Practice-Based Inquiry in Science

A Professional Development Course in Science for K-5 Teachers in Urban Districts

Developed by:
Chèche Konnen Center at TERC
and
Boston Teacher Residency

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2 Send inquiries to Ann S. Rosebery, co-Director, Chèche Konnen Center at TERC. Email: ann_rosebery@terc.edu

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Acknowledgements

The following individuals, listed in alphabetical order by affiliation, contributed to the development of this course:

Chèche Konnen Center, TERC: Ann S. Rosebery, Folashade Cromwell Solomon, Eli Tucker-Raymond, Beth Warren, Christopher G. Wright

Boston Teacher Residency: Denise Baumann, Lynne Godfrey, Jesse Solomon

Boston Public Schools: Heidi Fessenden

We especially thank the teachers who participated in the development of the course for sharing their insights, questions, and classroom practice with us and each other.
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Course Syllabus
Practice-Based Inquiry in Science

Description:
Practice-Based Inquiry (PBI) is a professional development course in science and sense-making. The main focus is developing teaching practices in K-5 science that build on understanding the intellectual power of the sense-making practices of students from communities historically placed at risk. By practice-based inquiry, we mean professional development that is centered in learning in and from investigations of everyday classroom practice. The overarching goal of this work is to support teachers in working together as practitioner-researchers to investigate their students' sense-making and their own teaching practice in order to create classrooms rich in meaningful and engaged learning in science.

Course Structure and Content:
With colleagues, you will work through classroom cases organized around:

a) learning to see and hear the diverse ways in which students make sense of the world and how these connect with scientific ideas and ways of knowing;
b) experimenting with pedagogical practices designed to engage students in complex scientific thinking and discourse; and
c) learning to think adaptively about science curriculum to deepen and expand connections between scientific and students' ideas and perspectives.

The scientific focus of the course is plant growth and development. This topic was chosen because it is represented in various standards from Kindergarten through grade 5. The course is 10 sessions.

Primary Text:
Rosebery, A. and Warren, B. (Eds.), Teaching science to English language learners: Building on students' strengths. Arlington, VA: NSTA Press. (Referred to as TSELL in course outline.)

Additional Texts:
Boston Globe, (Feb 1, 2005). *Yes, it appears to be true: Children grow overnight.* Available at: http://www.boston.com/news/science/articles/2005/02/01/yes_it_appears_to_be_true_children_grow_overnight/


**Course Expectations:**
- attend all 10 sessions and complete all homework assignments
- engage in investigations of plant growth and development
- teach plant science or another science topic if plant science is not possible
- make video/audio records of your classroom practice
- explore your students’ sense-making in science
- explore and experiment with new pedagogical practices in your classroom
- reflect, with colleagues, on video episodes of your pedagogical experiments
## Course Outline

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<td>Watch the video of your first science talk (recorded between Sessions 4 &amp; 5) &amp; choose a short segment to share with your data group.</td>
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Session 1

Introduction to course

Session Topic: Students are always engaged in making sense

Doing Science: Making Sense of Life Cycle Representations

1) Making sense of a plant life cycle representation

2) Making sense of Attenborough video excerpt
   (Private Lives of Plants, Vol 1, Branching out, 10:30-20:12

3) Making sense of students' ideas about plant life cycles (classroom transcript excerpts)
Science Protocol
Making Sense of a Life Cycle Representation Activity

1. **LIFE CYCLE REPRESENTATION (LCR):** Take 1-2 minutes to examine an image of the life cycle of a plant, and write down what you notice or what strikes you about the image.

2. **LCR:** In whole group, do 1 - 2 rounds of sharing:
   - Round 1: What do you notice about the image? Where do you see that in the image?
   - Round 2: What questions about a plant’s life cycle arise for you when looking at this image? What do you see in the image that makes you wonder about that?

3. **Attenborough VIDEO + LCR:** Jot down your thoughts about the following on a Post-It:
   - When considering the LCR representation in relation to the video excerpt from Attenborough’s, *The Private Life of Plants*, do any new questions arise for you?
   - What strikes you about the plant life cycle image now?

   Please post your questions and/or comments on the LCR posted on the wall.

   In whole group, volunteers share their thoughts on Question 3.

4. **STUDENTS’ IDEAS + LCR:** While talking with a neighbor, do one round of sharing:
   - What about the students’ ideas strikes or jumps out at you? Why?
   - When considering the LCR, in relation to the students’ ideas, do any new questions arise for you?
   - What strikes you about the plant life cycle image now?

   Write down your group’s thoughts to share with the whole group.
5. Summarizing and sharing our sense-making


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Making Sense of Students’ Ideas About Life Cycle: 2 Examples

A first grader’s question
How are the first leaves coming out of the seed strong enough to break the whole seed open?

Example 1: The Plant is Working Hard
Nancy: I think the plant is working really hard at making these little leaves.

Taneisha: I think it’s working hard at that growing, making it grow more every single day, grow and grow and grow.

Teacher: And where do you think that work’s happening?

Taneisha: Right here [pointing into soil] right under here.

Teacher: Underground? And what might be happening underground?

Taneisha: The roots are makin’ the plant grow bigger ... by pushing a little bit not so hard like going up, going up a little going up and then the plant goes up.

Teacher: So like somehow something’s pushing this so it gets longer, is that what you’re thinking? So something’s happening from the roots all the way up?

Taneisha: Yeah.

Teacher: Cool thinking. And you think it’s kinda connected to the whole plant all the way down?

Taneisha: Yeah.

Ethan: I think it’s working hard to get bigger and it’s trying to turn the little leaves bigger and it’s trying to turn the big leaves into flowers
and then the flowers are probably going to try to turn into pumpkins.

Example 2: The Big Job

Ricardo: How come the pumpkin has that much seeds inside that plant?

Teacher: You’re wondering. Why do you think? Why do they make all those seeds?

Ricardo: When it turns into a pumpkin it is round, you open the top, there are a whole bunch of seeds around it.

Teacher: You’re thinking, How did you get all those seeds around there?

Jaden: = when there was only one seed to start with.

Student: Oh, the seed makes seeds.
Session 2

Session Topic: Representations as Objects of Inquiry

Doing Science: Thinking Further About Life Cycle Representations
Looking Across Life Cycle Representations
  a. Examining the Fast Plant Life Cycle Representation
     (http://www.fastplants.org/pdf/grow/fastplant_lifecycle_illustrated.jpg)
  b. Zooming In On Growth of Our Fast Plants, Day 5
  c. Sketching the Life Cycle in Too Many Pumpkins

Case Study #1: “Too Many Pumpkins and the Class Mural”, Exploring Students’ and Teachers’ Sense-Making
Science Protocol

Thinking Further About Life Cycle Representations

1. Looking Across Life Cycle Representations
   
a) Take 5 minutes to examine the Fast Plants Life Cycle representation. Write down what you notice or what strikes you about the image.

b) At your tables, in pairs or groups of three, look at the Fast Plant Life Cycle along side the Life Cycle of a Plant representation we looked at last time. Think together about the following questions:
   • What aspects of the life cycle does each representation highlight or background?
   • How do you think the arrows function in each representation?

Pick 1 or 2 observations that stand out to share with the whole group.

2. Zooming In On Fast Plant growth, Day 5

   Take a few minutes to examine our Day 5 Fast Plant data. As a whole group, let’s think about the following questions:
   • What similarities do you notice among our plants?
   • What differences do you notice among our plants?
   • Does it raise any new questions for you?

3. Life Cycle in Too Many Pumpkins

   With colleagues at your table, take 10 minutes to develop a representation of the life cycle of the pumpkins that grew in Rebecca Estelle’s front yard in “Too Many Pumpkins.” Use chart paper and make it big enough for all to see. When your group has finished, post it on the wall. Look across the pumpkin life cycle images that each group developed.
   • What do you notice?
   • Does it raise any new questions for you?
Case Study #1: “Too Many Pumpkins and the Class Mural”

Instructional Background

I. Classroom Context

Scientific Focus & Instructional Purpose. A diverse 1st-2nd grade class is studying plant growth & development, with a pumpkin plant at the center of their investigation. Their study is structured around several “representations” of plant life and much of their work involves building understanding of the life cycle of plants through inquiry into and across these representations. The representations include:

- a live, growing pumpkin plant in the classroom
- a first draft mural they've painted of the pumpkin plant's life cycle
- various books, fiction and non-fiction related to the plant life cycle
- Attenborough's video series The Private Life of Plants
- drawings of their growing pumpkin plant
- seeds germinating in Petri dishes and students' drawings of daily changes
- a worm box in which they plant seeds
- students' accounts of the life cycle depicted in the mural

The mural they have painted of the life cycle of pumpkin plants is at the center of this work, continually being elaborated with new understandings as these are developed in the class. The idea that “the big job of plants is to make new plants” is explicitly introduced in the next lesson.

In this particular class, Ms. T and the children do a lot of work relating the life cycle implied in Too Many Pumpkins to the life cycle depicted in their first draft mural; as a part of this, they also examine a student’s earlier account of the life cycle shown in the mural to unpack what the “arrows” mean with specific details about plant growth; at the end of the class, they think about how a rotting pumpkin Ms. T places in a worm box is like Rebecca
Estelle’s pumpkin patch. The overarching conceptual goal of this lesson was to begin to engage the children in populating the arrows connecting one panel of their mural to the next (“time passing”) with specific meaning, i.e., detailed knowledge of the many changes taking place in the plant as it grows. In earlier classes, they established that the arrows mean “time passing,” but now the question taking shape is: What’s going on with the plant when time is passing? How is it growing and developing?

II. Structure and Content of the Lesson

Part 1. Ms. T asks the students first to think about plant growth in relation to *Too Many Pumpkins*, which they had read and talked about the previous day. She opens by reminding the students that “we found out a lot of things about how pumpkins could possibly grow.” She then asks, “What is something that happened in this story about the way that pumpkins grow?” Students respond with a number of ideas, including: seeds were everywhere and they “growed,” although they weren’t sure how; the pumpkins splattered and seeds got into the ground, it rained and they grew; maybe the seeds got into little holes in the ground and then grew, they didn’t just stay on top of the ground.

Part 2. Ms. T then asks the students to locate the cycle of Rebecca Estelle’s pumpkin patch in their painted mural. This leads into some discussion about how the two stories – the story in the book and the story in the mural – are different. Then Ms. T invites students to “tell the story” of the mural. We’re going to look closely at segments of transcript from this part of the class.
Part 3. Everyone moves to sit in front of the mural. A few students take a stab at telling the story of the mural, narrating the arrows as “time passes.” One student suggests that they write “time passes” on the arrows. Ms. T then comments that in the mural, like in the book, they have to figure out a lot of stuff about “time passes” - the writer didn’t tell every single thing that happened when time passed. And with the arrows in their mural, it’s kind of the same thing - a lot of things are missing. Students note that the changes from one panel of the mural to another can take a long time, days and weeks.

Part 4. Ms. T then zeroes in on the arrows. She talks about how the different painted panels show BIG changes, but not all the little changes. And she shares an account of the mural that one of the students, Kadeem, gave in an earlier class. He said of the second panel with the plants growing above ground:
“This one is rising up, from like when they’re seeds they rise up, because you don’t see the seed anymore, they cracked out.”

Ms. T then asks the students to identify which part of the mural Kadeem was talking about, which they do. This leads to a discussion of their experience germinating seeds and in particular how the seed case felt soft and got softer each time they watered the seed. With this, they drew out the way in which the seed germinated, populating the “time passes” arrow with specific detail about a process within the plant life cycle.

Ms. T then brings out the point that they can add even more things that happened in the time that passed. She shows them drawings they made of their seeds as they germinated, 7 days worth of changes, which she then tapes on the “time passes” arrow between panels 1 and 2 of the mural. She says: “It’s part of this story of time passing, that’s part of the arrow. The arrow doesn’t tell us that, we have to know that- that things happened, and we do because we’ve been studying how this plant grows…”

All of which work leads students to talk about other aspects of the plant’s growth that are “hiding” in the arrows: how the vines grow; how the growing pumpkins change color; when and how leaves develop; the rotting process; etc. Ms. T sums up this phase of the class’s discussion: “So Kadeem’s story told more than just the pictures. When he told it, he helped the listener know what happened to help these things change. He showed that the things were changing and how they changed.”

Part 5. Ms. T ends class by introducing the worm box, explaining how it’s filled with soil, like the soil you’d find at a pumpkin patch or in a front yard. It has worms inside the dirt, which they’ll talk about at a later time. For now, she wants the class to use the box to “imagine Rebecca Estelle’s front yard” just as they use the potted pumpkin plant to imagine the farm they visited to start their plant inquiry. She then passes around a slightly rotting orange pumpkin. “It’s like that arrow, from orange to rotten…” She then becomes the pumpkin truck, to the children’s great delight, saying she just happens to have a pumpkin that’s orange “but it’s in the arrow part, time is passing, it’s not shown up there, it’s starting to get a little bit rotten, and it
falls into Rebecca Estelle’s front yard...we’ll have to see what happens, because that’s what the story up there (the mural) tells can happen.” The class now has a rotting pumpkin sitting in the soil in the worm box.
Transcript Protocol: Case Study #1
“Too Many Pumpkins and the Class Mural”

We are going to approach this transcript from three angles. First, we will “work” the transcript by examining students’ ideas and sense-making practices. Secondly, we will examine the teacher’s sense-making. Thirdly, we will consider what we can infer about the intellectual and social norms of this classroom as a science learning space. Throughout this process of working the transcript, we will take an interpretive stance, as compared with an evaluative or diagnostic stance. This means that we will a) interpret the students’ talk assuming they are making sense of the subject matter, in this case, the life cycle of plants, and b) use the transcript as a source of evidence for our interpretations, staying close to the students’ words. We will do the same with our analysis of the teacher’s talk and classroom norms.

Interpreting the Students’ Sense-Making

- What ideas do we see the students exploring?
- From what point(s) of view are they thinking and speaking?

Interpreting the Teacher’s Sense-Making

- What scientific ideas and understandings do we think Ms. T is focused on developing with her students?
- From what point(s) of view is she speaking?

Interpreting the Norms of the Classroom

- What can we infer about the intellectual and social norms of this classroom? About what learning means here? About what it means to do science here?
- What do we see the students learning through this discussion?
- What do we see Ms. T doing to try and get her students to the desired scientific understandings?
- What do we see her do in response to her students’ ideas?
Classroom Transcript
"Too Many Pumpkins and the Class Mural"

1. Ms. T: We talked a little bit about this yesterday. That in this story there was a lot of time passing, right? I mean she says, first, it starts out, every spring she plants her garden. Then it says, each one autumn day. So spring and autumn, they're not the same time, right? This page is talking about spring and then on the next page she's talking about fall. Okay, that's a long time passing. From spring you have to have summer before you have fall. But she didn't tell us all about the summer-the writer didn't tell us all about the summer, she told us about-she went from one time of year and skipped a whole bunch of things to the next time of year that she wants to tell about. So the writer skips time passing, you know? Cuz in the fall that's when this happened, when the pumpkin fell into the ground, onto the ground. And then Rebecca Estelle ignores it but then spring comes again. So it's the fall when that happened, but then it's spring again and she notices. (...) and that's when things started to grow. So we didn't hear all the things that happened. So the rain part, right Hakim, you said they didn't say it in the story, rain.

2. Hakim: =yeah, they didn't say it.

3. Ms. T: right? They didn't say it, but can we think that it probably rained?

4. Hakim: yeah

5. Ms. T: Because she had all that time passing and didn't tell- the writer didn't tell about everything that happened. Because they expect you, the listeners and the readers

6. Hakim: =to know that already

7. Ms. T: =to know that or to think about, Ooh, what could have happened in between? Now when we looked at our murals yesterday, we were
trying to decide we were trying to decide which mural is the starting place for Rebecca Estelle’s pumpkin patch. Where would those murals which mural is the starting place [aside] for Rebecca Estelle’s pumpkin patch? I have two hands. I want to see all people looking at the murals thinking about it. [moves Kadeem closer, waiting for hands] Which of the murals would you say is showing the starting place for Rebecca Estelle’s pumpkins- ooh I see so many thinkers [aside to Kadeem]. Kari, where do you think is the starting place?

8. Kari: the seeds

9. Ms. T: Okay. Can you say why you think that the starting place for Rebecca Estelle’s pumpkin patch is the seeds?

10. Kari: Because the seeds made the pumpkins grow.

11. Ms. T: Because the seeds made the pumpkins grow. Okay? Let’s see what other people think. So she would say Rebecca Estelle’s pumpkin patch started at the seed place. What would you say? What would you say? [pause] Barry?

12. Barry: That um when they started to grow

13. Ms. T: The starting place, the very first- the thing that started Rebecca Estelle’s pumpkin patch, which one of those murals?


15. Ms. T: So that’s the first thing that happened in Rebecca Estelle’s pumpkin patch? Little plants?

16. Barry: [nods]

17. Ms. T: That’s the very first thing?

18. Barry: ( )
19. Ms. T: Why do you think that?

20. Barry: Because like I think-


22. Barry: I think when they said in the story that when she got home she saw ( )

23. Ms. T: Mmhmm, it did say that in the story. But the very first thing that got that pumpkin patch going. Where’s the starting place? What do you think? Sally.

24. Sally: Orange pumpkins.

25. Ms. T: Speak up.

26. Sally: Orange pumpkins.

27. Ms. T: Can you say why you think that?

28. Sally: Because a big orange pumpkin came and it splattered all over the place and that’s what, um, that’s how all the other pumpkins came.

29. Ms. T: Okay, so we have three different ideas. What- so the big orange pumpkin came, splattered all over the place

30. Hakim: = and there were seeds on the ground

31. Ms. T: = and that caused the seeds to be on the ground. But what about the rotten pumpkin? Did they show rotten pumpkins in here?

32. Kids: No, yes.
33. Ms. T: do you think rotten pumpkins might have happened? In the time passing?

34. Kids: Yes, no

35. Ms. T: some say no, some say yes. Why do you say, Yes, Taneicea?

36. Taneicea: Because rotten pump-cuz rotten pumpkins, even though it wasn’t in the book, um rotten pumpkins um are um almost like these orange pumpkins except the orange pumpkin got big and splattered all over the place and it could have got rotten when it splattered all over the place.

37. Ms. T: while time passed

38. Taneicea: =yeah


(approximately 3 minutes later)

40. Ms. T: This story- how is the story that you tell from this book different from the story you tell up there? How is the story different? Nick, how is this story different from the story that those pictures tell?

41. Nick: That the- that we painted that one. [Ms. T aside] We painted that one.

42. Ms. T: Yeah but it tells a story, right? What’s the story? Can you tell me the story that you would tell? That goes with those pictures? Go up there and tell us. Go ahead.

43. Nick: [walks over to mural, points] This-

44. Ms. T: Nice and loud, Nick, so people can hear you.
45. Nick: These are the people putting in the seeds. Then the plants are rising up.

46. Ms. T: But you know what? When you say those are the people putting in the seeds, do we know what kind of seeds?

47. Nick: Those people are putting in pumpkin seeds and those are the plants rising. These are the green, yellow, (then) orange pumpkins. These are the orange pumpkins. And these are the rotten pumpkins.

48. Ms. T: Yeah, Nick, you told me about each picture, but you didn't tell me what's going on (in) the arrow part.

49. Kid: Oh I know.

50. Ms. T: You want some help with that?


52. Ms. T: Okay, who can help him with that? Go ahead Suzi and then Barry, quick. Listen carefully, okay, Nick? Cuz you told about each picture.

53. Suzi: [pointing at arrow] It's like space passing.

54. Ms. T: Huh?

55. Suzi: It's like space passing like when you turn the page.

56. Ms. T: Okay, could you start the story for us? This is a story of what?

57. Suzi: It's of a pumpkin, like, a pumpkin timeline

58. Ms. T: =a pumpkin what?
59. Suzi: Timeline.


61. Suzi: Um you plant the seed, then a little time passes, then they- then they’re rising up, then a little more time passes, [Ms. T: speak up] and then an orange and a little green pumpkin ( ) - then time passes, orange pumpkins, then time passes, then rotten, then it goes all over again.

62. Ms. T: Then it goes all over again. So that’s a different kind of st-

63. Hakim: But it could start from orange like the book did.

64. Ms. T: So that’s a difference between this story and that story. Yeah, and this one has characters. There really aren’t any characters in that story.

65. Ethan: Except for that hand.

66. Ms. T: Except for the hands. But we could take the hands out, right?

67. Kid: But they wouldn’t know- but they wouldn’t know who put them in.

68. Ms. T: Well if we took the hands out of all the pictures, I think it might be able to work without the hands.

69. Taneicea: It can work without the hands.

70. Ms. T: =without the hands. Well there were no hands in this [holds up book]

71. Ethan: Then why is that pumpkin [points]- the bottom pumpkin hovering, if the hand wasn’t there?

72. Ms. T: Go ahead Taneicea. But Barry was supposed to talk next. Go ahead Barry.
73. Barry: It’s like on these, on these pictures [points, waves hand in circular motion] the one that’s (painted), it’s like this one never ends, and this one like does [points to book]. This has an ending and that one doesn’t.

74. Ms. T: Oh, this is a never-ending story, right [waves hand in circular motion]. This one’s a never-ending story.
Session 3

Session Topic: Embodied Imagining: A sense-making practice in science

Digging Into Embodied Imagining

1. Considering Our Embodied Imagining Accounts
   In small groups
   a. What do we notice about embodied imagining?
   b. Reflecting on your experience using embodied imagining.

2. Developing a Shared Understanding of Embodied Imagining
   In the whole group
   a. Examining Scientists’ uses of embodied imagining
   b. What is embodied imagining?

Case Study #2: “Do Plants Grow Every Day?”, Exploring Students’ Sense-Making
Digging into Embodied Imagining

Our purpose is to dig into a sense-making practice we call “embodied imagining” as one among various sense-making practices that expand possibilities for learning and teaching in science. In this session, we want to develop our attunement to embodied imagining – what it looks and sounds like and how it functions in our own thinking, students’ thinking, and scientists’ thinking to open up aspects of complex phenomena and processes. Throughout today’s session we will focus on unpacking embodied imagining as a practice: What are its aspects or elements? How does it help us see/think/understand, etc.?

1. Considering Our Embodied Imagining Accounts
   (Small Groups of 3 people)

   Read all 3 embodied imagining homework accounts aloud. Then, looking across them, take up questions i–ii, making sure to tie your thoughts specifically to the writings.

   i) What do you notice in these imaginings?

   ii) What do you find yourself thinking about with respect to plant growth and development? Do these imaginings raise any new questions or ideas for you with respect to plant growth and development?

   Now take up the following questions, which are about how the process of developing the embodied imagining accounts shaped your thinking. Feel free to connect explicitly to your Fast Plant observation notebooks.

   iii) What was it like for you to think from this embodied imagining perspective (or in this embodied imagining voice)?

   iv) Did thinking in this way surprise/inspire/unsettle/frustrate you in any way?
v) What resources did you draw on in writing your embodied imagining account (e.g., Fast Plant observations; TSELL Ch. 4; Growth & Development handout; life cycle representations; personal experience; other learning; etc.)? How did you use them?

2. Developing a Shared Understanding of Embodied Imagining
(Whole Group)

i) Share noticed aspects, new ideas/perspectives/questions, and thoughts on process.

ii) Read 3 examples of scientists’ embodied imagining practices (from Ch. 4 TSELL and the handout). Pick one that particularly resonates for you and jot down on a post-it (or two) what about it resonates & why. Post note on chart paper w/ example.

iii) Layering/complicating embodied imagining: Taking into consideration today’s work, first with our own accounts, then with scientists’ accounts, how would you respond to this question: If someone asked you, “What is embodied imagining? What is it good for?”, what would you say in response?
EXAMPLES OF EMBODIED IMAGINING AMONG SCIENTISTS

Barbara McClintock won the Nobel Prize for her groundbreaking work in the spontaneous movement of genes in corn. There was a time in her career when she was experiencing great difficulty in work she was doing with on chromosomes in Neurospora, a red bread mold. When she looked at slides under the microscope, she "wasn't seeing things, I wasn't integrating, I wasn't getting things right at all. I was lost." Out of frustration, she left the lab and sat on a bench under some trees. For a half hour or so, she pictured the chromosomes in her mind, turning them this way and that. In a later interview, she described the experience this way (Keller, 1983, p. 117):

When I was really working with them I wasn't outside, I was down there. I was part of the system. I was right down there with them and everything got big. I even was able to see the internal parts of the chromosomes—actually everything was there. It surprised me because I actually felt as if I was right down there and these were my friends.

Sir James Black, a Scottish pharmacologist, won the Nobel Prize in 1988 for his discovery of beta blockers, a family of drugs for treating heart attacks, heart rhythm abnormalities, and high blood pressure. During an interview with BBC radio, he confessed that he daydreamed himself into the action of molecules (Wolpert & Richards, 1997, p. 126):

You assume that the receptor doesn't know any more about chemistry than chemists do, and you then try and pretend that you are the receptor. You imagine what would it be like if this molecule were coming out of space towards you. What would it look like, what would it do?

Jonas Salk was a medical researcher and virologist. He is best known for discovering and developing the first safe and effective polio vaccine. In talking about his research, he reported that early on he developed a technique in which he would picture himself "as a virus, or as a cancer cell, and try to sense what it would be like to be either in order to better understand the viruses and what makes them tick" (Salk, 1983, p.7).
Case Study #2

“Do Plants Grow Every Day?”

I. Classroom Context

This event took place in a third-grade classroom in a dual language immersion program. Dual language immersion programs provide integrated language and academic instruction for native-speakers of English and for native-speakers of another language using both English and the other language. In this classroom, half the students spoke Spanish as a first language and were learning English; and half the students spoke English as a first language and were learning Spanish. All academic instruction took place in English one week and in Spanish the following week. In this way, all students had the opportunity to be both first-language-speaker models and second-language learners. Science, like all academic subjects, was taught one week in English and one week in Spanish. The event on which we focus took place during an English language week.

There were twenty-two students in the class. In addition to having varied language backgrounds, the students’ families had varied experiences with formal schooling (e.g., high school to graduate training). The students were studying plant growth and development using Plant Growth and Development by the National Science Resources Center (NSRC, 1991).

As part of this curriculum they grew Wisconsin FastPlants™ and regularly collected and recorded data on their plants’ growth in their science notebooks. As students asked questions during the investigation, their teacher, Ms. P,
listed them on a piece of chart paper that hung on a wall in the classroom. On this day, Ms. P was experimenting for the first time with a new form of discussion called science talks, which she had read about in Karen Gallas’s book, *Talking Their Way into Science*. She asked the students to think aloud together about one of the questions on the chart paper. To get them started, she asked Dalia to choose a question. Dalia responded by choosing a question she had posed: “Do plants grow every day?” Coincidentally, the day this discussion took place was Ms. P’s birthday.

Transcript Protocol: Case Study #2 (Students' Sense-Making)
“Do Plants Grow Every Day?”

We will “work” the transcript by examining students’ ideas and sense-making practices. First, as a whole group, we will read aloud the transcript, Do Plants Grow Every Day? Second, in small groups we will identify a focal student, track his/her utterances, and attempt to figure out what ideas the student is exploring. Third, as a whole group we will explore specific students who used embodied imagining and make connections to scientists’ uses of embodied imagining. Throughout this process of working the transcript, we will take an interpretive stance, as compared with an evaluative or diagnostic stance. This means that we will a) interpret the students’ talk assuming they are making sense of the subject matter, in this case, plant growth, and b) use the transcript as a source of evidence for our interpretations, staying close to the students’ words.

Interpreting the Students’ Sense-Making

- Small Groups
  a. Read transcript and discuss focal students in small groups
  b. Trace focal students
    i. What ideas do we see the students exploring?
    ii. How are they exploring these ideas?
    iii. From what point(s) of view are they thinking and speaking?

- Whole Group
  a. Trace focal students individually
  b. Return to Embodied Imagining
    i. Connect students’ embodied imagining and scientists’ embodied imagining and our own embodied imagining.
Classroom Transcript

“Do Plants Grow Every Day?”
Ms. P’s Dual Language Immersion Third Grade

Note: inside brackets [ ] is either 1.) information about what was going on while someone was speaking, for example, a child turns to face another child, or 2.) words that were not perfectly clear and are questionable.

1. Dalia: Umm. Do plants grow every day?
2. Ms. P: What?
3. Dalia: Do plants grow every day, that’s my question right there.
4. Ms. P: Maria, sit down. Do plants grow every day?
5. Students: Yes.
7. Students: No.
8. Ms. P: If you think it’s no, would you stand up? The Nos stand up. Do plants grow every single day?
9. Student: Maybe
10. Student: Yes or no?
11. Ms. P: These are the no they don’t grow every single day.
12. Student: Oh I think they grow every day.
14. Serena: They grow? They do or they don’t?
15. Ms. P: Maria, go sit by Ms. S because I don’t think you’re paying attention. Go over there. She’ll help you pay better
attention. This is the yes they grow every day. Have a seat, have a seat. If you’re not sure stand up now.

16. Student: I’m not sure.

17. Student: I’m not sure either.


19. Student: I’m not sure.

20. Serena: It’s so obvious. They grow all the time and so do we.

21. Ms. P: It’s so obvious? Have a seat. Have a seat. Serena says it’s so obvious they grow all the time just like we do. Anybody want to say anything back to her about that?

22. Serena: Uhh it’s so small.

23. Student: That’s true.

24. Serena: Tiny tiny tiny

25. Ronaldo: Tiny tiny tiny.

26. Girl: They’re growing all the time.

27. Serena: Our eyes can’t see it.

28. Ronaldo: Oh, it’s slow.

29. Carlita: How could you tell? How could you tell?

30. Lara: Some- some- some um plants have [burrs].

31. Ronaldo: How can they grow every single day?

32. Student: What does that mean?

33. Student: Just like we do.

34. Ronaldo: [ ] goes so slow.
35. **Ms. P:** Dalia, Dalia, Dalia, we’re talking about this now. Elena is going to talk and then Susannah D is.

36. **Ms. P:** Sit down. Carlita first. Okay Carlita what did you want to say?

37. **Carlita:** [turns to face Serena] How are you so sure that- that they grow every day if you- if you- um

38. **Serena:** Don’t you grow every day?

39. **Carlita:** Yeah how are you sure?

40. **Ronaldo:** If you’re not even sure-

41. **Ms. P:** We’ll do you next.

42. **Carlita:** And how do you know?

43. **Serena:** Do we grow every day?

44. **Carlita:** Yeah.

45. **Student:** No.

46. **Serena:** Then these ones do.

47. **Ronaldo:** That’s a good question.

48. **Ms. P:** It is a good question.

49. **Ronaldo:** I know.

50. **Student:** We don’t grow every day.

51. **Lara:** On our birthday. On our birthday, we grow.

52. **Ms. P:** On your birthday? Just on your birthday?

53. **Serena:** When you finally notice that someone’s grown they just grow like that?
54. Student: No.

55. Lara: Only one day they grow that fast?

56. Elena: I only grow in months. That's-

57. Serena: Do you see yourself growing? All of a sudden at midnight you grow like this and then the next day at night you grow like this.

58. [Ronaldo agrees]

59. Lara: No it is your birthday- when it is your birthday you grow.

60. Student: When it's not-

61. Lara: Hey, you're growing. [directed to Ms. P because it's her birthday]

62. Ms. P: Poor Elena. Talk Elena.

63. [Lots of crosstalk]

64. Student: You don't wait to grow.

65. Student: your body knows [

66. Ms. P: Did anybody notice a difference in Ms. P?

67. Students: Yes.

68. Student: Your hair is longer.

69. Ms. P: I don't think so. Elena is trying to talk here.

70. Elena: I think it does grow every day because every single day- every single day we look at the plant- every single day we look at the plants and it's growing a little bit more. Then we look again and then it- and then tomorrow we look again and it's- it's growing a little bit more. And the other- to- today- yes- I mean- I think it was Wednesday
that- n- no [pause] today's Wednesday [pause] it was Tuesday that I looked at my plant and it was all crooked and today's it's getting- it's getting stronger and the little peas- the little peas that they have on there I had a little teeny, teeny, teeny one now it's fat.

71. Ms. P: Elena, you make me feel so good. You've really been thinking. But does anybody notice when they looked at their plant some days there was no growth at all?

72. Students: Yeah.

73. Ms. P: Did you? John?

74. John: I did.

75. Serena: Ms. P, actually

76. Ms. P: Often or just once?

77. Serena: our rulers can't be perfect.

78. John: Just once

79. Serena: Maybe it grewed this much but we can't tell.

80. Ronaldo: My peas haven't growed in three days [ ].

81. Ms. P: Say that again?

82. Ronaldo: Mines haven't growed in three days.

83. Ms. P: They haven't grown in three days?

84. Ronaldo: No, my peas haven't.

85. Ms. P: The peas haven't.

86. Ms. P: Wait I'm going to get John and then I'll get the rest of you. Did you have more to say?
87. John: No.
88. Ms. P: Okay. Just Susannah and then Juana.
89. Jenny: I think it might, you know why? I think it might those things that they call peas I call it plants. Me and Elena and Ronaldo and Tanya say that they’re peas but I say- I haven’t changed my mind.
90. Boy: Those are seeds.
91. [someone sneezes]
92. Ms. P: Bless you.
93. Jenny: They’re flowers.
94. Elena: They say its seeds. They say its peas-
95. Ms. P: Susannah go ahead and talk and then Juana.
96. Susannah: Serena is right because every day when- when we’re like- every week we get bigger and bigger.
97. Serena: But we can’t tell.
98. Susannah: But we can’t tell. We just get one inch bigger.
99. Serena: Until-
100. Susannah: And then weeks- on weekends when we’re not here they get bigger too.
101. Serena: Even if we’re-
102. Ms. P: So you’ve noticed a big difference over- from Friday to Monday?
103. Susannah: Yeah, they were like this little.
104. [lots of cross talk]
105. Serena: If we were ever twenty-eight years old what would tell that we have grown? What would tell? Unless you have a grow chart and you grow yourself like every year you'll see that-

106. Lara: I do. I mark myself on the wall. I would say I'm more bigger.

107. Serena: And then-

108. Susannah: In the week, when we came back Monday my plant was a little bit big. Every week we grow bigger but we can't tell.

109. Ms. P: Thank you. Juana, what were you going to say?

110. Juana: How come you can't see us grow?

111. Serena: Because we grow so slowly.

112. Lara: Yeah, and the plants grow like a little bit fast.

113. Ms. P: She's got another question though. Stop. She's thinking.

114. Ronaldo: That's why they call them fast plants

115. Juana: How come we can't really see it- us grow and the plants- how come we can't see the plants grow and how come we can't see us grow?

116. Student: What?

117. Ms. P: Anybody know?

118. Serena: Well, if we had a chart for them-

119. John: I have a question, I mean not a question.

120. Ms. P: John?

121. John: I found a pod over there like on the table or something it
must have fallen off and I took one of the peas or whatever it was and I put it in my plant and then a couple of days later I saw a little thing coming up.

122. **Ms. P:** ooooooh.

123. **Serena:** Actually they-

124. **Ms. P:** the second generation.

125. **Serena:** I think they grow faster because they have such a short life. They grow faster than we do.

126. **Ms. P:** Oh.

127. **Juana:** Then how come we can't see them grow?

128. **Serena:** We can.

129. **Lara:** My plant will grow-

130. **Student:** We can't see ourselves grow.

131. **Ms. P:** Steve's got a question I think or something.

132. **Steve:** I have a question of Serena. You say you can never see the plants grow? Is that what you said?

133. **Serena:** Mmhmm.

134. **Steve:** So how come you're sure that they are growing?

135. **Serena:** We measure them.

136. **Lara:** We'll measure them.

137. **Ms. P:** Elena.

138. [Crosstalk about measurement, sizes]

139. **Ms. P:** I'm going to do Elena and then Lara and then Juana and
then Dalia. Elena.

140. Elena: I think I got the answer to Juana's question.

141. Ms. P: Good.

142. Elena: That I don't- I don't think we could see them grow but I think they could feel theirselves grow.

143. Ms. P: ooooh.

144. Ronaldo: Yeah, I feel myself growing.

145. Ms. P: So plants can feel themselves grow?

146. Students: Maybe.

147. Elena: Sometimes we can feel ourselves grow because my feet grow so fast cuz this little crinkly thing is always bothering my feet. That means it's starting to grow. It's starting to stretch out.

148. Susannah: [My brother] when he were little it was size five and then when he growed up he's size ten right now.

149. Ms. P: Whew! Okay, I said Elena, Lara and then Juana then Dalia.

150. Student: You know why they grow?

151. Lara: I got a question for Elena about the shoe thing that you said right now. Um I think I know how because the plant grows because um if the plant grows like um all the summer that we're not here maybe it grows and grows and get more bigger. Because my plant it hasn't grow yet. And at the summer when I came back there was little things coming out- little plants coming out.

152. Ms. P: Thank you.

154. Juana: I have two things to say. How- what makes the plants grow so slow?


156. Juana: And the other one-.

157. [crosstalk; Juana waits for the other students’ attention]

158. Ronaldo: They just grow slow.

159. Juana: and I think I can kinda see myself grow because one day I putted on my socks and they was too small for me so I can fit in my mom’s socks now.

160. Ms. P: So you notice that you have grown by how you’ve changed?

Session 4

Session Topic: Science Talk as a Pedagogical Practice

Doing Science: Participating in A Science Talk: Do plants move?

Case Study #2: “Do Plants Grow Every Day?”, Exploring Science Talk through a Practice Lens
Science Protocol
Participating in a Science Talk: Do plants move?

• In Small groups
  o Watch Attenborough clip (Private Life of Plants, Branching Out, Vol 1, 2:49-6:28)
  o Engage in science talk ourselves: Do plants move?

• In Whole groups reflect
  o What was it like for you as a learner in a science talk?
  o What was it like listening to and responding to others’ ideas?
Transcript Protocol: Case Study #2 (Practice)
“Do Plants Grow Every Day?”

Throughout the process of “working” the transcript, we will take an interpretive stance, as compared with an evaluative or diagnostic stance. This means that we will a) use the transcript as a source of evidence for our interpretations, staying close to the teacher’s talk. We are asking each of you within your small groups to take responsibility of holding to this interpretive stance in order to ground and discipline the conversations about this classroom event. We are going to approach this transcript from two angles. First, we will “work” the transcript by examining the teacher’s pedagogical practices. Second, we will consider what we can infer about the intellectual and social norms of this classroom science talk.

Interpreting the Teacher’s Pedagogical Practices

In the whole group we will pick a segment of the transcript to explore Ms. P’s pedagogical practices and identify the usefulness of a science talk.

In the whole group, we will read the entire transcript.

Using small chunks of the excerpted transcript (Line numbers 109-161) respond to the following questions:

• What do we notice about how Ms. P participates and responds to the students? What does she do? How does she do it?
• Do you see any places where you think the teacher connects students’ comment to scientific ideas or practices? Do you see any places where a new idea or perspective arises for the students or the teacher? How does she respond?
• What can we infer about the intellectual and social norms of this classroom?

What is a Classroom Science Talk Good for?

• What questions do you have? Worries?
Classroom Transcript

“Do plants grow every day?”

Ms. P’s Dual Language Immersion Third Grade

Note: inside brackets [ ] is either 1.) information about what was going on while someone was speaking, for example, a child turns to face another child, or 2.) words that were not perfectly clear and are questionable.

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163. Ms. P: What?
164. Dalia: Do plants grow every day, that’s my question right there.
165. Ms. P: Maria, sit down. Do plants grow every day?
166. Students: Yes.
167. Students: Yes.
168. Students: No.
169. Ms. P: If you think it’s no, would you stand up? The Nos stand up. Do plants grow every single day?
170. Student: Maybe
171. Student: Yes or no?
172. Ms. P: These are the no they don’t grow every single day.
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175. Serena: They grow? They do or they don’t?
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attention. This is the yes they grow every day. Have a seat, have a seat. If you’re not sure stand up now.

177. Student: I’m not sure.
178. Student: I’m not sure either.
179. Ms. P: Not Sures.
180. Student: I’m not sure.
181. Serena: It’s so obvious. They grow all the time and so do we.
182. Ms. P: It’s so obvious? Have a seat. Have a seat. Serena says it’s so obvious they grow all the time just like we do. Anybody want to say anything back to her about that?
183. Serena: Uhh it’s so small.
184. Student: That’s true.
185. Serena: Tiny tiny tiny
186. Ronaldo: Tiny tiny tiny.
187. Girl: They’re growing all the time.
188. Serena: Our eyes can’t see it.
189. Ronaldo: Oh, it’s slow.
190. Carlita: How could you tell? How could you tell?
191. Lara: Some- some- some um plants have [burrs].
192. Ronaldo: How can they grow every single day?
193. Student: What does that mean?
194. Student: Just like we do.
195. Ronaldo: [ ] goes so slow.
196. Ms. P: Dalia, Dalia, Dalia, we’re talking about this now. Elena is going to talk and then Susannah D is.

197. Ms. P: Sit down. Carlita first. Okay Carlita what did you want to say?

198. Carlita: [turns to face Serena] How are you so sure that- that they grow every day if you- if you- um

199. Serena: Don’t you grow every day?

200. Carlita: Yeah how are you sure?

201. Ronaldo: If you’re not even sure-

202. Ms. P: We’ll do you next.

203. Carlita: And how do you know?

204. Serena: Do we grow every day?

205. Carlita: Yeah.

206. Student: No.

207. Serena: Then these ones do.

208. Ronaldo: That’s a good question.

209. Ms. P: It is a good question.

210. Ronaldo: I know.

211. Student: We don’t grow every day.

212. Lara: On our birthday. On our birthday, we grow.

213. Ms. P: On your birthday? Just on your birthday?

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215. Student: No.

216. Lara: Only one day they grow that fast?

217. Elena: I only grow in months. That's-

218. Serena: Do you see yourself growing? All of a sudden at midnight you grow like this and then the next day at night you grow like this.

219. [Ronaldo agrees]

220. Lara: No it is your birthday- when it is your birthday you grow.

221. Student: When it's not-

222. Lara: Hey, you're growing. [directed to Ms. P because it's her birthday]

223. Ms. P: Poor Elena. Talk Elena.

224. [Lots of crosstalk]

225. Student: You don't wait to grow.

226. Student: your body knows [ ]

227. Ms. P: Did anybody notice a difference in Ms. P?

228. Students: Yes.

229. Student: Your hair is longer.

230. Ms. P: I don't think so. Elena is trying to talk here.

231. Elena: I think it does grow every day because every single day- every single day we look at the plant- every single day we look at the plants and it's growing a little bit more. Then we look again and then it- and then tomorrow we look again and it's- it's growing a little bit more. And the other- to- today- yes- I mean- I think it was Wednesday that- n- no
[pause] today’s Wednesday [pause] it was Tuesday that I looked at my plant and it was all crooked and today’s it’s getting- it’s getting stronger and the little peas- the little peas that they have on there I had a little teeny, teeny, teeny one now it’s fat.

232. Ms. P: Elena, you make me feel so good. You’ve really been thinking. But does anybody notice when they looked at their plant some days there was no growth at all?

233. Students: Yeah.

234. Ms. P: Did you? John?


236. Serena: Ms. P, actually

237. Ms. P: Often or just once?

238. Serena: our rulers can’t be perfect.

239. John: Just once

240. Serena: Maybe it growed this much but we can’t tell.

241. Ronaldo: My peas haven’t growed in three days [ ].

242. Ms. P: Say that again?

243. Ronaldo: Mines haven’t growed in three days.

244. Ms. P: They haven’t grown in three days?

245. Ronaldo: No, my peas haven’t.

246. Ms. P: The peas haven’t.

247. Ms. P: Wait I’m going to get John and then I’ll get the rest of you. Did you have more to say?

249. Ms. P: Okay. Just Susannah and then Juana.

250. Jenny: I think it might, you know why? I think it might those things that they call peas I call it plants. Me and Elena and Ronaldo and Tanya say that they're peas but I say- I haven't changed my mind.

251. Boy: Those are seeds.

252. [someone sneezes]

253. Ms. P: Bless you.

254. Jenny: They're flowers.

255. Elena: They say its seeds. They say its peas-

256. Ms. P: Susannah go ahead and talk and then Juana.

257. Susannah: Serena is right because every day when- when we're like- every week we get bigger and bigger.

258. Serena: But we can't tell.

259. Susannah: But we can't tell. We just get one inch bigger.

260. Serena: Until-

261. Susannah: And then weeks- on weekends when we're not here they get bigger too.

262. Serena: Even if we're-

263. Ms. P: So you've noticed a big difference over- from Friday to Monday?

264. Susannah: Yeah, they were like this little.

265. [lots of cross talk]
266. Serena: If we were ever twenty-eight years old what would tell that we have grown? What would tell? Unless you have a grow chart and you grow yourself like every year you'll see that-

267. Lara: I do. I mark myself on the wall. I would say I'm more bigger.

268. Serena: And then-

269. Susannah: In the week, when we came back Monday my plant was a little bit big. Every week we grow bigger but we can't tell.

270. Ms. P: Thank you. Juana, what were you going to say?

271. Juana: How come you can't see us grow?

272. Serena: Because we grow so slowly.


274. Ms. P: She's got another question though. Stop. She's thinking.

275. Ronaldo: That's why they call them fast plants

276. Juana: How come we can't really see it- us grow and the plants- how come we can't see the plants grow and how come we can't see us grow?

277. Student: What?

278. Ms. P: Anybody know?

279. Serena: Well, if we had a chart for them-

280. John: I have a question, I mean not a question.

281. Ms. P: John?

282. John: I found a pod over there like on the table or something it must have fallen off and I took one of the peas or whatever
it was and I put it in my plant and then a couple of days later I saw a little thing coming up.

283. Ms. P: ooooooh.

284. Serena: Actually they-


286. Serena: I think they grow faster because they have such a short life. They grow faster than we do.

287. Ms. P: Oh.

288. Juana: Then how come we can’t see them grow?

289. Serena: We can.

290. Lara: My plant will grow-

291. Student: We can’t see ourselves grow.

292. Ms. P: Steve’s got a question I think or something.

293. Steve: I have a question of Serena. You say you can never see the plants grow? Is that what you said?

294. Serena: Mmhmm.

295. Steve: So how come you’re sure that they are growing?

296. Serena: We measure them.

297. Lara: We’ll measure them.

298. Ms. P: Elena.

299. [Crosstalk about measurement, sizes]

300. Ms. P: I’m going to do Elena and then Lara and then Juana and then Dalia. Elena.
301. Elena: I think I got the answer to Juana’s question.

302. Ms. P: Good.

303. Elena: That I don’t- I don’t think we could see them grow but I think they could feel theirselves grow.

304. Ms. P: oooooh.

305. Ronaldo: Yeah, I feel myself growing.

306. Ms. P: So plants can feel themselves grow?


308. Elena: Sometimes we can feel ourselves grow because my feet grow so fast cuz this little crinkly thing is always bothering my feet. That means it’s starting to grow. It’s starting to stretch out.

309. Susannah: [My brother] when he were little it was size five and then when he growed up he’s size ten right now.

310. Ms. P: Whew! Okay, I said Elena, Lara and then Juana then Dalia.

311. Student: You know why they grow?

312. Lara: I got a question for Elena about the shoe thing that you said right now. Um I think I know how because the plant grows because um if the plant grows like um all the summer that we’re not here maybe it grows and grows and get more bigger. Because my plant it hasn’t grow yet. And at the summer when I came back there was little things coming out- little plants coming out.

313. Ms. P: Thank you.

314. Lara: Welcome.

315. Juana: I have two things to say. How- what makes the plants grow
so slow?


317. Juana: And the other one-

318. [crosstalk; Juana waits for the other students' attention]

319. Ronaldo: They just grow slow.

320. Juana: and I think I can kinda see myself grow because one day I putted on my socks and they was too small for me so I can fit in my mom’s socks now.

321. Ms. P: So you notice that you have grown by how you’ve changed?

Session 5

Session Topic: Data Groups

- What are they?
- Establishing some shared assumptions

Activity 1: Thinking about an excerpt from a volunteer’s classroom (volunteer will share video and transcript)

Activity 2: Thinking about an excerpt from a second volunteer’s classroom (volunteer will share video and transcript)

Transcript Protocol: Data Groups

In an effort to support a collaborative learning community, we will take an interpretive stance, as compared with an evaluative or diagnostic stance, when “working” the transcript. This means that we will use the transcript as a source of evidence for our interpretations, staying close to students’ language, referencing specific turns or exchanges, and considering possible meanings. We are asking every data group member to take responsibility for holding to this interpretive stance in order to ground and discipline the group’s conversation about the focal classroom event.

1. The teacher introduces the classroom excerpt.
   a. What is the science talk about?
   b. Why did you choose the particular segment?

2. Watch video.

3. Taking on the students’ voices, read the transcript aloud.

4. Taking the student’s point of view, interpret student sense-making (see a & b below), page by page. (Record the group’s ideas.)
   a. What ideas do we see the students exploring?
   b. What sense-making resources do we see the students using?
      What do we notice about:
      i. the ways they are using language?
      ii. the point(s) of view or perspectives they are taking on the question or phenomenon?
      iii. the lived experiences they invoke & how they use these?

5. Based on our interpretations, what would we want to know more about with respect to students’ ideas, perspectives, the science, etc.?

6. The presenting teacher has the last word:
   a. What are you taking or learning from this conversation?
   b. What are you seeing that you didn’t see before?
   c. What did you learn by transcribing? New insights? Surprises?
Reflection Protocol
How did your own science talk go?

In data groups

1. Reflect on classroom science talks:
   a. What was it like for you?
   b. What went well? What felt hard?
   c. What questions do you have?
   d. What might you try to do differently this next time?

Recording your lessons. Share questions, concerns and tips with one another.
Session 6

Session Topic: Metaphorical Thinking as a Sense-Making Practice in Science

Case Study #3: “Hakim’s Analogy”, Exploring Students’ Sense-Making

Data Groups Use “Transcript Protocol: Data Groups” on pg 56
Case Study #3: "Hakim’s Analogy"

Classroom Context

The transcript we will work in this session is from the same combined 1st-2nd grade classroom we looked at earlier. The students are well into their investigation of the "big job of plants"—to make new plants. The week before the focal event, the teacher (T) engaged the class in discussing possible titles for their mural.

The students suggested various titles and talked about what the suggested titles highlighted about the life of a pumpkin. During the discussion, Hakim said, "It’s like a spider." T asked him to say more. He continued, "because a spider, when the mom dies, it lays eggs before it dies." T commented on Hakim’s idea, noting that "it’s a good example of how it’s like something else." She then asked for additional ideas. In a seminar similar to this one, T shared Hakim’s analogy along with some of his recent writing. The group’s discussion inspired her to pursue his analogy in class, within a practice she was developing with Chèche Konnen staff called Science Workshop. In Science Workshop students explore the meaning potential of an idea or account like Hakim’s or one of Newton’s Laws of Motion or one of Attenborough’s figurative descriptions. The idea is written on chart paper, contextualized, and then presented to the class for discussion. The students are asked to discuss what they think Hakim or Newton or Attenborough means. Typically, this simple question produces extended classroom discussions that a) generate deep and expansive meaning-making about significant scientific subject matter, and b) reveal ways in which various forms of language work to organize and value meaning in academic disciplines such as biology and physics.
Transcript Protocol: Case Study #3 (Students' Sense-Making)
“Hakim's Analogy”

We will “work” the classroom transcript by examining students’ ideas and sense-making practices, specifically focusing on tracing the development of ideas through the conversation. (Each table group will assume responsibility for working through one part of the transcript, based on font color.)

1. In small table groups:
   a. Read the transcript aloud, taking on voices of the students
   b. Segment-by-segment, working through the whole transcript, trace the meanings the children are developing for Hakim's analogy:
      1. What meanings are they developing?
      2. How are they using language to explore these meanings?
      3. From what point(s) of view are they thinking and speaking?
      4. How are they expanding the science of Hakim’s analogy?

2. Coda

As a whole group, let’s talk about what we think analogical/metaphorical thinking is good for, using evidence from the sources we’ve considered today: the Root-Bernsteins’ chapter on Analogizing and our work on the transcript of Hakim’s analogy.
Ms. T introduces Science Workshop to her students
Teacher (T): ...it’s gonna be a time just like in Writing Workshop how we talk about the words people used in their writing? Well, we’re gonna talk about the words people have used in science, what people said in science. And we’ll probably think a little bit about what they meant with those words. And so it’s a little bit like Writing Workshop because we’re talking about the words people used but – (Ayanna) sit back – and we’re also gonna talk about why they used them, why they might have chose those words to use um instead of some other words, why those words helped us in science. Okay? And so today we’re gonna start with something that happened on Monday. Okay? And uh we’re gonna think a little bit first about what those words meant, what did they mean by those words, and um how those words helped us to think.

(approximately 2mins 30 secs later)

Discussion of Hakim’s Analogy

1. T: Hakim said, “It’s like a spider, because when the mom dies it lays eggs before it dies.” [reads it again] And I want to start with Hakim telling us what you meant by that and then we’ll all talk together about it. What did you mean by that when you said, “it’s like a spider because when the mom dies it lays eggs before it dies.”

2. Hakim: Because sometimes some pumpkins

3. T: Speak loud, your loudest voice, okay, honey?

4. Hakim: Because sometimes some pumpkins open up and they have- and they drop seeds. And sometimes farmers collect them and then they put ’em in the ground.
5. T: So:: “it’s like a spider because when the mom dies it lays eggs before it
dies.” How’s that like a spider what you just said?

6. Hakim: um cuz they plant more- um because they get planted all over again.

7. T: uh hunh, okay. Let’s see what other people think Hakim means.

[Aleximately 5 minutes later]

8. Annie: Well I think

9. T: Speak nice and loud. And then I want to hear from Keshia, Nick and
Nick, so you be thinking.

10. Annie: I think um that- well so [looking intently at mural of pumpkin patch
life cycle on opposite side of the room] the mother um is the big orange
pumpkin and then when it gets ready to die before it lays like um eggs, but
the eggs are actually not really eggs they’re seeds for the pumpkin, and then
the mother dies and the se- um the baby spiders, the seeds start to grow
and they get a little bigger, bigger spider, then bigger spider, then bigger
spider, and then they get eggs and they die and it just keeps going.

11. T: So you’re saying the parents are the orange ones and then when they die
they become rotten and ro- and the eggs that they lay are the seeds into
the soil. [Annie nods] Interesting. Okay, Who was next? Go ahead Ayanna.
Then it was Bruno.

12. Ayanna: um like um like if the um- wait what were we talking about?

13. T: How is this- what does Hakim mean when he says “It’s like a spider
because when the mom dies it lays eggs before it dies.”

14. Ayanna: um:: He means like um the mother of the pumpkin, it lays eggs and
like the um baby spider is like- the little egg was the baby spider, the baby
spider it needs to do all the like- it needs to know like how to first- like it
might not know how to like (walk)- like it might- if like it was a baby spider,
and it was so small, and no one could see it, it would step on it but it would die, and if it died, it wouldn't grow up.

15. T: Right but the mom dies and in the spider when the mom dies it lays eggs

16. Ayanna: =yeah

17. T: The eggs get laid before it dies. How is that like the pumpkin? Cuz that's what Hakim said, it's like a pumpkin. The pumpkin is like the spider.

18. Ayanna: =Because the- that- the way as the pumpkin dies is like it gets rotten and the way as the spider dies it's gonna get old

19. T: =yeah

20. Ayanna: =and it's kinda like the same because um the um rotten pumpkins- cuz of the rotten pumpkins and the um spiders, they're getting old and that's how they die.

21. T: uh hunh, and what happens when they die?

22. Ayanna: They lay eggs

23. T: Both of em?

24. Ayanna: Well not the pumpkin [smiling]

25. T: Well that's what Hakim says, it's like the spider.

26. Ayanna: The pumpkin- the pumpkin doesn't lay eggs because- um if the pumpkin lays eggs it would- wait- if the pumpkin laid eggs um that would be weird because if the pumpkin laid eggs, and um the spider laid eggs, and the pumpkin didn't, didn't have nothing in it, that would be

27. Hakim: =The pumpkin does have something in it
28. T: Tell her what you think

29. Hakim: The pumpkin has *seeds* inside

30. Ayanna: I know but I'm talking about the egg. The egg doesn't have- a spider only has an egg cuz if the pumpkin had an egg [thinking] (3 sec)

31. T: =But you're thinking inside the egg of a spider when it opens it's a spider.

32. Ayanna: =Yeah

33. T: =Inside the egg of a pumpkin when it opens it's not- you don't think it's a pumpkin?

34. Ayanna: No [shaking her head]

35. T: Hmm, that's interesting. [To Hakim] You have anything to say about that?

36. Hakim: Yeah

37. T: Go ahead

38. Hakim: The seed is *almost* like an egg.

39. T: Speak up and talk to Ayanna

40. Hakim: The seed is *almost* like an egg.

41. T: Can you explain how you think that?

42. Hakim: Because there's seeds inside a pumpkin [T aside to Jay] because there's seeds inside a pumpkin and sometimes some of the pumpkins splat open and they get planted by theirselves.
43. T: And so how is a seed like an egg? I heard you [to Bruno] say it, that the egg is the seed. Go ahead, say what you think.

44. Bruno: The seed is kinda like an egg because an egg- cuz like something’s inside a egg

45. T: Talk to Ayanna, too

46. Bruno: =so the um spider when it lays eggs and then it dies, it’s like fir- when it dies and lays eggs something’s in there, a spider, a born spider, and the same thing with the pumpkin, it has- but except it has more eggs, like the seeds, but the seeds are eggs but it looks like- but in- the spider and the pumpkin have something inside the seed and the egg.

47. T: So the seed is the egg, so when you- inside the egg of a spider, say, would be a spider, or something that might start a spider, right? //We don’t know

48. Bruno: //()

49. T: Inside the seed, is there a pumpkin? [Nick, on T’s left, vigorously shaking his head, No]. [Suzi nodding her head, yes, vigorously.]

50. Bruno: Something like uh


52. Suzi: Cuz it’s like a sprout of a pumpkin

53. T: Cuz we saw, right, what happens, //it’s like the beginning of a pumpkin

54. Bruno: //like the ( )

55. Suzi: Uh hunh
56. Bruno:  *Cuz like the spider has something in the egg and the pumpkin has something in the seed, they //both have something in the seed and the egg*

57. Hakim:  //and then it grows and grows and grows

58. T:  *The seed and the egg have something in it that- and it grows and grows and grows*

59. Bruno:  *=It’s like it’s born*

60. T:  *=It’s like it’s born, it’s like the beginning of it getting born. Cool.*
Session 7

Warm-up: Share collected metaphors and analogies at tables

Session Topic: Science Workshop

Case Study #3: “Hakim’s Analogy”, Exploring Science Workshop through a Practice Lens

Data Groups Use “Transcript Protocol: Data Groups” on pg 56
Transcript Protocol: Case Study #3 (Practice)
“Hakim’s Analogy”

Throughout the process of “working” the transcript, we will take an interpretive stance, as compared with an evaluative or diagnostic stance. This means that we will a) use the transcript as a source of evidence for our interpretations, staying close to the teacher’s and students’ talk. We are asking that we each take responsibility to hold ourselves to this interpretive stance in order to ground and discipline the conversation about this classroom event. We are going to approach the transcript from two angles. First, we will work the transcript to better understand Science Workshop as a teaching practice. Second, we will consider what we can infer about the intellectual and social norms of Science Workshop. Each small group will focus on analyzing a particular transcript segment and then will be asked to share their thinking with the whole group. In this way, we will collectively build a view of Science Workshop as a teaching practice.

Interpreting Teaching Practice in Science Workshop
1. As a group, read aloud the assigned transcript segment.
   a. Take a few minutes to talk about what strikes you as key elements of Science Workshop. What’s the transcript evidence for these elements? Write down your group’s thoughts for sharing with the whole group.

2. Consider the following questions and record your group’s observations, thoughts and supporting transcript evidence on chart paper:
   a. What do you see Ms. T doing? Then what do you see happening?
   b. What can we infer about the intellectual and social norms of Science Workshop?

Building a Collective View of Science Workshop
1. What do we see as the key elements of Science Workshop? What do we see as the intellectual and social norms of Science Workshop?
2. As you think about trying out Science Workshop in your classrooms, what questions do you have? Worries or concerns?
Transcript Segments
Case Study #3: “Hakim’s Analogy”
Exploring Science Workshop through a Practice Lens

SEGMENT 1  Lines 1-11
SEGMENT 2  Lines 12-30
SEGMENT 3  Lines 25-42
SEGMENT 4  Lines 43-60

Notes:
Yes, there is some overlap in two segments!
If you finish your segment, work on another one of your choosing.
Classroom Transcript
“Hakim’s Analogy”

Teacher (Ms. T): ...it’s gonna be a time just like in Writing Workshop how we talk about the words people used in their writing? Well, we’re gonna talk about the words people have used in science, what people said in science. And we’ll probably think a little bit about what they meant with those words. And so it’s a little bit like Writing Workshop because we’re talking about the words people used but - (Ayanna) sit back - and we’re also gonna talk about why they used them, why they might have chose those words to use um instead of some other words, why those words helped us in science. Okay? And so today we’re gonna start with something that happened on Monday. Okay? And uh we’re gonna think a little bit first about what those words meant, what did they mean by those words, and um how those words helped us to think.

(Assimately 2 mins 30 secs later)

Discussion of Hakim’s Analogy

61. Ms. T: Hakim said, “It’s like a spider, because when the mom dies it lays eggs before it dies.” [reads it again] And I want to start with Hakim telling us what you meant by that and then we’ll all talk together about it. What did you mean by that when you said, “it’s like a spider because when the mom dies it lays eggs before it dies.”

62. Hakim: =Because sometimes some pumpkins

63. Ms. T: Speak loud, your loudest voice, okay, honey?

64. Hakim: Because sometimes some pumpkins open up and they have- and they drop seeds. And sometimes farmers collect them and then they put ’em in the ground.

65. Ms. T: So:: “it’s like a spider because when the mom dies it lays eggs before it dies.” How’s that like a spider what you just said?
66. Hakim: um cuz they plant more- um because they get planted all over again.


[Approximately 5 mins later]

68. Annie: Well I think

69. Ms. T: Speak nice and loud. And then I want to hear from Keshia, Nick and Nick, so you be thinking.

70. Annie: I think um that- well so [looking intently at mural of pumpkin patch life cycle on opposite side of the room] the mother um is the big orange pumpkin and then when it gets ready to die before it lays like um eggs, but the eggs are actually not really eggs they're seeds for the pumpkin, and then the mother dies and the se- um the baby spiders, the seeds start to grow and they get a little bigger, bigger spider, then bigger spider, then bigger spider, and then they get eggs and they die and it just keeps going.

71. Ms. T: So you're saying the parents are the orange ones and then when they die they become rotten and ro- and the eggs that they lay are the seeds into the soil. [Annie nods] Interesting. Okay, Who was next? Go ahead Ayanna. Then it was Bruno.

72. Ayanna: um like um like if the um- wait what were we talking about?

73. Ms. T: How is this- what does Hakim mean when he says “It’s like a spider because when the mom dies it lays eggs before it dies.”

74. Ayanna: um: He means like um the mother of the pumpkin, it lays eggs and like the um baby spider is like- the little egg was the baby spider, the baby spider it needs to do all the like- it needs to know like how to first- like it might not know how to like (walk)- like it might- if like it was a baby spider, and it was so small, and no one could see it, it would step on it but it would die, and if it died, it wouldn’t grow up.
75. Ms. T: Right but the mom dies and in the spider when the mom dies it lays eggs

76. Ayanna: =yeah

77. Ms. T: The eggs get laid before it dies. How is that like the pumpkin? Cuz that’s what Hakim said, it’s like a pumpkin. The pumpkin is like the spider.

78. Ayanna: =Because the- that- the way as the pumpkin dies is like it gets rotten and the way as the spider dies it’s gonna get old

79. Ms. T: =yeah

80. Ayanna: =and it’s kinda like the same because um the um rotten pumpkins- cuz of the rotten pumpkins and the um spiders, they’re getting old and that’s how they die.

81. Ms. T: uh hunh, and what happens when they die?

82. Ayanna: They lay eggs

83. Ms. T: Both of em?

84. Ayanna: Well not the pumpkin [smiling]

85. Ms. T: Well that’s what Hakim says, it’s like the spider.

86. Ayanna: The pumpkin- the pumpkin doesn’t lay eggs because- um if the pumpkin lays eggs it would- wait- if the pumpkin laid eggs um that would be weird because if the pumpkin laid eggs, and um the spider laid eggs, and the pumpkin didn’t, didn’t have nothing in it, that would be

87. Hakim: =The pumpkin does have something in it

88. Ms. T: Tell her what you think
89. Hakim: The pumpkin has **seeds** inside

90. Ayanna: I know but I'm talking about the egg. The egg doesn't have- a spider only has an **egg** cuz if the pumpkin had an egg [thinking] (3 sec)

91. Ms. T: =But you're thinking inside the egg of a spider when it opens it's a spider.

92. Ayanna: =Yeah

93. Ms. T: =Inside the egg of a pumpkin when it opens it's not- you don't think it's a pumpkin?

94. Ayanna: No [shaking her head]

95. Ms. T: Hmm, that's interesting. [To Hakim] You have anything to say about that?

96. Hakim: Yeah

97. Ms. T: Go ahead

98. Hakim: The seed is **almost** like an egg.

99. Ms. T: Speak up and talk to Ayanna

100. Hakim: The seed is **almost** like an egg.

101. Ms. T: Can you explain how you think that?

102. Hakim: Because there's seeds inside a pumpkin [T aside to Jay] because there's seeds inside a pumpkin and sometimes some of the pumpkins splat open and they get planted by theirselves.

103. Ms. T: And so how is a seed like an egg? I heard you [to Bruno] say it, that the egg is the seed. Go ahead, say what you think.
104. Bruno: The seed is *kinda* like an egg because an *egg*- cuz like something’s inside a *egg*

105. Ms. T: Talk to Ayanna, too

106. Bruno: =so the um spider when it lays eggs and then it dies, it’s like fir- when it dies and lays eggs something’s in there, a spider, a born spider, and the same thing with the pumpkin, it has- but except it has more eggs, like the seeds, but the seeds are eggs but it looks like- but in- the spider and the pumpkin have something inside the seed and the egg.

107. Ms. T: So the seed is the egg, so when you- inside the egg of a spider, say, would be a spider, or something that might start a spider, right? //We don’t know

108. Bruno: //()

109. Ms. T: Inside the seed, is there a pumpkin? [Nick, on T’s left, vigorously shaking his head, No]. [Suzi nodding her head, yes, vigorously.]

110. Bruno: Something like uh


112. Suzi: Cuz it’s like a sprout of a pumpkin

113. Ms. T: Cuz we saw, right, what happens, //it’s like the _beginning_ of a pumpkin

114. Bruno: //like the ( )

115. Suzi: Uh hunh

116. Bruno: Cuz like the spider has something in the egg and the pumpkin has something in the seed, they //both have something in the seed and the egg
117. Hakim: //and then it grows and grows and grows

118. Ms. T: The seed and the egg have something in it that- and it grows and grows and grows

119. Bruno: =It’s like it’s born

120. Ms. T: =It’s like it’s born, it’s like the beginning of it getting born. Cool.
Session 8

Session Topic:  Adaptive Practice

Data Groups  Use “Transcript Protocol: Data Groups” on pg 56
Pedagogy Protocol
Developing a Collective View of Adaptive Practice

Today, we’re going to begin to develop a collective and emerging view of what it means to be an adaptive practitioner. In other words, we’re going to develop what this means together through analysis and reflection on our work thus far and going forward in light of the work we do in these next—and final—three sessions.

Working at your tables, talk together about what you feel you’ve learned in relation to our three strands of inquiry:
- plant growth and development,
- students’ sense-making, and
- new pedagogical practices.

Please discuss a) what is important for you about that learning, and b) any questions this work has raised for you that you would like to share or pursue or have ways of thinking about.

Please come up with at least 2 learnings for each strand, write them on post-its, and post them. Please come up with at least 1 question related to any of the strands, write on post-it, and post.

1. In new groups (1-4), working with only one of the post-it charts, add, comment, refine this working characterization of adaptive practice.

2. As a whole group, we will then discuss these characterizations of our learning and their implications for practice.
Session 9

Session Topic: Adaptive Practice, Part 2
In pairs or groups of three, discuss connections and questions with our work here that came up as you read “What should we do next?” Does the practice discussed in the chapter resonate (or not) or challenge (or not) your professional experience? In what ways?

Data Groups Use “Transcript Protocol: Data Groups” on pg 56
Session 10

Data Groups  Use “Transcript Protocol: Data Groups” on pg 56

Final Reflections: Post & Tour Reflective Writings  As you tour and read one another’s reflections, take note of a few things that stand out for you in other people’s writing. In small groups at tables, we will discuss what has emerged as important for us in this course and why. We will share our thinking with the whole group.