



Shifts in Positions, Epistemic Authority, and Epistemic Agency in a Secondary Mathematics Classroom

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Abstract: In this study, we investigate the interactional positions negotiated among students and the teacher during joint mathematical exploration in the classroom. Using qualitative coding of two video episodes in a secondary mathematics classroom, we found participants take up positions of uncertain knower and explorer in addition to positions of knower and actor identified in previous research. These additional positions help illuminate collaborative knowledge building and negotiation of shared epistemic agency and authority in learning.

Student collaboration and productive disciplinary engagement, such as exploration of disciplinary questions, is seen as a strategy to bring about meaningful learning but is still a challenge to support in classrooms (Damşa et al., 2010). Thus, it is crucial to understand teacher and student interactions that position students as active epistemic agents. We examine how joint mathematical exploration is established and maintained as students and the teacher investigate mathematical questions. We aim to identify the interactional positions the teacher and students take up as evidenced by negotiation moves. We investigate the following questions: (1) What positions do students and teachers take on while establishing and maintaining joint exploration? (2) How do shifts in positions reflect how epistemic authority and agency are distributed?

Theoretical Perspectives & Background

We combine a sociocultural perspective toward classroom interactions and positioning theory (Davies & Harré, 1990) as a theoretical lens to investigate the roles that teachers and students move between in instances of joint exploration. We define *joint exploration* as “the collaborative activity of investigating disciplinary questions and ideas among students and/or teachers through interaction” (Dyer et al., 2021, p. 548), and in which students and the teacher take on and shift between various socio-epistemic roles. Traditionally the teacher takes on a role of someone who gives knowledge and requests actions (Amit & Fried, 2005), and the student receives knowledge and performs actions. Within joint exploration, students would need to take on active roles in guiding the exploration process and in deciding when and how ideas are validated. Thus, this type of activity likely requires negotiation of authority over disciplinary knowledge and redistribution of epistemic agency. Previous research, using discourse analysis methods, has found that students take on and shift between positions of *primary and secondary knower*, as those who give and receive information, and *primary and secondary actor*, as those who request and perform actions (González & DeJarnette, 2015; Lo & Ruef, 2020). In joint exploration, rather than only exchanging information, individuals jointly explore and exchange strategies and may actively seek knowledge together, not in another individual, but tested and validated among the group. Therefore, we hypothesize that aspects of joint exploration include different types of negotiations, and thus, positions.

Methods and Data Sources

To characterize the teacher and students’ interaction, we analyzed transcript and video of two episodes of joint exploration during small group work identified in a previous study (e.g., Dyer et al., 2021). These episodes occurred during mathematics lessons in a class with grade 10 and 11 students. We illustrate these findings using one episode of joint exploration when James, a student, poses a new problem when the teacher was with his group. The two students and teacher are not certain of the answer to this question in the beginning; however, it ends with students having consensus and the knowledge to answer this problem.

The first two authors coded the video and transcript of the two episodes using Lo and Ruef’s (2020) group work positions coding scheme and resolved disagreements through discussion. These disagreements revealed positions not well-captured in the existing coding scheme. Thus, the researchers used open and axial coding to characterize the negotiation moves associated with these new positions as additional codes and applied the revised coding scheme to the episodes. These new codes included: “E1-Primary Explorer”, “E2-Secondary Explorer”, and “K1-U: Primary knower uncertain.” Two researchers coded the episode with this revised coding scheme, checked for inter-coder agreement, and resolved any disagreements through discussion.

Results

Our analysis found that individuals took on positions in which they were exploring ideas collaboratively and the "known" answer was not yet clear. Rather, the "known" answer was the object of their investigation. These positions are not adequately captured by the knower and actor in previous analytical schemes (Lo & Reuf, 2020). Thus, our analysis identified added the positions of "E1-Primary Explorer", "E2-Secondary Explorer", and "K1-U: Primary knower uncertain" (RQ1). The new positions of uncertain knower and explorer allow us to understand knowledge as not solely possessed by an individual but constructed through joint activity.

The position of *primary knower uncertain* captures negotiation moves that propose knowledge in a way that is tentative. This position happened while establishing joint exploration, such as when a student, James, suggested a possible solution. We were not able to accurately capture James' position by the "knower" positions, since James appeared to suggest a possible idea for others to consider rather than stating a relevant piece of information that he seemed to be confident about.

The position of *primary explorer* captures moves to seek knowledge through investigation when it is not known for certain. This position occurred while maintaining joint exploration when the students and the teacher sought knowledge that they did not yet have. For example, James took on a position of a "primary explorer" by leading the charge to find the solution. Unlike the primary and secondary knower, James did not have the knowledge that was being sought and was not seeking knowledge in another person. James is positioned with some knowledge of how to go about exploring that requires him to have intellectual courage and have a recognized epistemic authority, not simply request or perform an action associated with the "actor" position.

The position of *secondary explorer* captures moves that position people to support the investigation to seek knowledge. This position occurred while maintaining joint exploration. Sergey, the other student, supported the suggested exploration path and refined the offered solution. This position has less authority than primary explorer since the position follows the pathway that was led by the "primary explorer."

Positional shifts often coincided with the redistribution of authority and agency (RQ2). For example, James and Sergey shift from being the primary and secondary explorers to primary knowers and start seeking confirmation in each other once the solution has been tested. Similarly, a student took on a "primary knower uncertain" position while establishing joint exploration and transitioned to explorer positions in maintaining it.

Significance

The three new positions captured the interaction regarding the knowledge building in group work, including how students negotiated shared epistemic agency (Damşa et al., 2010). They offer a way to characterize negotiation moves that are at the heart of authentic collaborative learning, in which knowledge is not solely possessed by an individual but constructed through joint activity. Moreover, the shifts in positions illuminate the redistribution of authority and agency and how joint exploration is established and maintained. This study motivates thinking about the contributions of how teachers, educators, and curriculum designers might design and think about activities in a way that allows students to take on positions of explorers and teachers to redistribute epistemic agency.

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