

# LANGUAGE USE IN THE SCIENCE CLASSROOM: LOOKING AT WHAT STUDENTS AND TEACHERS NEED TO KNOW AND BE ABLE TO DO

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## INTRODUCTION

*In schools, talk is sometimes valued and sometimes avoided, but—and this is surprising—talk is rarely taught. It is rare to hear teachers discuss their efforts to teach students to talk well. Yet talk, like reading and writing, is a major motor—I could even say the major motor—of intellectual development.*

(Calkins, 2000, p. 226)

Language and communication are central to the learning process. Researchers and practitioners alike have underscored the importance of language development and the impact it has on student learning. All modalities—reading, writing, and oral language—are important. This chapter focuses specifically on the role of oral language, one area that is less often discussed in science education. Yet the research suggests that it is talk that leads to understanding and helps us process what we are learning (Barnes, 1993; Cazden, 2001). Social constructivist theories based on the work of Lev Vygotsky (1934, 1978) suggest that learning and higher-level thinking are enhanced when students have opportunities to talk with peers and teachers about their ideas, and respond to and challenge the ideas of others (Almasi, 2002).

Lauren Resnick (1999, *Effort-Based Education and Learnable Intelligence: Principles for Teaching and Learning* section, ¶ 8) expands on these basic ideas suggesting that

...not all talk sustains learning or creates intelligence. For classroom talk to promote learning, it must have certain characteristics that make it accountable. Accountable talk seriously responds to and further develops what others in the group have said. It puts forth and demands knowledge that is accurate and relevant to the issue under discussion. Accountable talk uses evidence in ways appropriate to the discipline (for example, proofs in mathematics, data from investigations in science, textual details in literature, documentary sources in history). Finally, it follows established norms of good reasoning. Accountable talk sharpens students' thinking by reinforcing their ability to use knowledge appropriately. As such, it helps develop the skills and the habits of mind that constitute intelligence-in-practice.

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But for accountable talk to take place in the classroom, it is not enough to simply provide time for discussion and teach the appropriate vocabulary. The norms and skills that allow students to engage in such talk must be taught explicitly, yet this happens rarely.

### **The role of talk in science learning**

This discussion of the role of talk in science learning is situated within the context of hands-on, inquiry-based science teaching, where students have opportunities to explore, question, and then investigate phenomena both firsthand and using secondary resources; gather their own data; and begin to construct ideas about the natural world. Talk plays a critical role in such science learning, not only because of the importance in science of communicating data, analyses, and ideas, but also because it is fundamental to the development of scientific reasoning skills and the construction of theories and explanations. As students talk about their experiences and the data they have collected and as they debate their ideas, they clarify their thoughts, generate conclusions, and develop new theories.

Anyone walking into an active hands-on science class at the elementary level will notice no dearth of talk as students work. But when gathered together in small or large groups, quiet descends and the teacher's voice emerges loud and clear. "Who will share their data"? "What did you learn today?" Often silence is the response. The excited chatter is gone and is replaced by teacher-led questions and response with little real dialogue among students. The challenge for teachers is to create a classroom culture of science inquiry and to teach the skills and norms of accountable science talk so students can engage in rigorous discussions without losing the excitement and fluency of the talk they engage in as they actively investigate.

### **Language in science teaching: A historical perspective**

Inquiry-based elementary science curricula developers have tended to underestimate the importance of talk in student learning. In the 1980s, as they began the process of developing new inquiry-based curricula, they were responding to a world in which much of the hands-on experiential side of science had vanished despite its strong presence in many of the programs of the 60s and 70s. There was a renewed concern about science learning in general, and a particular concern that science ought to be taught through inquiry and direct experience with phenomena. The thrust was to return hands-

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on science to the classroom. The developers of the inquiry-based programs also recognized that elementary teachers would require a good deal of guidance when it came to materials management and the science content of a particular module. They recognized the importance of providing carefully sequenced experiences to support the gradual development of conceptual understanding. But in retrospect, they did not think deeply enough about the bridge between direct experience and the understanding necessary to explain and theorize. They assumed it would happen and therefore provided relatively little guidance to teachers on how to support student reflection on ideas and the construction of explanations and theories based in the evidence they collected. It is now evident that building this bridge requires that students discuss their experiences with one another. Providing the opportunity for accountable talk is a vital component of science teaching and learning and many teachers need guidance if they are to make this happen.

In what follows, we assume that students are actively engaged in inquiry-based investigations and that language is a critical ingredient for developing the necessary scientific reasoning and conceptual understanding. We suggest ways that teachers can create the norms and teach the skills students need to think and communicate about their work with one another to reach new conclusions individually and as a group.

## **DEVELOPING AND SUPPORTING STUDENT SCIENCE TALK**

Conducting and facilitating fruitful discussions in science requires a great deal of thought and skill on the part of the teacher. Many teaching strategies and skills are the same as those used in comprehensive literacy programs and research-based mathematics programs. For example, in comprehensive literacy models, teachers first ask students to discuss a question with a partner before they ask for contributions to the full-group discussion. In many literacy programs, students learn, practice, and discuss specific skills such as active listening, waiting their turn, and how to add ideas to the thinking of others. Likewise in many mathematics programs, students learn to explain their thinking and how they arrived at a particular answer. *A Research Companion to Principals and Standards for School Mathematics* (Kilpatrick, Martin, & Schifter, 2003) devotes a chapter to describing the thoughtful use of communication and language in mathematics teaching and learning.

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But while there is much to transfer from literacy and mathematics discussion into science talk, teaching science talk requires specific attention to the

- science content and thinking goals that are the focus of the discussion;
- nature of a classroom culture of science inquiry;
- purpose of the discussion within an inquiry framework
- stages of a discussion
- guiding of a discussion
- recording of ideas and information

### **The thinking and content goals**

Critical to effective facilitation of science discussions is the teacher's clarity around the content being discussed, the various ways students build their understanding of the science, and her explicit understanding of the learning expectations. Without this knowledge, it is difficult to determine a good question or prompt to start a discussion; to know which students' ideas to follow and when to refocus; and when to bring closure to a discussion. Though necessary for rich science discussions, how to go about building and deepening this knowledge is not the purpose of this chapter.

### **A classroom culture of science inquiry**

We define a classroom culture of science to include norms of behavior, attitudes, and expectations. Teachers who provide students with direct experience often consider this hands-on exploration of materials to be the only place where science learning happens. They assume that the exploration of materials alone embodies the essence of a culture of science inquiry in the classroom. When pressed for time, they may skip over the discussions that precede or follow the experience. But those discussions are equally as important as the hands-on experiences and are where much of the rigorous scientific reasoning needed for understanding takes place. So a culture of science practice must include the expectations that

- discussion takes place,
- ideas and experiences are shared,
- all thoughtful and interesting ideas are valued,

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- scientific reasoning is expected, and
- debate and argument are assumed to be part of science learning.

Along with an explicit set of expectations, students need to learn and practice basic discussion skills such as listening to one another, responding to one another's ideas staying on focus, and supporting the participation of all of their peers. These need to be taught and practiced. For example, the teacher might introduce, describe, and demonstrate in a mini-lesson a discussion skill such as how to listen to others, much as she would do when conducting a literature circle or modeling for students how to use a magnifier. Once introduced, such a skill becomes a classroom norm to which students and teachers alike refer when engaged in a science discussion. Other expectations focus more on the reasoning process itself. For example, evidence-based debate and argument are important to the development of science ideas and are both a part of accountable talk. Here, too, appropriate skills and behaviors need to be learned and practiced, including using data, disagreeing respectfully and asking for clarification of someone's ideas. Mini-lessons can teach the use of specific language that makes this respect more explicit, such as "I have a different idea," or "tell me why you think that."

If we were to drop in on a science discussion in a classroom where there is culture that supports serious science discussion, we would likely notice most or all of the following common characteristics:

- The students are seated in a circle facing one another, making accountability more likely.
- There is a natural flow to the conversation with a good deal of student-to-student interaction rather than question and response with the teacher.
- The conversation is focused, and the students make connections to one another's ideas and linger on a particular idea.
- The conversation is not dominated by a single student or by the teacher.

### **Purposes of science talks**

Science discussions can have a number of different purposes; each purpose influences the structure of the discussion and the roles of teacher and students. In an attempt to develop a framework for

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thinking about group discussions, we have identified a range of purposes for discussion. These include

1. to gather and take stock of ideas,
2. to plan an investigation, and
3. to develop conceptual understanding.

(See Figure 1)

A discussion to *gather and take stock of ideas* is one in which students are encouraged to talk about what they know, describe experiences they have had, share ideas, and listen to the experiences and ideas of others. This kind of discussion often occurs at the beginning of a new topic or focus when it is important for students to make explicit what and how they think about a topic. It also can occur after some initial direct experience to uncover the thinking the experience has sparked. For these discussions to be effective, basic norms for discussion must be in place, but rather than argument and lengthy debate, the discussion is one of brainstorming, speculation, and wondering.

As an example, consider this from a third-grade class just beginning a study of water:

Teacher: We're going to have a science talk as we begin a study of water. Let's remember that as we have this talk we want to listen to each other. Be sure to ask questions if you aren't sure about what someone means. What are some things you have noticed about water and what it does?

Maria: It can push.

Tyrone: Push? What do you mean?

Maria: I saw it push leaves down the street when it was raining.

Joanne: Oh yeah! I saw rain push a plastic bottle down the street!

T: So some of us have seen water push. What else can water do?

Damien: It can make sounds.

T: Is anyone curious about what Damien is thinking when he says that?

Irina: What sounds?

Damien: Like when I was walking down the street yesterday when it was raining and when a car drove by it made a sound like water going ssssss....

This small piece of discussion displays some elements that are important to the class's study of water. It occurs in an environment in which students are learning how to listen and talk to one another, and in which the sharing of a range of ideas is encouraged. As these ideas are based on the experiences of individual students, there is no need to challenge their ideas at this point. Instead, the teacher encourages students to ask questions about one another's ideas. The teacher recognizes that sharing prior experiences with water will help her students begin to think about what they already have experienced which will be a starting point for how they might begin to think about some of the properties of water.

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A discussion to *plan an investigation* is one in which the class comes together to identify and/or clarify a question, focus on what is to be found out, and plan an appropriate investigation. It includes determining what data needs to be collected, how to collect it, and what to record. Once again, basic norms of discussion must be observed, but the goal usually is group consensus on what will be done.

Here, later in their water unit, we find the third graders sitting in a circle next to their working partners, making some plans.

T: Yesterday we investigated drops of water on wax paper. Afterwards Tyrone had an idea for what we might try today—what was your idea, Tyrone?

Tyrone: I said, what if we tried to put drops on other things.

T: Such as...?

Tyrone: Aluminum foil, towels, raincoats...

T: Yesterday each of your groups talked about what they might want to try today. So let's talk about what you think we should do and what we ought to look for. But before we go on together, I want each pair of you to talk together about this for a couple of minutes.

T: OK, now let's talk about what you might do. Feel free to make suggestions to each other, but be sure to remember to wait until someone is through talking before you add or suggest anything. Luis, do you want to begin?

Luis: Well, I think each group will have to have some of the same things and some different things to put the drops on.

T: And what will we look for when we put the drops on different things?

Tanisha: If it makes a circle.

T: What do people think about what Tanisha said?

Maria: Well, yeah, I agree, but it's a circle when you look down on it. But when you look at it from the side, it's different.

T: Maria, do you mean you want to look at it from above and from the side just like we did with the wax paper?

Maria: Yeah

Irina: Then we can see if it looks the same or different than how it looked on the wax paper.

Maria: If you make it a big drop it won't.

Here the teacher is encouraging the students to talk to one another and to come up with some plans that will help them know what they might look for as they engage in the investigation. The students are free to challenge one another, but the group will be responsible for making a decision about how to proceed and what to look for. The teacher still is doing much of the talking, but she is trying to encourage others to share their ideas. It often takes a good deal of this kind of encouragement and direct teaching over many discussions before students are able to take on more responsibility to respond to one another.

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Finally, a discussion to *develop conceptual understanding*, the most difficult for teacher and students, is one in which data is analyzed, meaning is sought, explanations and theories are tried out, and argument and debate are encouraged. Here, too, the basic norms of discussion, as well as those for debate and argument, must be observed. In addition, there are expectations for the use of evidence and scientific reasoning as theories and explanations are developed.

Here are the third graders after they have had several experiences with looking at drops on different surfaces:

T: So, we've looked at drops of water on wax paper and on a number of other surfaces. We have kept records of the drops in our notebooks with drawings and descriptions of what we have observed. We compiled some of the data about your predictions of what you would see and what actually happened from your notebooks onto the class chart yesterday. As we have this discussion remember to use evidence to support your ideas. What kinds of ideas do you have about drops on different kinds of surfaces?

Tanisha: It wasn't always in a circle.

T: What is your evidence for saying that?

Tanisha: On the chart, I saw that sometimes drops were in a circle and sometimes they weren't.

T: You sound surprised. Did it surprise you that the drops weren't always circles?

Tanisha: Yeah, it wasn't always like the wax paper. Only on some things.

T: Were others of you surprised about the data we see on the chart? Michael?

Michael: Yeah, I didn't like the aluminum foil.

Damien: Me either.

T: So what was it that you didn't like?

Michael: I thought the aluminum foil would be like the wax paper, that the drops would look like half circles, but the drops spread out all over the place.

Damien: That's what I thought, too. The foil is smooth like the wax paper but it kind of, like, melted.

T: As I look on our chart I see that both Michael and Damien predicted that drops on foil would be like those on wax paper, and that in both cases the drops ended up looking very different. So what do people think makes them different? How might you explain what's happening?

Maria: They aren't always the same.

Irina: It depends on what you put them on.

T: Do you agree with Maria and Damien or disagree? Why?

The teacher is now encouraging her students to use the class data chart to formulate some ideas about some factors that affect the shapes of drops of water. Students are using evidence to begin to analyze the patterns they might have observed. This teacher is certainly very present in the discussion, but her role is to generate conversation and thought rather than answer questions.

In the first two columns of Figure 1, we review the three types of discussion and some key characteristics of each.

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## **Stages of a discussions**

Clearly, the teacher's role in science discussions of all kinds is critical. As she guides a science discussion, the teacher must keep in mind the science concepts and skills that are the goals of the study and the particular discussion, and she must have a sense for the level of understanding to be expected of her students. With this in mind, she must orchestrate the discussion as a whole and manage a flow that proceeds through several basic stages:

- *Setting the Stage:* How the teacher begins a discussion can deeply impact its success. The opening of a discussion also is the time for the teacher to establish with the students the purpose of the discussion, and to review the appropriate discussion norms and expectations.
- *Moving further:* This is the heart of the discussion. Teacher comments, questions, and prompts support rich discussion, maintain the focus as needed, and gently guide the thinking.
- *Bringing closure:* Depending on the purpose of the discussion, closure may be a review of ideas; a plan of action; a synthesis of ideas; or, indeed, an explicit statement or conclusion.

These stages appear in the third column of Figure 1.

## **Guiding a discussion**

Teachers generally see their role as question-asker. But in our experience, this often means that they ask many questions in a rapid-fire format, eliciting brief responses. Such a structure often does the thinking for students and rarely leads to the kind of reasoning and discussion that can result in new theories or explanations. Another common practice is to repeat what a student has said, making listening to one another unnecessary. Our experience suggests that one of the most difficult parts of guiding science discussions is determining the question(s), comment(s), and prompt(s) that will initiate and move a discussion forward. These must be specific enough to focus the thinking of the group yet open enough to invite thought. They must reflect student thinking and move the discussion towards common goals. They must encourage debate and argument yet stay focused on the ideas at hand.

Much is written about questions and questioning and how to categorize and describe different kinds of questions in terms of the responses they elicit. Here we have drawn from the work of Elstgeest

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and Jelly (found in Harlen, 2001) to describe two basic categories of questions: unproductive and productive.

### *Unproductive questions*

Unproductive questions do not invite discussion. They include questions that ask for facts, definition, repetition, or rhetorical/information checks. They may be useful to the teacher to check for specific surface knowledge, vocabulary words, and definitions, but they do not generate the thinking that leads to deeper understanding.

### *Productive questions*

In contrast, productive questions do not presume a single, correct answer but, rather, offer more open-ended opportunities that lead to conjecture, dialogue, argument, and other types of science-based discussion. The focus of productive questions is clearly important for all involved, not just for the teacher. Productive questions open up student thinking rather than test student knowledge.

Productive questions or prompts include language such as

- What do you notice...?
- What do you think will happen if...?
- What do you think we'll observe when...?
- How might you explain...?
- What connections can you make...?

Productive questions serve specific purposes during the course of a science experience or unit. For example, *prior knowledge questions* can be useful when probing students for what they already know about a topic. *Action questions* and *problem-posing questions* can be particularly useful during the investigation itself. *Reasoning questions* can be posed to begin group discussions when it is appropriate to process for some understanding of the implications of the investigation. The third column of Figure 1 provides examples of questions for different kinds of discussions and different stages of each.

In addition to focusing on the nature and specific substance of the question, teachers also consider how questions reflect what students know and what interests them. Eliciting student questions and selecting from them is one way to share the ownership of a discussion. A good discussion is often guided by a mix of questions, some that are teacher driven and, thus, very centered on the topic, and others that are offered by students, which can maintain a high level of student interest while not losing focus on important concepts and skills. As the teacher gains skill in posing and soliciting questions, she models important components of the inquiry process for her students.

### **Recording ideas and information**

What happens to a discussion? How are interesting ideas preserved for future use? What record is there of the thinking of the group? It is common elementary teaching practice to record elements of classroom discussions—a brainstorm of ideas, vocabulary lists, descriptive phrases, class conclusions—on chart paper or on the board. These charts can play an important role in student learning, but it is vital to ask what purpose the recording serves and what recording strategy might be most effective for this purpose. Some important purposes for recording include

- to display data from the whole group for group analysis. The data may be entered at the time of the discussion—if the focus is on the nature of the data gathering itself—or before.
- to record key ideas that emerge from an analytic/synthesizing discussion—a chart of progress.
- to summarize conclusions/essential ideas temporarily as the discussion proceeds—an anchor chart.
- to model what a notebook page, a set of notes, or any other kind of recording strategy can look like and sound like.

If the recording is done as the discussion proceeds for all to see, then the recording should not interrupt, slow, or distract attention from the discussion. The charts should remain visible to the class only as long as they play a role in the ongoing learning—as progress reports, as data collections, and as data for which there is likely to be some future need. They are useful if they are needed as learning tools, but not so if they are used as “displays.”

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As important as these charts can be in recording the development of ideas, they are not always recommended. Teachers may instead choose to take notes that are later turned into a sheet to be passed out to students or turned into a class chart. The teacher may use them to support summaries of what has been done or said, to refer students to what others have said, and/or to identify discourse patterns for discussion.

Rather than a class recording, in some cases students may record in their notebooks during or after a discussion. Again, this depends on the ultimate goal of the discussion. Taking time to record in notebooks can sometimes interfere with the discussion, so it is up to the teacher to decide if the recording will push the students' thinking as much as will participating in the discussion.

And finally, there are times when there is no need to record. There is nothing to be gained by recording everything for no apparent purpose. Even worse, excessive recording can actually interfere with student learning or, at least, send an inappropriate message about why this information is being recorded.

## **CONCLUSION**

Talking is both an important component of the learning process and central to the culture of science. Discussions among students in classrooms and among colleagues in the science community serve to push thinking forward as well as to share experiences and ideas. Yet, classroom science discussions in which students are held to certain norms and are challenged to think deeply occur infrequently. There are a number of possible reasons for this. Time may be one, but if by neglecting these discussions students, in fact, learn less, then the time for discussion must be taken from some of the time set aside for the experience itself. A lack of understanding of the importance of discussion to inquiry-based science is certainly another reason for the infrequency of discussions. In this chapter we argue that carefully designed discussions are a critical part of science instruction, complementing, not replacing, the necessary direct investigation of phenomena, and providing the opportunities for students to come to a deeper understanding of the science in which they are engaged and a better understanding of the role of communication in science practice.

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Figure 1: TALKING IN SCIENCE

PURPOSES/ GOALS	CHARACTERISTICS OF GROUP TALKS	PROMPTS/QUESTIONS
<p><b>I. Gathering and Taking Stock of Ideas</b></p> <p><b>Purpose</b> To take stock at a point in time of a group's experiences and ideas about an aspect of the science topic at hand</p> <p><b>Through</b></p> <ul style="list-style-type: none"> <li>• activating prior knowledge;</li> <li>• capturing ideas, questions, and experience;</li> <li>• generating hunches and wonderings</li> </ul>	<ul style="list-style-type: none"> <li>• Focused on a topic or idea</li> <li>• Initiated with a statement and/or productive question</li> <li>• Open ended</li> <li>• All ideas accepted</li> <li>• Limited challenge or disagreement</li> <li>• Dialogue around detail, understanding</li> </ul>	<ol style="list-style-type: none"> <li>1. <b>Setting the stage</b> (What are we wondering about?) Let's look at this X.               <ul style="list-style-type: none"> <li>• What do you notice?</li> <li>• What does it make you think about?</li> <li>• What do you wonder about?</li> </ul> </li> <li>2. <b>Moving further</b> (What do we think/speculate about this?)               <ul style="list-style-type: none"> <li>• What makes you think that?</li> <li>• That's an interesting experience. Can you tell us more?</li> <li>• Where did you find that out?</li> </ul> </li> <li>3 <b>Bringing closure</b> (What are our collective experiences and ideas?)               <ul style="list-style-type: none"> <li>• You shared a lot of ideas. Some of you...</li> </ul> </li> </ol> <p><b>Encouraging child-to-child discourse</b></p> <ul style="list-style-type: none"> <li>• X, that's sort of like your experience. What do you think?</li> <li>• Y, what do you think about M's idea?</li> <li>• Is there someone who has had a similar experience?</li> </ul>
<p><b>II. Planning an Investigation</b></p> <p><b>Purpose</b> To develop and/or evaluate the particulars of a plan for an investigation, decide on "next steps," and understand why and how these next steps will help collect the data</p>	<ul style="list-style-type: none"> <li>• Focused on a specific investigation</li> <li>• Initiated with a challenging question (make a plan)</li> <li>• Ideas backed by</li> </ul>	<ol style="list-style-type: none"> <li>1. <b>Setting the stage</b> (What's the question?)               <ul style="list-style-type: none"> <li>• Let's be clear on what our question is. What is it we want to find out?</li> </ul> </li> <li>2. <b>Moving further</b> (How will we find out?)               <ul style="list-style-type: none"> <li>• What data do we need to help answer the question?</li> <li>• What do you think are some ways to get that data?</li> <li>• What do you think that will tell us?</li> <li>• What might we have to do first? next? finally?</li> </ul> </li> </ol>

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<p>needed to pursue the question.</p> <p><b>Through</b></p> <ul style="list-style-type: none"> <li>• focusing on a question,</li> <li>• planning steps of the investigation,</li> <li>• determining data to be collected, and</li> <li>• determining recording structure</li> </ul>	<p>explanation</p> <ul style="list-style-type: none"> <li>• Dialogue for reasoning, clarity</li> <li>• Debate about effectiveness of the plan/step</li> </ul>	<ul style="list-style-type: none"> <li>• How might we record our data?</li> </ul> <p>3. <b>Bringing closure</b>(What do we predict?)</p> <ul style="list-style-type: none"> <li>• Let’s review the plan and be sure we have all the details.</li> <li>• What do you think will happen? What do you think we will find out?</li> </ul> <p><b>Encouraging child-to-child discourse</b></p> <ul style="list-style-type: none"> <li>• Do you have any questions for X about her suggestion?</li> <li>• Y, how can you add to H’s idea?</li> <li>• See if you can agree on what might be the best next step.</li> </ul>
<p><b>III. Developing Understanding/ Processing</b></p> <p><b>Purpose</b> To develop and articulate the understanding that the group holds at a moment in time of a science idea or concept central to the current investigation, based on data collected by its members.</p> <p><b>Through</b></p> <ul style="list-style-type: none"> <li>• sharing data,</li> <li>• analyzing and discussing group members’ evidence.</li> <li>• finding relationships and patterns,</li> <li>• coming to new conclusion/</li> </ul>	<ul style="list-style-type: none"> <li>• Focused on data/ evidence from a specific investigation</li> <li>• Initiated with a productive question</li> <li>• Meaning/theory oriented (What do we understand now?)</li> <li>• Ideas/theories based in evidence (notebooks, class data )</li> <li>• Debate and argument about interpretation, ideas, patterns, relationships</li> </ul>	<p>1. <b>Setting the stage</b> (What data do we have?)</p> <ul style="list-style-type: none"> <li>• We are going to be thinking about... Let’s gather all of the records we need to discuss X.</li> <li>• What does our experience/data tell us about X?</li> </ul> <p>2. <b>Moving further</b> (What does the data say? What claims can we make? What is the evidence to support them?)</p> <ul style="list-style-type: none"> <li>• What can we tell about X by looking at everyone’s data?</li> <li>• How is the data from A different from the data from Y?</li> <li>• How might we explain this to someone else?</li> <li>• What do you think is the relationship between X and Y?</li> <li>• What evidence do you have for that idea?</li> </ul> <p>3. <b>Bringing closure</b>(What can we conclude? What new questions do we have?)</p> <ul style="list-style-type: none"> <li>• What have we learned?</li> <li>• What do we need to check again?</li> </ul>

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<p>closure, and</p> <ul style="list-style-type: none"> <li>• raising new questions</li> </ul>		<ul style="list-style-type: none"> <li>• What will we do next?</li> </ul> <p><b>To encourage child-to-child discourse</b></p> <ul style="list-style-type: none"> <li>• D, what do you think about that?</li> <li>• B, listen to J's idea and see what you think.</li> <li>• J and you seem to have a similar idea. Why don't you two discuss it and come back?</li> <li>• J, what do you have to say to R about her idea? It's pretty different from yours.</li> </ul>
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