachers have something in common— they can both make complex performances look effortless. The great jazz pianist, Thelonious Monk, would take song requests from the audience then reinvent the piece as he played it by changing the key, tempo, and mood of the tune. At the right time he would back off the melody to let another player in his ensemble take charge, then listen for subtle rhythmic cues that it was his turn again to take the lead; his fingers would dance over five octaves on the keyboard while he gazed out at the crowd, smiling.

Monk had a deep understanding of the fundamental structure of the music, but knew how to shape and improvise the experience for the audience as well as share the production with others in his band.

The experienced science educator is no less an artist when it comes to classroom conversations. Consider a "simple" high school laboratory activity that begins with the teacher placing a mass on a scale at the front of the classroom. The scale reads "10 kilograms." He then produces a large bell jar which he places over the entire scale and attaches the jar to a vacuum pump. "Can anyone share their thinking about what the scale might read if I pump all the air out?" Over the next 20 minutes he orchestrates a flow of discourse among his students that compels them to hypothesize about the effects of air on the weight of objects, to suggest thought experiments, to make reasoned connections, to try out and justify explanations with one another—in other words, *to think*. He poses questions that probe the mental models his students are beginning with, assessing how elaborate these models are, how generalizable, whether they are referring to observations or to theory. During this time the teacher constantly judges whether the discussion is moving the students toward a scientific way of thinking about the phenomena. He must decide who has "pieces" of the scientific explanation and how to help students put these partial understandings together for themselves. In addition to all this, he monitors whether students are following classroom norms for civil conversation and the degree of involvement, puzzlement, or frustration of individual students.



Helping kids make sense of science is done, in large part, by *getting students to talk*. There are two reasons for this. First, talking is the primary mode of sense-making in human beings. Second, hearing kids' talk, gives you access to their thinking and allows you to adapt instruction to their current understandings. What kids think is often vastly different from what you *believe* they are thinking.

How does one develop expertise like this? For any teacher, there are principles of classroom discourse that can be studied, practiced, and refined. The following sections of this document will acquaint you with some fundamental ideas about productive discourse in classrooms. They can serve as conceptual tools to help you analyze the classroom discourse of other teachers and to begin planning your own forms of conversations with kids.

The beginning set of discourse ideas we introduce are:

- maintaining a safe classroom environment for discussions
- priming yourself for different conversations
- cognitive demand of questions and tasks
- asking meta-cognitive questions
- using wait time
- productive discourse moves
- scaffolding students' use of academic language
- encouraging peer-to-peer talk

Idea #1. Maintaining a safe classroom for student conversation

A safe classroom is one in which students feel that they will not have their ideas ridiculed, and that the teacher and their peers will value what they have to say. Productive conversations require students to take risks in public—to hypothesize about things they are only partially familiar with, to comment on the ideas of classmates, or to ask questions that may reveal a lack of understanding. Because of this, the most basic pre-requite for productive conversations is that all students *feel safe* in speaking publicly.

Classrooms should have norms for civil discussions that are developed—with help from your students—from the first day of school, that are explicitly modeled by the teacher (i.e. the teacher "names" the norm as she/he uses it) and reinforced on a daily basis. Here are some samples of these norms—there are many possibilities:

- Anyone can ask questions if they don't understand an idea that is being talked about.

• We (students and teacher) can critique ideas of others, but personal attacks are out of bounds.
• Don't talk over your classmates.
• The teacher will give "think time" before asking for students' ideas.
• In small group work, everyone will contribute to the conversations.

It is helpful to re-visit these norms periodically, asking your students: "How did we do today in our discussion? What do we need to work on?"

Idea #2. "Priming" yourself for classroom conversations

Novice teachers often flounder in the middle of classroom conversations because they haven't imagined what the specific goals of the conversation are. It is vital to "pre-think" where you'd like to *end up* at the finish of a conversation. Do you want a list of students' initial ideas about a scientific phenomenon? Do you want them to make sense of an activity? Do you want them to critique an explanatory model?

These considerations "prime" you to hear certain types of talk from students and prepare you to respond without having to improvise every word you say. We start by considering *three major conversation types* that we use to organize our thinking—each has a different purpose, and each uses different instructional moves to accomplish that purpose. These are:

• *Eliciting students' initial scientific hypotheses in order to plan for further instruction*. The goal of this discourse is to draw out students' understandings of a phenomenon (e.g. a bicycle rusting in the backyard) that is related to an important scientific idea (in this case chemical change or conservation of mass) and then to analyze students' ways of talking about it in order to adapt upcoming lessons.

• *Connecting activities with scientific ideas*. The goal of this practice is to combine hands-on work with readings and conversation in order to build content knowledge and to advance students' understanding of a natural phenomenon.

• *Pressing students for evidence-based causal explanations*. This discourse is designed to happen at the end of a unit, but elements of this conversation can also happen when the teacher is trying to get students to talk about evidence. The goal of this discourse is to assist students in co-constructing evidence-based explanatory models for the natural phenomenon that have been the focus of the unit.

If you are clear about what kinds of talk you want to foster—even to the point of having different kinds of names for these conversations—it becomes easier for you to anticipate student contributions and to plan how students can become meaningfully involved in the talk.

Idea #3. The cognitive demand of questions/tasks

While working with a group of 6th graders during a lesson on solubility, a teacher asked students to work with a partner to help them make sense of a reading. One young girl, Emmy, was dumbfounded, she approached the teacher and said "*You mean I have to make it make sense?—doesn't it make sense by itself?*"

We share this example because all too often, we forget that sense-making is a student-driven process, not something inherent in an activity or a lecture. It requires active processing on the part of students to help make connections among ideas and to understand explanations.

Sense-making has a lot to do with the types of questions that get asked in class. Questions and tasks in classrooms can be thought of in terms of what they require learners to do intellectually. These can roughly be divided into those with *low-cognitive demand* and *high-cognitive demand* (Henningson & Stein, 1997; Leach & Scott, 2002).

Lower cognitive demand questions/tasks

These typically focus on either memorization (recall), on vocabulary-level understanding only, or on procedural tasks that ask students to follow prescribed steps or plug numbers into formulae. There is nothing inherently wrong about low cognitive demand questions. They can be challenging for students to answer, but they don't involve much intellectual work. If they become the default mode of your instruction and you fail to ask higher cognitive demand questions, your students will only rise to the level of what you are asking them.

Worth noting: The idea of high and low cognitive demand applies to written as well as spoken questions and tasks.

Higher cognitive demand questions/tasks

These typically focus on *sense-making* by the students. These questions/tasks demand more intellectual work and may not have discrete answers—this is why they are often referred to as "authentic questions or tasks." They are much like what professionals deal with in everyday life.

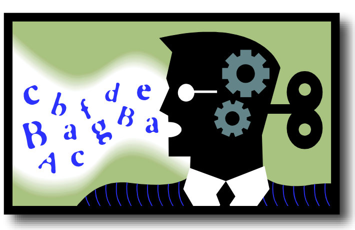
Following are some comparisons between low and high cognitive demand questions.

Asking students to work with information	
Lower Cognitive Demand	Higher Cognitive Demand
Recalling and reproducing ideas • Task/question requires only the recall of previously learned material—sometimes a one-word or one-phrase response. In one physics textbook, a question is posed "What is meant by freefall?" In another section, "What two units of measurement are necessary for describing speed?" In biology, a student may be asked to "Define natural selection." • Task/question involves reproducing an explanation previously seen in written material or given by the teacher. An examples here is: "Where is DNA stored in a cell?" Another example: "What 2 particles account for almost all of an element's atomic mass?"	***Processing ideas*** • Tasks or questions require students to use (not regurgitate) ideas and information in ways that expand understanding, such as to: - make connections between different kinds of representations of ideas (e.g. as represented in visual diagrams, graphs, drawings, analogies, manipulatives, symbols, problem situations) - recognize and use evidence to support explanatory claims - distinguish between "what", "how", and "why" explanations - create and critique explanatory models - apply knowledge in contexts different from those previously discussed in class An example may be: "A frog's heart has 3 chambers (2 atria and 1 ventricle), and their blood flows from the right atrium, to the ventricle, to the lungs, to the left atrium, and then back to the same ventricle. Because of this structure, why might it be possible for humans to have more endurance than a frog?" An example from chemistry: "Imagine you live in a water-proof (but not pressure-proof) house 20 meters under water. How might your cooking habits change if you had to boil water?" An example from physics: "When riding in a car, roll down the window and hold your hand like a flat wing in the air. Slightly tilt the front edge of your hand up and pay attention to how the air moves against your hand. How can Newton's Laws of Motion help you to explain the lifting effect? Are these laws enough for a complete explanation or do you need other ideas?"

Questions about classroom activities	
Lower Cognitive Demand	Higher Cognitive Demand
Failing to connect activities to ideas • Task is like a recipe to follow; it leaves little ambiguity about what needs to be done and how to do it. Many lab activities, for example, are often made into robotic exercises in following directions. Usually it is good to be explicit about what you want students to do in a task, but students should be given the opportunity to problem-solve on their own rather than rotely follow procedures. • Sometimes questions/tasks involve manipulating numbers and symbols. Again, these are not bad questions, unless they become the staples of your instruction. An example in physics: "What is the acceleration of a vehicle that changes its velocity from 100km/hr to a dead stop in 10 seconds?" A chemistry example: "Please balance the following equation: $Zn + HCl \rightarrow ZnCl_2 + H_2$"	***Connecting activity with ideas*** • Task/question requires hands-on activity to be in the service of developing or testing a science idea. • Task requires some thinking: although may use a procedure, it cannot be followed mindlessly. Students need to engage with conceptual ideas (understand what they mean) in order to successfully complete the task. • Task solution not self-evident to student, due to nature of solution process required. An example in chemistry: "You and your friend like to cook. Your friend thinks that pure water (H_2O) will boil faster than salt water. You disagree. Who is right? Design an experiment to test your respective hypotheses about water boiling, and provide evidence you could use to support your claims.

Asking for explanations	
Lower Cognitive Demand	Higher Cognitive Demand
Seeking a "what" explanation • Task or question requires only a "what" explanation" of the target phenomenon, not "how" or "why" explanations. A "what" explanation is *not an explanation at all*— it is merely a detailed description of something observed or read about. For example, a "what" explanation in chemistry might be "Explain what the differences are between acids and bases." Or "Explain what happened when we mixed baking soda and vinegar." ***Hiding behind vocabulary*** • In some cases a question is phrased as a "why" but the teacher is satisfied when student gives a vocabulary term as the answer. An example here is: "Why do arctic fox have white fur?" Student answer: "Because of evolution." Another example is: "Why does dye disperse faster in warm water than in cold water?" Student answer: "Because of kinetic molecular motion." Students may be able to reproduce or recognize such brief responses, but they should be pressed further: "What do you mean by that? Can you explain?"	***Seeking "why" explanations*:** • Task/question requires a why explanation. By a "why" explanation, we mean that the student can use evidence, information, and logic to tell a *causal story* for the target phenomenon. This causal story *always involves unseen, underlying events and processes that have to be connected in a logical way to explain observable events*. This causal story is often referred to as an *explanatory model* because it can be used to explain a whole range of phenomena in the natural world. An example from biology might be: "The bird flu (a virus found in birds) has been in the news recently because several people have died from it. However, the infected people did not transmit the bird flu to any other people. Using your understanding of evolution, please explain a) Why people can become ill from a virus that infects birds, and b) Is it possible for someone infected with the bird flu to transmit the virus to another person? If so, why?" From chemistry: "Explain at the molecular level why baking soda and vinegar produce gas when mixed."

Cognitive demand: Avoiding I-R-E patterns of talk



One common pattern of talk in classroom regularly uses low cognitive demand questions. This pattern, I-R-E, stands for initiation-response-evaluation. It represents discourse that is *not* conducive to student thinking, and is actually used by teachers to constrain students' talk in the classroom. The *initiation* (by the teacher) is typically a question that has a known, "correct" response, and requires only recall or a simple calculation on the part of the student. The *response* (by the student) is usually a one or two word phrase. The *evaluation* (by the teacher) is a comment that the student is either right or wrong. An example would be:

> *Teacher*: What are the three different kinds of rocks?
> *Student*: Sedimentary, metamorphic, and igneous?
> *Teacher*: Yes, that's good.

Some teachers have a “fill in the blank” or “read my mind” speech pattern, but it still qualifies as I-R-E. An example would be:

> *Teacher*: So we measure mass in ________? (with rising intonation in the voice)
> *Student 1*: Weight?
> *Teacher*: Noooo…(again the rising intonation of voice)
> *Student 2*: Pounds?
> *Teacher:* Almost…can anyone help?
> *Student 3*: Newtons?
> *Teacher*: That’s right.

There are many variations on this theme. Students may give partial answers and the teacher may have other students fill in what is missing from a initial student response. Some teachers are more polite than others about incorrect answers, some are more terse. This sort of dialogue can become a running quiz that puts most kids on edge, allows only certain kids to participate, focuses only on the lowest levels of thinking, and in the process, drastically undershoots what kids are capable of. Teachers using I-R-E typically cherry-pick the right answers from student and then assume everyone has that shared understanding. The teacher then moves forward under this faulty assumption.

The “guess-what’s-in-my-head” dialogue is so common that it’s been called the default pattern of talk in schools. Its dubious distinction is that it is the most school-like form of talk.

This type of discourse is also one of the most difficult for students with different cultural and linguistic backgrounds. They do not know how this artificial speech pattern is part of the “game of school” and find it a bizarre exchange between teacher and learner.

We write about I-R-E here because, as we mentioned, it is so common in schools. We have seen entire 50 minute class periods in which students have endured one I-R-E sequence after another. If you recognize this form of talk in your own classroom, you should make every effort to figure out why you are using it and how you can shift to more productive forms of discourse. One place to start is to raise the cognitive demand of the questions you’re asking students. Another is to consider how you could build upon or create another question from students’ responses, rather than simply judge them as correct or incorrect (see the section coming up: *Using discourse moves*).

Idea #4. Meta-cognitive questions in the classroom

Meta-cognitive questions ask kids to think about their thinking. These kinds of questions aim to get kids to self-monitor their thinking to judge for themselves whether they are understanding an idea. Meta-cognitive questions also can help a student self-regulate their progress towards important project goals. For example, a teacher may ask students working together on a project to write or talk about:

> What progress am I (are we) making on this problem?
> How will I know if I am (we are) successful?
> What additional information or experiences do I (we) need to be successful?
> What gaps do I (we) have in my (our) thinking?

Using meta-cognitive questions help make students a bit more independent of the teacher—rather than needing the teacher to tell them about the quality of their thinking, kids learn to fairly judge it for themselves. They are not used to thinking this way! It also helps them manage their time and effort across class activities that take a while to complete.

Idea #5. Using wait time

In whole class discussion, kids need time to think. Not all kids can spontaneously interpret what a teacher's question means and respond to it within a couple of seconds. Rapid fire questioning privileges those few kids who have mastered English, who are familiar with the "game of school", who can anticipate the types of questions the teacher will ask, and who can recall facts easily. The majority of kids, however, are silenced by this inequitable type of discourse.

One way to make conversations more equitable is to pay attention to *wait time*. This is the amount of time between when a teacher poses a question, and when the teacher either calls on a student, rephrases the question, gives a hint, or answers the question himself or herself— essentially the amount of time the teacher gives the students to think. Research has shown that the wait time teachers give students is remarkably short. Believe it or not, the average wait time for most teachers is approximately *one second!* This is because teachers are almost immediately uncomfortable with silence in a classroom conversation, and seek to fill the void with a student's voice, or their own.

This same research has shown that when wait time is kept short, only a small minority of kids respond, and their responses are very brief. Some teachers have purposely lengthened their wait time to 5, 10, or 20 seconds, to give all kids time to think. In these classrooms, a *far greater percentage* of kids responded to the teachers' questions, and the responses were *longer and more thoughtful*. Wait time works best when the cognitive demand of questions is at a medium or high level.

There are other strategies to give all kids time to think before joining the conversation. *Think-pair-share* is a move where a teacher poses a question, then asks students to consider silently how to respond for about 30 seconds, then join with a peer to compare their responses, then return to the whole class conversation to share their ideas. An even simpler way to give kids time to respond is to pose a question, request that everyone keep their hands down for 30 seconds, then ask for responses after that.

In summary, extending wait time is one of the simplest but most effective ways to encourage equitable and higher quality participation in classroom discourse.

Idea #6. Using different discourse moves

By *discourse moves*, we mean the specific conversational strategies that teachers use to foster the development of ideas in the classroom. These moves can be used either in whole class conversations or when the teacher talks with students in small groups. Discourse moves serve several purposes. They elicit student thinking, model how one thinks, encourage all students to participate, emphasize key ideas, and ultimately help students appropriate scientific discourse themselves. Here are four categories of moves that skilled teachers use. There are not presented in any particular order.

Probing

Probing questions or prompts get students to make public more of their thinking. This is perhaps the most important function of classroom conversation. Usually these questions or prompts are preceded by some activity/situation/reading/video about which students can share initial ideas. Common probes include:

> What experiences have you had with…?
> Can you tell me more about that…
> Can you explain it in a different way?

One specific kind of probing is the reflective toss (van Zee & Minstrell, 1997). The reflective toss refers to the teacher catching the meaning of a students' remark and throwing responsibility for thinking back to the student. A sample of this kind of three-part exchange might go this way:

> T: How might we find the best representative of three different measurements of the same thing?
> S: Average them.
> T: Okay, we might average them. Now what do you mean by "average" here?

Usually a reflective toss addresses the most recent remark by a student, but it can address an earlier remark, or the teacher can address the remark for the entire class to respond to.

Re-voicing

Re-voicing means that the teacher repeats or paraphrases what a student has said, in order to achieve an instructional goal. Here are some examples of re-voicing moves and the reasons you would use them:

Marking/Amplifying: This is when a teacher selects a specific portion of students' comments that the teacher believes will contribute to the classes' development of a scientific idea. The teacher will repeat that "piece" of an idea to the class. It may sometimes be only a word the student has said, but it can be a full hypothesis, observation, or a question. This is used when there may be a number of ideas "flying around the room" that could confuse students, or that divert from the main idea that the class is working on. Here is a common sentence stem a teacher might use after a student has given a legitimate but long and occasionally disconnected interpretation of a classroom demonstration: "So [name of student], what I hear you saying is that [heat has something to do with the motion of the molecules of water in our food dye demonstration]?"

Repairing/clarifying an idea: This is a teacher's re-statement of a student contribution in which the teacher judiciously corrects one aspect of an otherwise valid statement. This is done to prevent confusion by students when such statements might otherwise be taken without comment by the teachers. This does not mean the teacher "corrects" statements on a routine basis or evaluates them overtly, but it does mean that clarifications are made in a sensitive way. A sentence starter here might be "I understand your explanation, but did you mean to say ____?"

Connecting students' everyday language with academic language: This is also to be used judiciously. Students need to hear how some forms of everyday language are connected with scientific language. Scientific language is valuable because it allows students to think in conceptual terms about ideas, and because it allows a common reference to talk about scientific practices (i.e. what counts as an "explanation", or what counts as a "model"). An example here might be: "So when you talk about acceleration, you usually mean to speed up like you do when you press the gas on a car. Scientists though use that term in a different way— to mean any change in speed or direction." Another kind of connection between everyday and scientific (or academic) language is when a student uses an everyday term and the teacher re-voices by substituting a scientific term. For example, substituting "convection" for a student's description of "warm air rising while cold air sinks." The teacher here, however, must take care to maintain the students' ownership of that idea.

Pressing

Teachers are generally sensitive not to embarrass their students in public discussions. This is understandable. Students, however, can come to expect that if they give one-word answers to questions, sometimes not even finishing their sentences, that the teacher will not ask them to finish their thought or to think more deeply about a question.

Because of this, there are times when a teacher must "press" students in both whole group and small group conversations. This is a reasonable way of holding kids accountable for thinking. By press we mean that the teacher does not allow students to offer shortcut responses, unsupported claims, or respond with "you know." When a student offers an initial idea, the teacher for example, can ask in return: "What evidence do you have for that claim?", "Isn't that a contradiction to what you said earlier?" or "Why do you think that?" You can tell when you are pressing students because they will often visibly squirm when you won't give up on their thinking.

Pressing students is very different from just hearing everyone's voice during a class period (i.e. it is different from probing). It does little good to get dozens of one-word responses from a variety of students. Getting one word responses from kids does not mean they are involved.

As you can imagine, knowing who and when to press requires that you know your kids and that you've established a safe classroom environment for these conversations. You will need extra patience with this conversational expectation in the classroom, since "press" is something that very few kids experience in their other classes or in their entire history as students.

Putting an idea "on hold"

In the enthusiasm of whole class discussions, students often make statements that can be off-topic, or that are better addressed later on. In these cases, teachers need polite ways of acknowledging the students' contributions, while marking it as something that is not going to be talked about at this point. A teacher might say: "That's an interesting idea, and it is something that we will talk about tomorrow, but for now…" or "I like your thinking, but let's hold on to that thought…"

Cautionary note: Many of our beginning teachers have used this conversational move to avoid really interesting and relevant questions by students. Do *not* use this strategy to suppress kids who want to explore the boundaries of the lesson!

Some teachers have a section of their wall space devoted to genuine questions or comments that students have which may not be the focus on the current lesson. This has been called the "Parking Lot", and it signals to students that their ideas have value, but may not fit the current discussion.

Idea #7. Scaffolding academic language

Academic language can be defined as the language used in the classroom or school-talk. It is needed by students to do the work in schools. Academic language includes such things as specialized vocabulary, grammar and punctuation, conventional text structures within a field (e.g., essays, lab reports), particular forms of talk (e.g., storytelling, talk about evidence), and other language-related activities typical of classrooms, (e.g., expressing disagreement, discussing an issue, asking for clarification). For some students, academic language seems to come naturally because it is similar to the kinds of language used by peers and family members. However, for many students, academic language represents an entirely new language. Proficiency in conversational English does not necessarily mean that students will easily take up this "new" academic language. It is a teacher's responsibility to help students develop fluency in the academic language of schools and the specific language of science so that students can become "multilingual" participants in science at school.

> **Worth noting:** Learning an academic language is not just for English Language Learners. All your students will need help learning to speak "school" and "science."

When thinking about how to scaffold academic language for students we have to consider all of the ways that students communicate to others through *producing* language, (e.g., speaking, writing, drawing) and all of the ways that students receive communication from others by *consuming* language, (e.g., listening, reading, viewing). To learn a language and develop fluency, it is crucial that students engage in regular practice in all of the ways of producing and consuming language. It is also important to provide scaffolding –temporary help in the form of tools or tasks that give students a boost when trying something that is challenging or new. The main purpose of scaffolding academic language is to make all of the elements of language more visible for students including the modes of communication, forms of talk, language structures and functions, and specialized vocabulary. The following table provides additional descriptions of each of these as well as suggestions about possible scaffolding. You will need to identify further resources beyond this primer to help you design this scaffolding.

5 Elements of Language	Ask Yourself …	Possible Scaffolding
Modes of Communication Language consists of inputs (listening, reading, viewing) and outputs (speaking, writing, drawing).	• How is language being used by students in the classroom? • Are you providing opportunities for students to engage in speaking, writing, reading, drawing, listening, and viewing in the academic language of science?	• Provide sentence starters and connecting words to help students talk and write in academic language. • Use pre-reading and during-reading strategies to help students read academic texts.

Forms of Talk Language includes forms of talk specialized for particular fields which can seem unusual to people outside a field. These forms are part of the "culture" of a field such as arguing with evidence in science or law.	- How are specialized forms of science talk necessary in the classroom? - Are students making explanatory claims, providing evidence, designing experiments, and discussing merits of models?	- Provide explicit expectations about the content of "good" explanations and arguments and generate rubrics with students in class. - Be a role model by 'thinking' out loud so students can hear academic forms of talk.
Language Structures Language is organized into structures such as the type of "why … because" question and answer structure common in schools. Structures are often "invisible" and can seem mysterious until they are explicitly identified.	- What kinds of structures of language are used in the classroom? - Are students expected to make comparisons, answer "why" questions, use symbols and equations, or use conventional representations like graphs?	- Explicitly identify the structure of language in the task and help students see what they are supposed to do to communicate. - Introduce transitions between structures step-by-step (i.e., move from an idea, to words, to symbols, to graphs, and back).
Language Functions Language serves specialized functions unique to a field or a context like school. Like language structures, the functions of language can seem "invisible" until someone explicitly identifies the functions of certain language practices.	- What kinds of functions are served by language in the classroom? Why are certain language practices being used in certain circumstances? - Are students proposing tentative explanations, forming specific hypotheses, describing, explaining, inferring, relating events across time, interpreting data, or generalizing to new contexts?	- Work together with students in class to clarify *why* certain language practices are used in different circumstances (e.g., observations are used in descriptions, but explanations require theory and inferences). - Construct examples with students and work together to evaluate "good", "better," and "great" exemplars.
Specialized Vocabulary Every field and every context has specialized vocabulary that is used only within that field or context.	- What specialized academic and/or scientific vocabulary is *required* for participation in this activity? What academic/scientific vocabulary is *required* to make sense of a class text? - How can students slowly gain vocabulary to enrich their participation in academic and scientific communities?	- Work with everyday words and academic or scientific terms in parallel until students can make vocabulary transitions(e.g., physics students might say "drag" instead of saying "friction" which is fine initially). - Provide transition words for students to use as tools when writing: "For example," and "In addition," help students elaborate their paragraphs in an academic tone.

Idea #8. Encouraging peer-to-peer talk for students

Productive conversations are not only about teachers' questions, they are also about *students' questions* and how the teacher *helps students talk to one another* using the language and rhetoric of science. One long-term goal you should have regarding classroom conversations is that eventually your students should take over some of the responsibilities of guiding the discourse. The difference between the first and last week of school should be that, by the end of the year, your students have begun to ask the questions that *you* asked earlier and that your students are doing the probing, the comparing of ideas and the critiquing of peers' ideas. Your students should be developing the civility needed to elaborate on and critique the ideas of others in a public setting—without you acting as an intermediary between every turn of talk.

To start this process, you need to tell students explicitly that you want them to address each other's ideas. Also, you should regularly provide responses to students that you want them to say to each other. Here are example sentence-starters , some of these can even be put on cards that students use in small groups, you may recall these are forms of probing, reflective toss, and pressing:

Worth noting: You may literally have to turn away from your students to force them to address one another with their comments.

"Can anyone add to ______'s idea?"

"What is the difference between what you've said and what _____ has said?"

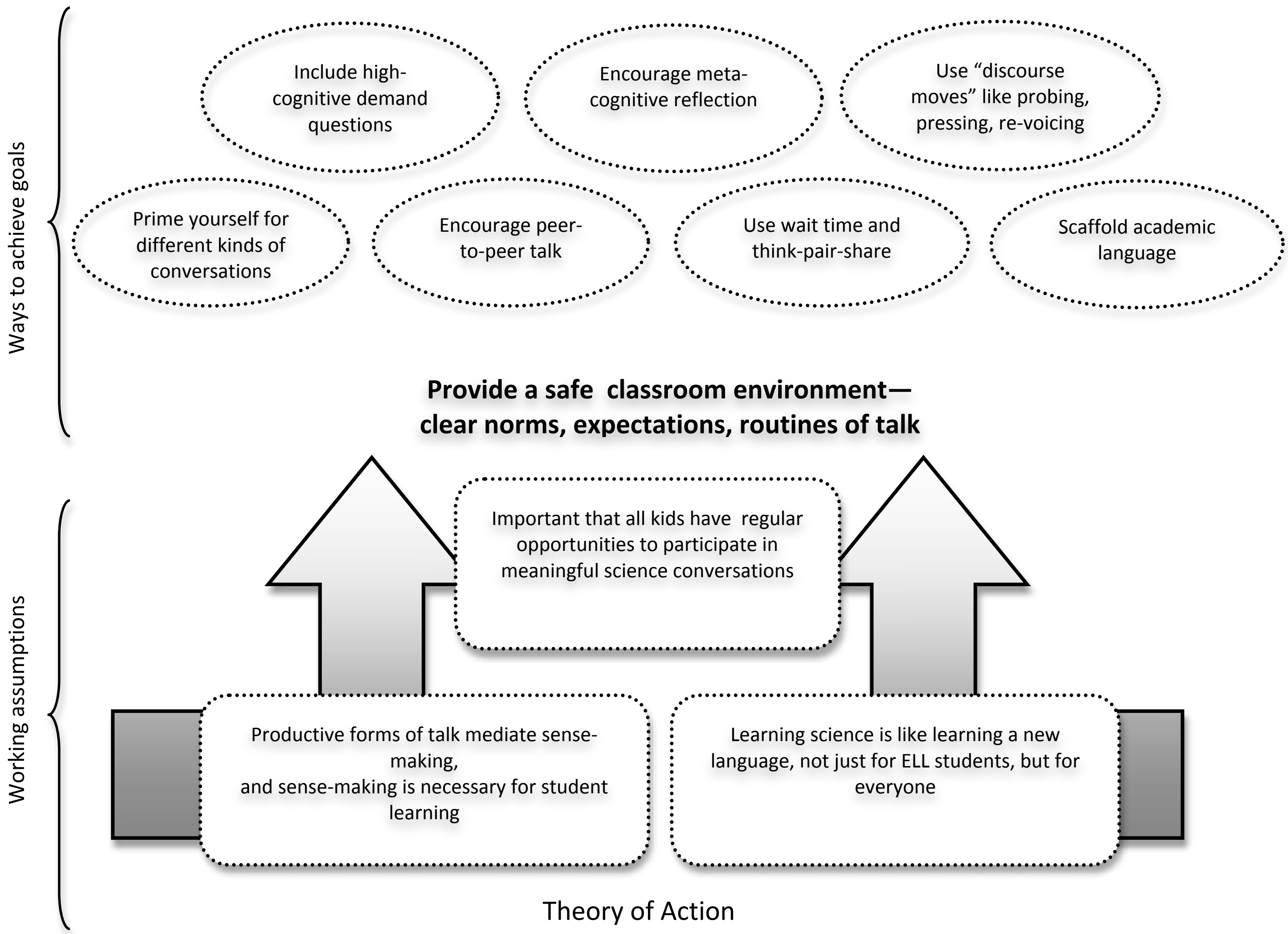
"Does your idea make you question something that _____ has said?"

"So, _______, it sounds like your claim is _______ and one piece of evidence is ______. But _____ has this other piece of evidence which conflicts with yours, what do you think?"

Developing peer-to-peer talk is difficult work that will take weeks or months of encouragement. Most teachers experienced in classroom discourse look for students to begin engaging with one another after about three months. Yes, that's a long time, so persistence is the key.

In summary: Developing a theory of action

Although we've talked about a number of ideas, it is most helpful for teachers to relate these ideas together in a "theory of action"—a way of organizing what is going to be done in a classroom and why. We provide one example here, but we encourage you to reorganize this framework, add to it, in order to make it your own.



Theory of Action

Another way to think about the ideas in this paper is a check-list you might use as you plan or your own classroom discourse.

☐ The classroom **environment will be safe** for students to express their ideas.
☐ **Goals of classroom conversations**/discussions regarding will be **anticipated** by the teacher and made clear to students.
☐ **Questions** and tasks will be predominantly **of high cognitive demand** for making sense of science ideas and phenomena.

☐ **Wait time will be used** after asking questions requiring high cognitive demand and after each student responds.
☐ A **variety of discourse moves will be used** to manage the initiation and development of ideas while at the same time honoring the thinking of all members of the class.
☐ **Meta-cognitive questions** will be part of all lessons so that students learn to self-critique their thinking and monitor their progress toward longer term goals.
☐ Students language and forms of **communication will be scaffolded** from what they bring to class toward more academic ways of speaking.
☐ The **teacher and students will model interactions** that fosters being critical of unsupported ideas while encouraging sharing of ideas and respect for those who are sharing.

Classroom talk matters for student learning. This general guide to classroom discourse is only a starter document, but you can use the ideas here for several purposes:

- to interpret classroom discourse you hear from other teachers,
- to help you evaluate your own classroom discourse patterns,
- to serve as a framework to design your own sequences of conversational moves,
- to help you establish long-term discourse goals for your classroom community.

Using this document as an interpretive framework can hopefully convince you that “teacher storytelling” or “quizzing” is not how most students learn, and that good teaching is the product of having specific goals and enacting specific patterns of verbal interaction with learners.

Some beginning teachers have a natural aptitude for fostering meaningful conversations, but no novice has the all the skills to artfully design conversations. *Every* teacher, however, who takes a principled approach to classroom discourse can eventually develop an interactional expertise with student conversations that will lead to learning. We have seen this happen in first year teachers—and it is inspiring to see how kids from all cultural, linguistic and socioeconomic backgrounds in their classrooms are given the chance to participate and to achieve at high levels.

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