

Complexities and Contradictions in a Teacher's Activation of Epistemological Resources and their Consequences for Student Framing

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Abstract: This research employs the lenses of epistemological resources and framing to examine the complexities of one teacher's efforts to position his middle-school biology students as sensemakers. Through interviews, classroom observations, and document analysis, we trace the teacher's activation of varied epistemological resources and how such resources positioned students' efforts throughout the lesson. While the launch of tasks was framed as an opportunity for "doing science," this framing became less stable when the teacher engaged with students in small group work and during the wrap up that were focused on the "right answer." Specific phases of the lesson served as a context that influenced the epistemological resources activated, helping us understand the varied, dynamic, and sometimes contradictory nature of the teacher's moves and their consequences on students' framing of their efforts.

Introduction

Science education reform efforts envision classrooms as sensemaking spaces where students explore natural phenomena to refine their understanding of scientific ideas and practices (NRC, 2012). Engaging students in science learning through sensemaking is "notoriously challenging" as teachers must "navigate an unpredictable terrain of student ideas" (Watkins & Manz, 2022, p. 1). With these considerations in mind, this research examines the complexities of one teacher's efforts to position his middle-school students as sensemakers in science.

Methods

Data for this case study were drawn from a year-long professional development (PD) project designed to foster teachers' abilities to support student sensemaking about science through talk. We focus on one middle school biology teacher, Jerry, and his middle school students' framing of his instructional practice. We focus on Jerry and his class because we observed that while he provided space for students' sensemaking and employed the tools introduced in the PD, his teacher-led wrap ups discussions centered on providing canonical knowledge. We wondered about the factors influencing his varied instructional moves and their consequences.

Data sources included classroom video observations of three lessons (*Cell Structure*, *Cell Reproduction*, and *Mechanism of Evolution*), classroom artifacts, teacher surveys, and a series of open-ended and structured stimulated recall teacher and student interviews. To begin our analysis, we examined the kinds of student thinking required by the task, using the categories described by Tekkumru-Kisa and colleagues (2022). Classroom videos from three, multi-day lessons were segmented to broadly characterize the different lesson phases (launch, small group work, round robin, wrap up discussion, and write up). Within each segment, we analyzed Jerry's instructional moves for evidence of epistemological resources underlying his instructional decisions. Drawing from Elby and Hammer (2010), we recognized two epistemological resources at play in Jerry's instructional moves: *knowledge as propagated stuff* and *knowledge as constructed*. Drawing from Berland and colleagues (2016), we examined classroom videos and interviews for evidence of students' framing as "doing school" or "doing science," noting instances of interruptions of, or shifts in, how students framed their efforts during a lesson segment.

Results

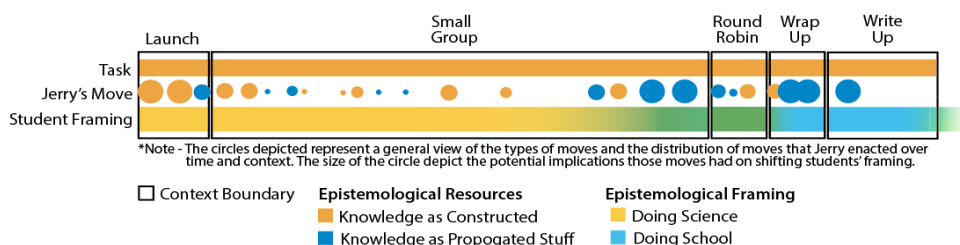
Analysis of the three lessons revealed consistent patterns in Jerry's instructional moves, patterns which speak to the activation of different resources around knowledge and learning in different contexts. We came to understand that different phases of the lesson represented distinct contexts for Jerry, and influenced his activation of resources around knowledge, knowing, and learning, including those related to *knowledge as propagated stuff* and to *knowledge as constructed* (Elby & Hammer, 2010). Figure 1 depicts how the activation of these resources varied across phases of the lessons. Student interviews suggest that despite the varied framings across the lesson phases, some of the students recognized that their classroom experiences were

distinct from those scientists engage in, and even given these complex dynamics, understood that scientists construct knowledge through such negotiations.

Our analysis sheds light on the dynamic nature of epistemology and framing in one teacher's efforts to engage his students as sensemakers in science. This analysis across three lessons identified variabilities in Jerry's moves across lesson phases. The launch of the task and much of Jerry's moves in small group work activated the resource of "knowledge as constructed", and many of his moves were consequential for students' framing of their efforts as "doing science" as they engaged in sensemaking about a phenomenon. The launches are particularly interesting as they highlight the role of the tasks in supporting Jerry's attempts to position his students as sensemakers. Their role in the launch and small group work was consequential for cuing "knowledge as constructed" as the prominent epistemological resource that Jerry tapped into. However, toward the end of the small group discussions, we begin to see that Jerry made very different sorts of moves that aligned with a view of "knowledge as propagated stuff". In the latter phases of the lesson, these moves were consequential for how students took up the framing of "doing school".

Figure 1

Graphic Representation of the Interplay Between the Epistemological Resources Underlying Jerry's Moves and the Task, and Students' Framing of their Efforts across the Lesson Phases, Generalized from Three Lessons.



Conclusions

Our findings highlight the fine-grained epistemological elements that the teacher activated in different contexts and phases of the lessons examined and their consequences for students' framing of their efforts. This resource activation explanation for one teacher's moves helps account for the frequently documented shifts that occur when teachers navigate the unpredictable challenge of new practice. While this research examines the epistemological resources employed by just one teacher, this close speaks to the need to support teachers to explicitly make connections between resources, moves, and student framing. These findings are tentative and require further investigation. If the utility of the resource framework holds up, it suggests that PD should be structured to help teachers examine the consequences of their enactment of specific teacher moves throughout stages of a lesson to help them learn to activate more productive resources to engage students in sensemaking.

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