Fostering Teachers’ Use of Talk Moves to Promote Productive Participation in Scientific Practices

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Abstract: This paper explores variation in how teachers use talk moves intended to help students engage productively in science discourse. Participants in the study were 13 middle school Earth science teachers from a large, diverse urban school district and their students. Teachers implemented tools intended to help students orient to other students’ contributions in class, particularly their reasoning about weathering and erosion and about plate tectonics.

Introduction
Strengthening students’ competency with scientific practices related to specific science content is a key goal of the framework for the next generation of science standards in the United States (National Research Council, 2011). One line of inquiry into how to facilitate students’ productive participation in scientific practices focuses on talk moves as tools for teachers. Talk or conversational moves are discursive practices teachers can use to elicit student thinking, promote scientific reasoning, encourage students to explain their thinking so others can understand, and build knowledge within classroom communities (O'Connor & Michaels, 2011). Some talk moves, such as revoicing, position students differently vis-à-vis one another and scientific knowledge in ways that support these goals (O'Connor & Michaels, 1993).

At present, learning sciences researchers are only beginning to investigate how to support teachers’ effective use of talk moves as tools for promoting science learning (O'Connor & Michaels, 2011). Although there is abundant research on how the processes by which eliciting student thinking, promoting productive participation in practice, and adapting teaching to students facilitate learning (National Research Council, 1999), professional development programs focused on helping teachers make productive use of talk moves in science classrooms have emerged only in recent years.

The Current Study
In this paper, we analyze variation in implementation of a program of professional development designed to help teachers make effective use of talk tools to support student learning in an investigation-based middle school Earth science program. A total of 13 teachers and their students from a single large urban school district in the US participated in the study. The study of implementation variation is useful in helping teams prepare to expand the reach of learning sciences innovations that have been developed and tested in a few classrooms. Here we focus on variation associated with teachers’ uses of tools to support students’ developing proficiency with explanation in Earth science. We present vignettes from videotaped observations of practice to illustrate variations in teachers’ use of talk tools to help students formulate compare their claims and reasoning to peers.

Variation in Generativity of Tool Uses for Helping Students Think with Others
In this paper, we focus on variation in use in one type of move, the “weighing perspective” move. In this move, teachers encourage students to consider their ideas in relation to other ideas. This move is a key strategy for creating a culture of argumentation within the science class, because peers are invited to agree or disagree and to argue using evidence to support different views.

A strong example of using the weighing perspectives move occurs in Ms. Thomas’s class, at the end of an investigation on weathering. The teacher is checking students’ understanding of core ideas of the investigation by posing a series of three “clicker questions.” For each question, students first write their thinking individually on a handout to explain the reason for their choice while voting with the response systems. After collecting all students’ clicker votes, Ms. Thomas displays the distribution of responses for each answer choice on the screen and engages the whole class in discussing their thinking for each answer choice.

In discussing the problematic answer choice “Live plants release carbon dioxide to break down rocks” to the clicker question “How might plants break rocks down through physical weathering?” Ms. Thomas first elicits students’ reasoning when asking “Why might someone have chosen that?” This initial move invites all students to offer an explanation even if they had not selected that answer, as illustrated in the following excerpt:

T: We are gonna start with B. Why might someone have chosen that? [pauses] Ok
S1: I think someone might have chose that, chosen that, because I think when we saw the picture of the big rock that had broken I think someone said it was plants that could have broken it, broken it down, and also because carbon dioxide has, I think, doesn't it have acid in it that dissolves it?

We see here that the first move successfully engages a student who offers a reason why a student might have chosen one of the responses. After revoicing and linking the thinking shared to a previous learning experience, Ms. Thomas uses the “weighing perspectives” move to engage students in arguing for their ideas:

T: Carbon dioxide can mix with water and oxygen in the atmosphere to form a weak acid, that's absolutely true. Very good, very good, and S1 said someone may have remembered our conversation from that original elicitation question when we saw those big boulders and that grassy field, do you guys remember that? Cool. Does anybody want to disagree with or agree with S1?

S1: I want to disagree with myself.

T: [laugh] Oh cool! One second. S2?

S2: Eh, I disagree with S1 because of the plant, well, it's really lichen, and lichen is an organism that sprays chemicals on rock.

This particular “weighing perspective” move succeeds by eliciting a different response, one that closer approximates (but does not yet meet) the goal or target understanding and by inviting a self-correction from S1.

A lesson led by Mr. Smith reveals counter-productive uses of ‘weighing perspectives’ moves. In this example, which took place at the beginning of an investigation during the study of the Dynamic Planet unit, Mr. Smith follows an elicitation pattern in order to bring forth students’ initial ideas on forces that cause movements within the Earth. The clicker question “The cookie dough above has just come out of the freezer. When it gets warmer, it will become easier to mold into cookies. How is the cookie dough like Earth’s mantle?” is displayed side by side with a photograph of a ball of cookie dough resting on a baking sheet. Each of the four answer choices reflect some aspects of the goal facet and provide an entry point for discussion. After reading over the question and the answer choices, Mr. Smith asks his students to vote using the response systems. After displaying the distribution of responses, he instructs them to “turn and talk” to a partner to discuss the reasons for their choices and to try to make a convincing argument when their choices differ. To spark the discussion, Mr. Smith uses a form of a weighing perspective move when saying “If the person next to you clicked on the same one, I want you to say why, but if you clicked D and your neighbor clicked C, I want you to prove your point and try to change their minds.” After students got a chance to share their ideas in pairs, they engage in a whole class discussion about the answer choices. Few students, however, engage with the content in the productive ways Ms. Thomas’ students do.

Conclusion

Fostering productive participation in argumentation in science class is not an easy task for teachers. The current paper offers hope and examples for ways that talk moves can support teachers in doing so. At the same time, a conclusion we draw from this study is that the distinction between generative and less generative uses of moves is often subtle, easier to see in retrospect, yet consequential within the flow of classroom activity.

References


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