Two distinct ways of attending to the substance of students' ideas

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Abstract: Research-based calls for science education reform emphasize that, for inquiry and deep learning to occur, teachers must attend to the substance of students' ideas, which must play a prominent role in class. Using classroom video and teacher interviews, we illustrate two different ways of attending to students' ideas, both of which sustain students' sense-making. These two different kinds of attention reflect different, perhaps tacit, answers to the question, "What kind of activity is this?"

Introduction

Constructivist views of learning support the claim that student ideas need to play a prominent role in science classes if students are to develop a deep understanding of science (Driver, Guesne, Tiberghien, 1985). Ideally, an "authentic dialogue about scientific ideas and processes…occurs between students and teachers and among students themselves" (Deneroff, Sandoval, Franke, 2002). But what does it look like, exactly, when teachers "display and demand respect for the diverse ideas, skills and experiences of all students," by "(f)ocusing on student understanding and use of scientific knowledge, ideas, and inquiry process skills, as the National Research Council (1996) report suggests? In this paper, we illustrate two distinct answers to this question — two different ways in which teachers can frame their classroom interactions (Tannen, 1993), both of which demonstrably involve attending to the substance of students ideas and both of which help to sustain students' sense-making. Studying the different ways a teacher may attend to students' ideas will help us develop more nuanced understandings of teachers' practices and their influence on students' learning (see Lau, Elby & Hammer, in preparation), all of which have implications for teacher education.

Two ways of attending to the substance of students' ideas

The teachers in this study, Dave Hovan and Joanna Myeson, were part of a three-year research and professional development project focused on responsive teaching in science. Lau regularly taped the teachers' classes. For the two classroom episodes discussed below, right after the class, Lau conducted an open-ended interview to capture the teacher's initial impressions of how the class went and what he or she noticed. Later, Lau used the classroom video to conduct video-stimulated recall interviews with the teacher. Although stimulated recall involves more reconstructing than direct remembering, our independent analysis of the teacher's classroom behaviors in these two episodes meshed with the teachers' recollections. We lack space here to argue in detail that, in each episode, the teacher was indeed attending to the substance of students' ideas and students were engaged in sense-making. We hope to show, however, that the teachers were paying attention and framing their interactions in different ways.

Dave's framing: exploring student ideas

In this brief snippet from a longer interaction, a student named "George" is discussing his thoughts about whether air resistance helps to explain why a bowling ball and a small rock fall down at the same rate.

53. George: If there wasn't no air the ball would be coming down very very slow.	64. Dave: Number one, it doesn't matter, any height.
54. Dave: If there was no air?	65. George: I mean, if you drop this from a certain height, it wouldn't…hit the ground.
55. George: Yeah.	66. Dave: Not at the same time?
56. Dave: So you're saying it would come down slower if there was no air.	67. George: Nah.
57. George: See like this (holds a book up and moves it down slowly) very slow. Like this, very slow, steady, because there isn't any air.	68. Dave: (pause) So are you saying the higher up that you drop something, like, the less likely they are gonna hit the ground at the same time?
58. Dave: So you're saying air makes things fall faster.	69. George: Yup.
59. George: Yeah. (turns to write on worksheet)	70. Dave: Okay why?
60. Dave: Okay.	71. George: Because its heavier. Say look, say like, if I got, if I stand on top of this (slaps the top of the lab bench), right, and [we drop?] this (holds up a book and then a binder)…the binder's gonna drop first.
61. George: (8 second pause, writing) How high is this thing? Like if you dropped it, how high is it?	
62. Dave: For which one.	
63. George: For number one.	

From the classroom and interview data, we see evidence that Dave is focused on helping his student articulate and explore that student's idea, independent of correctness. He paraphrases and reflects back what George says (lines 54, 56, 66), asks about implications of George's ideas (58 and 68), and asks for a rationale (70). This fits in with his goals for the lesson (from interview data) of helping students explore their ideas as well as helping them develop their reasoning skills and eliciting misconceptions to be addressed during later instruction. We argue that Dave was able to maintain his attention in this way because of contextual cues in his interaction with George that supported this way of framing the activity. For example, George typically responds to Dave with statements about his ideas.

Joanna's framing: learning about the mechanism with her students

In the snippet below, students in Joanna's class discuss whether the melted water on the surface of ice aided or hindered an object sliding on the ice.

24. Abe: It—the reason why it's slippery on ice is cause there's a little water. If you have ice, with no water, with no melted water, then you'll probably [wouldn't slip on it]. 25. Joanna: So you think that the melted—the little—(draws on the board) you're basically saying here's our ice and that there's like a *little, little, little*, tiny thing of water right there and that's what makes it super slippery. (Abe: Yeah) Is what you're saying. So someone who thinks that it makes it, slows it down, tell me why you think it slows it down, cause that's our counter argument, right? So, so why do you think Melissa? 26. Melissa: Well I'm not sure, but like, maybe if it's like water then it's like just more stuff to go over.	27. Joanna: Oh, so you're kind of thinking like (Melissa: I don't know)…like what would be an example of that? 28. Melissa: Umm…I'm not sure. (multiple student voices) Like a puddle? 29. Joanna: Like a puddle? How would a puddle slow it down—like, what do you mean? Like what's an example of that? 30. Tiffany: Going into the water, you know, just like- 31. Joanna: Like if something is kind of like– 32. Rhonda: Well if you're doing a marble across a table or something it would probably go slower in the water cause it has more stuff that it's going through. 33. Joanna: So it's kind of going deeper in the water right? So as it rolls in, it's actually sinking in and eventually the water is stopping it….

Joanna's attention and responses have a different flavor from Dave's. Instead of reflecting back or drawing out Abe's idea with a follow-up, she adds onto his idea (line 25): there's like a *little, little, little* tiny" amount of melted water. In lines 27 and 29, she asks for clarification because she does not yet understand the student's idea (according to her interview recollections). Once she "gets" what Melissa is saying, she interrupts another student (30-31) and adds onto and transforms Melissa and Rhonda's explanation; the idea of going "deeper" into the water and "sinking in" is not explicit in what Rhonda or Melissa say. This analysis, analyses of other episodes in this class, and Joanna' interview comments point toward the following interpretation: Unlike Dave, who was engaged in the elicitation of ideas about which he already had a firm understanding, Joanna is engaged *with* the students in trying to figure out something she had not previously figured out: why water on the ice might slow something down instead of helping it slide. Despite these differences between Dave's and Joanna's classroom interactions, the students in both cases engage in sense-making, which was supported in both cases by the teacher's attention to their ideas; see Lau (in preparation) for full analysis.

In summary, there is more than one way of following the exhortation to attend to the substance of student ideas and make them a central part of science class. Teacher education that privileges one type of interaction could do harm, e.g., by telling Joanna to stop interrupting and stop bringing her own ideas into the discussion. As this snippet may illustrate, if students interpret these "bad" elicitation moves as the teacher's taking their ideas seriously enough to build them into her evolving understanding and explanations, their sense-making may be supported rather than shut down. Since "good" or "bad" may depend on such interpretations, more research should focus on how teachers and students frame the teacher's attention to students' ideas.

References

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