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Supporting Epistemic Reasoning in Classroom Discourse

Na'ama Y. Av-Shalom, Rutgers University, naama.avshalom@gse.rutgers.edu

Abstract: A core aim of schooling is to prepare students to reason effectively in the real world. To address this, my dissertation seeks to develop our understanding of how teachers can best support students in reasoning aptly during collaborative epistemic discourse. The data are from an implementation of a middle-school, model-based inquiry curriculum. In preliminary findings, the teacher promotes reasoning through establishing participatory classroom practices. This work will establish an empirically grounded approach for evaluating instruction.

Introduction and theoretical framework

A core aim of schooling is to prepare students to reason effectively in the real world, beyond the classroom walls. Yet, the real world, with its current "post-truth" climate, makes it increasingly difficult to discern truth from falsity. Increasingly, people disagree not only about how to interpret facts but even about what are the counts as facts (Kavanagh & Rich, 2018). One approach to prepare students for this complicated real world is to make classrooms better reflect scientific practices so that students will become increasingly adept at engaging with a variety of claims, evidence, and arguments that vary in credibility and quality. Further, students should engage with these practices in the context of a community, as these practices are thoroughly social.

Social scientific practices afford better vetting of scientific knowledge. Epistemic products, such as models and evidence are evaluated by the community, and over time developed or discarded. This evaluation is done through *epistemic discourse*, the varied communication that people in epistemic [knowledge-related] communities (e.g., science or classroom communities) engage in to manage knowledge (Longino, 2002). Given its centrality in science, engaging in and learning about epistemic discourse should also be foregrounded in science education (NGSS, 2013).

Teachers have an important role in establishing epistemic discourse practices in classroom communities. Through their choices of which students' ideas to highlight or suppress, teachers send messages about what knowledge is valuable and how or who develops it (Russ, 2018). While teachers' decisions affect how the class engages in discourse, we still do not fully understand how teachers can best foster collaborative epistemic discourse that supports students in being able to reason aptly across contexts, both in and out of the classroom.

Barzilai and Chinn (2018) posit that a way to support students to in becoming good epistemic reasoners is through promoting *apt epistemic performance*. E*pistemic performance* refers to how students deal with knowledge-related matters, such as understanding evidence. When it is *apt*, epistemic performance is successful (comes to the best conclusion based on one's aims) through competence (uses reliable knowledge and processes). The authors developed the Apt-AIR framework, which provides an account of what it means to be epistemically successful across contexts and how we might engender such performance. In this work I am operationalizing the Apt-AIR framework as it applies to classroom discourse to understand how teachers can support students in developing more apt epistemic discourse in model-based science inquiry contexts. Specifically:

1. How are the aspects of apt AIR manifested in teacher talk: which are more (or less) salient?
2. What teacher moves initiate and reinforce apt epistemic classroom discourse?

Context, participants, and episodes

The data come from the Promoting Reasoning And Conceptual Change In Science (PRACCIS) project (http://www.praccis.org/). In this project, teachers implemented a middle school, life science, model-based inquiry curriculum covering topics such as genetics and natural selection. Throughout the intervention, students developed class criteria for good models, evaluated and interpreted evidence, and engaged in scientific modeling. I will be analyzing epistemic discourse from class discussions in the class of one participating teacher, Ms. Pisano (pseudonym), who taught at a suburban school in the Northeastern United States; she maintained high fidelity to the PRACCIS curriculum and seemed to be excellent at supporting her students in engaging in high quality epistemic discourse. In her classroom, the PRACCIS intervention happened throughout the course of one school year and included 10 PRACCIS units from which I will be identifying episodes; during the year, Ms. Pisano also taught six non-PRACCIS units. The students in the study were in seventh grade (approx. 12-13 years old).

Evaluation of epistemic products is a key part of epistemic discourse in science (Longino, 2002). Given its importance in scientific practice, I decided to focus on class discussions pertaining with evaluation-related aims, such as evaluating models, arguments, or evidence. I identified 22 episodes in which the class engaged in evaluation activities. The episodes were between three to 23 minutes (average: 10 minutes). I will also analyze

episodes pertaining to the purpose or practices of the activity that happened prior to the evaluation episodes to identify how the teacher may be scaffolding later epistemic discourse. For example, in one episode the teacher led a discussion about how to engage as a scientific community in preparation for an evaluation activity.

Methodology

Currently I am refining a coding scheme that I developed based on the Apt-AIR framework (Barzilai & Chinn, 2018), coding how each of the five aspects and three components in the framework are used. For example, one aspect of the Apt-AIR framework is participating in epistemic performance together with others. Examining the data revealed that the teacher and students referred to participation in several different ways (see Table 1).

I will code teacher and student talk, and analyze the coded data to identify patterns in the epistemic discourse. Through this process I will also identify broader themes, such as whether Ms. Pisano highlights a particular aspect more than others (RQ1). Based on the findings, I will choose episodes that highlight broader themes for a closer qualitative analysis. These episodes will serve as cases of different ways in which the teacher initiated and reinforced more apt epistemic classroom discourse (RQ2), particularly attending to which aspects of apt epistemic performance the teacher highlighted, and how she reinforced them during the discourse.

Table 1. Sample of codes under the category of "participating in epistemic performance together with others."

Category	Definition	Examples from Teacher Talk
Class community	About features of a classroom community	- What do I want this [class discussion] to look like, sound like? … I want the people in the front to call on those of you out in the crowd with your hands up, and I want you to challenge each other: Make each other prove it, make each other really think about it.
Community of scientists	About features of a scientific community	- This is what scientists do: one says, "this is what I've learned," and everyone else asks questions and shares their opinions, and tries to get to the right answer together.
Building on ideas	Directing students to discuss others' ideas	- Okay, response to that. So not a new idea, but a response to what Ava said. - Kat, you want to help her with that?

Expected findings and contribution

Based on preliminary analyses, I anticipate that many of the findings of this work will highlight how Ms. Pisano facilitated participation in a knowledge-building community. In watching her videos, what seems unique is how frequently she emphasizes participatory practices—one of the aspects of apt epistemic cognition (Barzilai & Chinn, 2018). Ms. Pisano emphasized participation through facilitating discussions about how and why students and scientists engage in modeling and discourse practices; she also often positioned herself as a participant and modeled how to engage with others' ideas. As Ms. Pisano positions the class as a knowledge-building community, she also highlights other aspects from the Apt-AIR framework, such as guiding students to consider how becoming adept at modeling practices is valuable to varying communities and in students' personal and civic lives. These findings will shed light on how teachers can support classroom communities in thinking well *together*, akin to how scientists engage in epistemic discourse to build communal knowledge.

Overall, the lens of the Apt-AIR framework helps characterize epistemic discourse, but because it is currently only in the early stages of being used empirically, it is unclear whether or how each of the aspects is reflected in verbal classroom discourse. Through analyzing patterns in epistemic discourse, I will be able to give a comprehensive look at how the five aspects of apt epistemic performance are reflected in classrooms. Moreover, the framework is currently focused on student talk, and this work will extend its use to teachers.

More broadly, the aim is to establish an empirically grounded approach for evaluating epistemic discourse in classrooms. This can be useful for evaluating both teacher moves and student performance. I envision that this analytic tool could also be adapted for use by teachers to enhance their instruction, and can guide the development of curricula seeking to develop students' epistemic discourse as they engage in scientific inquiry.

References

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