Learning in a Group, as a Group, and between Groups

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ABSTRACT

Learning in groups is a common feature of science classrooms. The three articles I have chosen to feature in this installment of *Current Insights* reflect recent research of group learning at different scales. The first examines within-group dynamics, identifying interactions among students that allow scientific sense-making discussions to begin and continue. The second proposes to study groups as the unit of analysis, asking why some groups are able to persevere in the face of challenging problems. The third considers the potential for learning to occur between groups, through connections in students' extended social networks. Each brings new ideas and questions to the study of group learning.

Learning in groups is now a common feature of most classrooms. In this installment of *Current Insights*, I bring together three recent articles from outside life sciences education that expand our understanding of how students can learn together.

FEELING SAFE ENOUGH TO SHARE IDEAS

Conlin, L. D., & Scherr, R. E. (2018). Making space to sensemake: Epistemic distancing in small group physics discussions. *Cognition and Instruction*, *36*(4), 401–428. https://doi.org/10.1080/07370008.2018.1496918

Sharing ideas in a group setting can be risky, setting up potential conflict or embarrassment. These feelings can be a real threat to productive group learning. In their research on group learning in college physics, Conlin and Scherr noticed that students often made conversational moves like hedging, joking, or quoting that softened their commitment to their ideas. In this article, they use the term "epistemic distancing" to denote how these moves allow people to personally distance themselves from knowledge claims or critiques, potentially making it easier to share in the first place.

Conlin and Scherr examined the role of epistemic distancing in students' sense-making discussions in a college physics course. Working from more than 2000 hours of group video, the researchers first identified moments when student groups were transitioning into sense-making (beginning to seek mechanistic explanations for physical phenomena). They then chose to closely analyze three groups, focusing on the role of epistemic distancing at two time points: 1) in their very first discussion together and 2) the first time they began collaborative sense-making.

In their results Conlin and Scherr describe various ways in which epistemic distancing can impact the depth of group discussions. Here, I briefly summarize one of the more salient comparisons among the groups studied.

The "green" group's first conversation started off with relatively strong epistemic distancing. Students began interacting by exaggeratedly performing their answers for one another in an ironic mocking of the task. Yet despite the mocking tone, they did actually share their ideas, which, the authors argue, "established a precedent of taking the tutorial seriously, but not too seriously." Later, as the group transitioned into sense-making, instances of epistemic distancing decreased. The students were comfortable enough to present their thinking and engage with one another's ideas.

The "red" group began epistemically "closer" to their claims. For example, one student presented his idea as having "been proven." This appeal to authority closely

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aligned him with the claim. It also functioned to shut down group discussion. It took this group much longer to begin making sense of physics problems. They eventually did so when a new student joined the group and asked, uncertainly, "Are we um, allowed to discuss now?" This move slowed down the group interactions (which were headed toward experimenting without talking first) and made room for group members to begin to offer their own ideas. They did so by hedging ("I dunno, maybe…") and phrasing claims as questions to continue to maintain a safe epistemic distance.

Across the episodes, Conlin and Scherr find evidence that epistemic distancing often helped open up discussion, effectively "making space for sense-making" to begin and continue.

For instructors, this research points to the potential use of epistemic distancing to ease tensions and encourage students to share ideas. Conlin and Scherr's data offer a concrete example of how this might look. In one episode, an instructor began by asking a group, "What happened there?," but then followed up with, "What do you think happened there? Any idea?," subtly making space for students to distance themselves from their responses. The students responded in kind, tentatively offering their ideas and continuing to do so even after the instructor left.

This work builds on a growing understanding that human learning is deeply entangled with emotions. If we expect students to take intellectual risks in group learning, then we need to better understand how they mitigate the social consequences of that risk-taking.

PERSEVERANCE AS A FEATURE OF GROUPS

Sengupta-Irving, T., & Agarwal, P. (2017). Conceptualizing perseverance in problem solving as collective enterprise. *Mathematical Thinking and Learning*, *19*(2), 115–138. https://doi.org/10.1080/10986065.2017.1295417

Across many disciplines, the ability to persist in the face of challenging problems is recognized as a core aspect of disciplinary practice. Part of learning to do science, engineering, or mathematics is learning to tolerate uncertainty and push through difficulty. Typically, the ability to persevere in problem-solving situations is conceptualized as an individual capacity. The authors of this study propose and defend an expanded understanding of perseverance as an emergent characteristic of groups.

Sengupta-Irving and Agarwal argue that learning to persevere at the group level is an important outcome in itself. Given the increasingly collaborative nature of disciplinary practice, collaborative, as opposed to individual, persistence is a more authentic learning goal. They also argue that experience with group-level perseverance can help students value themselves and their peers as capable, creating more equitable and connected learning communities. The authors therefore propose to study "perseverance as a collective enterprise."

The context of their empirical work was a fifth-grade mathematics classroom where they collected data of focal groups solving challenging tasks over a 6-day period. The tasks were chosen because they were "group worthy"—they had multiple entry points and multiple viable solution pathways (Lotan, 2003).[1] The researchers describe and analyze five episodes of group problem-solving, illustrating problem solving with and without perseverance and perseverance as a collective or divided enterprise. The authors highlight three main contributions of this work.

First, the authors identify and describe "productive struggle," which is necessary for perseverance. When students come to a quick consensus on an answer, there is no struggle and no perseverance. When students are completely stuck, their struggle can become unproductive. Struggle is productive when it "stimulates collective mathematical activity." By tracking various forms of struggle in these groups, the authors identified empirical markers of productive struggle: conflicts over solutions, declarations of uncertainty, critiques of strategy elegance or efficiency, and attempts to clarify the task. These specific markers can help researchers and teachers recognize productive struggle.

Second, the authors show that productive struggle, while necessary for collective perseverance, is not sufficient. It is possible for groups to resolve struggle without functioning as a cohesive group. Sengupta-Irving and Agarwal propose two additional features of learning environments that can support perseverance as a collective enterprise. These are 1) shared norms that hold individuals accountable to their groups and 2) teacher moves that support and sustain group interaction.

Finally, simply having empirical examples that feature children listening to one another, engaging with one another's ideas, and making progress on difficult mathematics problems *together* is a useful contribution. In a culture of education that prioritizes individual performance, Sengupta-Irving and Agarwal argue that constructs like "perseverance as a collective enterprise" remind us that there are other ways to conceptualize learning and that having these concepts in mind can impact what teachers notice and value as well as what researchers study.

LEARNING FROM INTERGROUP CONNECTIONS

Rienties, B., & Tempelaar, D. (2018). Turning groups inside out: A social network perspective. *Journal of the Learning Sciences*, *27*(4), 550–579. https://doi.org/10.1080/10508406.2017.1398652

In classrooms, instructors organize students into groups in the hopes that students will form connections that improve their learning. They do this knowing that students' social networks outside the classroom are considerably more vast. In this article, Rienties and Tempelaar investigate how social connections *between* formal school groups (intergroup relations) impact academic performance.

The authors hypothesized that intergroup relations might be beneficial for several reasons. First, students tend to have quantitatively more intergroup relations than intragroup relations. Second, these connections may be more established and therefore may more effectively support learning. Finally, because different groups may approach problems differently, intergroup connections may be a source of innovation and creativity.

To explore these ideas, the authors collected data from 693 undergraduate and postgraduate participants from a business school in England. During the 11-week study, participants worked in small groups (average group size = 5.24) on authentic tasks. The researchers collected information on each individual's social network and academic performance, as well as other demographic variables. Social networks

[1]Lotan, R. A. (2003). Group-worthy tasks. *Educational Leadership, 60*(6), 72–75.

were constructed using self-reported identification of three relationship types: friends, working, or learning. More specifically, learning relationships were defined by the statement "I have learned a lot from…" Measures of academic performance included exam scores and overall grade point average (GPA). The researchers also collected information on gender and cultural identifiers.

Rienties and Tempelaar compared the structure of students' initial social networks with their networks after the 11-week unit. They then used structural equation modeling (SEM) to examine correlations between social network properties and academic performance, taking into account the effects of gender and cultural variables.

Over the 11 weeks, students made more intragroup learning connections. At the same time, intergroup learning connections remained constant or increased slightly. For the majority of students, intergroup learning connections outnumbered intragroup learning connections both at the beginning and end of the 11-week unit.

The SEM analysis found that measures of academic performance, both grades and GPA, were positively correlated with proportion of intergroup learning connections at the end of the unit. This result is somewhat surprising, as it suggests that more connections across groups, not within the groups they had been working with for 11 weeks, were related to academic success. From this, the authors conclude that researchers have underestimated the impact of learning from one's extended social network.

Rienties and Tempelaar point to several limitations of this work. First, they note that this analysis relies only on quantitative measures of connection and says nothing about the quality of these relationships. Second, it is not clear to what extent the group tasks were actually group worthy—did the tasks provoke collaborative discussion or were students simply working in parallel together? Finally, depending on the nature of the assessments, it is not clear that final grades or GPA are good measures of disciplinary learning.

Despite these limitations, this work sheds light on intergroup learning as a phenomenon to study. Rienties and Tempelaar call for more research that pairs social network analyses with "deep, qualitative analyses" in order to better understand the nature of learning that students identified in their social networks.

CROSS-STUDY CONNECTIONS

Reading these articles together raises some interesting questions. Can epistemic distancing promote collective perseverance? Readers might look for markers of epistemic distancing in the cases presented by Sengupta-Irving and Agarwal or for evidence of productive struggle and perseverance in the cases presented by Conlin and Scherr. Are intergroup learning connections qualitatively different from intragroup connections? Future research might investigate how people build trust in various group relationships and how the nature of those connections influences the depth of learning together that is made possible.