

Students' Dynamic Framing of Epistemic Agency

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Abstract: Learning environments are socially shared cognitive spaces where students can act as *epistemic agents*. This case study explores how students mutually frame opportunities to enact epistemic agency in a group-based laboratory setting. We show how an undergraduate student group frames epistemic agency within course constraints but maintains ownership of the collective group frame's negotiation and reproduction via individual discursive and active contributions. Results suggest students can maintain a collective group frame of epistemic agency in a learning environment, even when students offer distinct frame contributions.

Theoretical Background and Methodology

Scientific inquiry learning environments allow students to collectively and actively engage in scientific experimentation to generate new knowledge through a socially shared cognitive context. In these contexts, students are meant to act as *epistemic agents*, or “individuals or groups who take, or are granted, responsibility for shaping the knowledge and practice of a community” (Stroupe, 2014). Epistemic agency is thought to exist inseparably between the individual and the utilized mediational means, such as discourse, apparatus, and sociocultural norms (Wertsch, 1993). As learners experience significant shifts in learning environments that now expect greater levels of enacted epistemic agency, it is essential to understand how learners generatively perceive and interpret their learning environment as a shared space to enact their epistemic agency. This study focuses on how students collectively contribute to a group's framing of epistemic agency within a socially shared setting. Specifically, we present a case study of four students engaging in a group-based physics laboratory investigation, exploring their mutual framing of epistemic agency within the course structure's constraints and expectations.

This study focuses on four students, Lacey, Ethan, Mika, and Caroline (pseudonyms), who engaged in an undergraduate introductory physics for life sciences (IPLS) laboratory course. This course's primary learning goal is to productively engage students in complex scientific practices while interacting and sensemaking with interdisciplinary concepts. The course in question emphasizes epistemic agency by: a) giving students freedom to develop their own investigative questions and experimental methods; and b) training teaching and learning assistants (TAs and LAs) to empower students to be epistemic agents in their investigations. The presented data comes from the group's third multi-week investigation in the course; each student previously worked with at least one of their current group members. To investigate students' framing of their epistemic agency through a mediated lens, we employ frame analysis (e.g., Goffman, 1974) to study: a) the discourse and associated action involved in student investigation and how this contributes to the development of a collective group frame in light of larger sociocultural processes; and b) how continuing discourse and action from participating individuals sheds light on their contributions to and changes of the collective group frame. We first sought to identify the collective group frame's outer boundaries and thereafter explore individual student contributions to the group frame (Steinberg, 1998). We note our view that frames exist between individuals, rather than within them individually, with each individual uniquely but mutual-dependently contributing to the collective frame. (Medvedev and Bahktin, 1978).

Dynamics of and Within Collective Group Frame

Via initial introductory material and direction from the TA, the course structure sought to impose a preliminary framing of epistemic agency (e.g., TA: “These are just possible options... we definitely want your groups to come up with something unique and something specific that you want to study.”). The course and instructors “primed” students to frame their investigation as an opportunity to enact epistemic agency without assessment/criticism from TAs/LAs but within the larger course structure (i.e., consistency with scientific topics and experimental apparatus). In response, the group mutually developed a collective group frame within these implicit constraints; for example, through discursive moves, the group explored potential research questions that accounted for the lab's guiding prompts and available apparatus. During this discourse, students incorporated external scientific phenomena that resided outside the course material rather than attempting to unearth and utilize conceptual or procedural information from lab documentation, a common practice in laboratory settings. When interacting with the TA, the group asked clarifying questions about apparatus and course requirements but did not ask for prescriptive steps or affirmation of their methods, suggesting they were framing the learning environment as permitting them to be the main epistemic agents in their experiment. This highlights how the group collectively developed a collective group frame that resided within the course's implicit constraints on epistemic agency.

Though a collective group frame was developed, distinctions between student involvement arose; for example, while Lacey, Caroline, and Ethan engaged in active dialogue to develop potential research questions and experimental plans, Mika asked questions more dependent on other group members' enacted epistemic agency (e.g., "So what's gonna be our [research question]?"). Mika's framing of the group's ability to enact epistemic agency resided within the constraints defined by the course structure and initial introduction and maintained by the group, in that she understood the need for the group to enact its collective epistemic agency to conduct their experiment but seemed reluctant to personally enact her epistemic agency within the group. Though this and other distinctions arose, they did not significantly impact the group's experimental trajectory, instead potentially providing additional opportunities for the group to enact its collective epistemic agency to initiate experimental progress. The discourse resided between Mika and her group members and mutually benefited both parties; Mika gained further understanding of the experimental methods, and the collective group having additional opportunities to enact epistemic agency by discussing experimental details and future progress.

During formal experimentation, additional distinctions arose between group members. For example, Lacey gravitated towards the procedural aspects of experimentation, making decisions on setting up and using experimental apparatus to generate experimental results. In contrast, Ethan consistently brought conceptual topics and questions to the group to explore what conceptual knowledge was necessary to connect their experimental results to external scientific phenomena. These examples suggest that Lacey and Ethan both framed the learning environment as providing significant freedom to enact epistemic agency, though they individually chose how to enact it. Caroline and Mika exhibited more passive perceptions of their opportunities to enact epistemic agency. For example, Caroline framed her role as one of support and revoicing of Ethan's conceptual ideas and Lacey's experimental methods, and Mika frequently asked self-clarifying questions about experimental methods and concepts. Noteworthy in their contributions to the group's experimentation is that, though they did not often enact their own epistemic agency explicitly, they maintained (and even sometimes bolstered) the group's collective epistemic agency. This is in stark contrast to potential alternative outcomes, such as a clash in individual perceptions of the learning environment, which could result in reformation of the collective group frame away from epistemic agency and towards authoritative dependency, as often occurs in laboratory settings.

Discussion

The above vignette shows how a group of undergraduate students in a group-based physics laboratory course developed and maintained a collective group frame that resided within the course's intended framing of epistemic agency, even when students maintained unique roles and individually contributed distinct, and sometimes contested, discourse and action to the collective group frame. These results suggest that students can effectively maintain a collective group frame of epistemic agency and learning within an agentic instructional approach, even with distinct and unaligned individual contributions. This study adds to literature suggesting inquiry-based STEM environments can enhance student enactment of epistemic agency, but results show the nuance of individual distinctions in student contribution to the group's collective framing of epistemic agency (Miller et.al., 2018).

References

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