Hearing All Voices to Promote Learning Orientation and Effective Collaboration

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Motivation and collaboration intersect in important ways in a science classroom. One important motivational component of collaborative work is what students understand the goal of that work to be (Ames 1992). When students feel they are competing, especially within their own groups, to get the highest grade, complete the task fastest, or show that they are smart (*ego orientation*), they can view collaboration as an impediment to those goals and show less willingness to cooperate (Rogat and Linnenbrink-Garcia 2019). A high-achieving student might take control to ensure that her group's product shines and reflects well upon her—but then gets

frustrated feeling like she's "doing all the work." Another student who lacks confidence might use the collaboration to skate by, making small contributions to avoid the group's wrath but not otherwise challenging himself. By contrast, if teachers can cultivate a *learning orientation* such that developing deeper understanding is the goal, students work more effectively in teams (Hijzen, Boekarts, and Vedder 2017). Collaboration becomes an essential tool for three-dimensional science learning because diverse perspectives, ideas, and approaches all contribute to making sense of phenomena and solving problems (Table 1).

We are part of a team of teachers and researchers across multiple states who co-designed a professional learning experience called M-PLANS to translate motivation research into classroom strategies for science teachers. After learning about instructional design principles for supporting student motivation, middle school science teachers tried implementing new strategies in their classrooms. Our first analysis of teaching practices focused on learning orientation (Liu et al. 2023). We found that students perceived stronger learning orientation messaging when teachers created a positive social climate focused on science learning and used strategies to support all students' participation and collaboration. This varied not just across different teachers' classrooms but also *by lesson*; on days when a teacher used more supportive social structures, students perceived a greater emphasis on learning orientation that day compared with other days. This suggests that promoting a learning orientation can help students collaborate more effectively, and collaboration can help students perceive a learning orientation.

Even as students' perception of the learning orientation environment in a classroom might vary from day to day, the study also highlighted the importance of teachers developing structures for collaboration to revisit and draw on throughout the school year. These structures work best when established at the beginning of the year using the very collaborative processes

that they will go on to support. In particular, involving every student in building these classroom structures is crucial to setting the tone early on that this science class embraces a learning orientation in which the ideas of every community member are valued, rather than only those of the smartest, loudest, or quickest. In the next section, two teachers who helped co-design M-PLANS share how they use student collaboration to establish foundational structures for a positive classroom community that, in turn, reaps continuous rewards by providing students with a safe environment in which to collaborate in scientific sense-making.

Collaborating to build a circle of trust

Developing a positive social climate at the start of a school year is key to the student buy-in that will support effective collaboration throughout the year. I (Colwell-Johnson) have learned that students want to be part of developing classroom norms, but only if those norms are authentic. To help develop a community of collaboration and autonomy, it can't just be a list of "rules." Middle school students are wise enough to know the rules are generally the same in every class. My idea to make norm-setting an authentic exercise came from the movie *Meet the Parents*, where the father tells his son-in-law to stay inside the family's "circle of trust" and warns when certain behaviors threaten to put him outside the circle by violating that trust. Though used for comic effect in the movie, I wondered what a circle of trust might look like in my class, not just for student behaviors but for mine as well. Being inclusive means thinking about all stakeholders in the classroom community.

I start by having students list all the negative teacher behaviors that have made them feel uncomfortable or miserable in the past. They then list student behaviors that have likewise made

them–or their teacher—uncomfortable. Finally, they list positive teacher and student behaviors that have made them feel comfortable and included.

Students generate these initial lists individually. Everyone has a voice and is expected to write at least one response for each prompt. Students then share their lists with their table group—generally three or four people. Conversations start naturally because they have a common language about what they do and don't like about teachers' and other students' behavior. I give the groups sticky notes and direct them to record one idea per sticky. They add a "T" for teacher behaviors and an "S" for students. I draw a big circle on the whiteboard and students post their notes according to whether the behavior is *favorable* and belongs inside the circle or *not nice* and belongs outside the circle. Now, thinking is visible to all of our class stakeholders.

I read all of the sticky notes aloud to the class. I see a lot of head nodding and hear murmurs of agreement as I go through them. Sometimes we have to weed out the ones that aren't reasonable for a classroom focused on learning. For example, someone always puts in the circle that the teacher should never give tests and should pass out candy every day. We talk about whether that is something that students have realistically experienced in past classes and whether that makes sense if the goal is to help students learn science. We still discuss it, because there is validation in being heard, but there is a collaborative decision as to what is reasonable for all parties involved.

Whenever I have done this, there end up being far fewer notes outside the circle than in. Inside the circle is the heart of the classroom community. Students want teachers to treat them with kindness. They want to be heard. They want their teachers to treat them fairly and with respect. Equally, if not more important, students desire all of those things from each other. I take

the notes from all my classes, make a giant circle with all the agreed-on reasonable ideas for positive behaviors inside the circle and negative examples outside the circle, and post it at the front of my room (Figure 1). Throughout the year, anyone can reference it to say, “Is what you are doing inside or outside of the circle right now?” The physical presence of these community norms supports our collaborative learning throughout the year.

In establishing this common set of desired behaviors, students practice the collaborative structures that I continue to use with them throughout the year, such as think-pair-share in their table groups as well as whole-class discussion and consensus-building. These structures foster collaboration and convey a learning orientation to students by valuing everyone’s input in our scientific sense-making, not allowing certain voices to dominate while others hide.

Using the Driving Question Board to promote collaborative participation

Integrating a Driving Question Board (DQB) in the classroom has helped me (Taylor) produce different patterns of participation and students building off each others’ ideas to create a classroom community that embraces diverse questions as part of individual, group, and whole-class sense-making. I used to pose a question and get five or six students to raise their hands, then solicit answers from one or two of the volunteers. I followed this format for a while until I realized that it was not telling me what the other 98% of students thought about a concept or question. The DQB was a game changer. Instead of focusing on answers, students are now focused on formulating questions, which allows for different kinds of science-based interactions between them. Instead of dividing the class into the “usual hands” (who might become competitive trying to be the first with the correct answer) and the “quiet kids” (who might just be trying to avoid drawing attention to themselves), the DQB involves all students in asking and answering questions—their own, and each other’s—as we work to make sense of a phenomenon.

I introduce the DQB at the end of the first lesson in the IQWST unit "How Can I Make New Stuff from Old Stuff?" (Activate Learning 2019). In the first lesson, students experience the anchoring phenomenon by placing loosely crumpled aluminum foil in copper chloride solution to cause what they will later learn is a chemical reaction: The substances change color and give off heat as they transform into copper metal and aluminum chloride. I have students generate questions about the phenomenon and write one question per sticky note. Then, every student selects at least one of their questions to read aloud to the class before placing it on the DQB. I emphasize that it does not matter if there are duplicate questions, but that everyone will share a question.

My initial attempt at this led to the first time in my more than 15 years of teaching that I had 100% student participation. No student balked at having to share. Students actively listened to each other and were able to identify duplicate questions that could be placed alongside each other on the DQB. Some students had multiple questions that they wanted to add to the board. I remember thinking, *This is what student engagement looks like.* It felt great!

This introduction to the DQB sets an important foundation for our work. We continue to revisit the DQB throughout the unit, with students reflecting on their learning by adding new questions or sharing observations related to existing questions that they or their classmates have previously posted. When we are able to give a scientific explanation for a question, we celebrate the moment and move the question off the DQB into a separate container. I tell the students not to worry about running out of questions—there are always more being added by students as their understanding deepens and they realize that there is still more to learn. I make sticky notes available even when it is not a designated class activity, and sometimes students go up and add questions to the board on their own or when they have been working in groups and cannot

resolve something. I only require that students read the question aloud to the class before posting it, so that we can all consider the question as part of our ongoing sense-making (Figure 2).

I have found that the DQB supports more equitable student participation and gives me more real-time data for formative assessment. Giving every student a voice supports the sharing of diverse opinions and ideas, or the same ideas expressed in different ways, as students make meaning from their activities and observations. This promotes collaboration and a learning orientation by valuing students' questions and the work they do together to try to answer them over quick "textbook" answers.

Conclusion

Cultivating effective collaboration among middle schoolers requires more than putting students in groups and telling them to work together. Foundational activities like Colwell-Johnson's "circle of trust" norm-setting and Taylor's introduction to the DQB establish core structures for collaboration and convey a learning orientation by modeling the importance of hearing from all classroom community members instead of implicitly pitting students against each other through competitive participation structures. Taken together, the two practices also highlight the important intersection and reciprocity between collaboration and learning orientation. Authentic, collaboratively identified classroom norms are vital for a "next-generation classroom culture" in which students feel safe sharing their ideas in pursuit of deeper understanding (Krist et al. 2016). The DQB normalizes questions as a vital part of sense-making rather than a sign of struggle or incompetence and demonstrates the importance of collaborating to bring diverse questions and ideas together to build scientific knowledge (Schwarz, Passmore,

and Reiser 2017). Research has suggested that these practices leave an impression on students and matter for effective collaboration in science.

More information and free tools for integrating learning orientation and other motivation design principles into *NGSS* instruction can be found at https://m-plans.org.

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TABLE 1: Learning versus ego orientation in a science classroom.

FIGURE 1: Colwell-Johnson's sample sticky notes and circle of trust community norms poster.

FIGURE 2: Taylor's Driving Question Board.

Table 1.
Learning vs. ego orientation in a science classroom

	Learning orientation	**Ego orientation**
Goal	Three-dimensional science learning	Look smart or avoid looking incompetent
Typical behaviors	Embrace challenge as learning opportunity Use deeper learning strategies	Avoid challenges (risk of failure) Seek quickest path to good grade
Effect on collaboration	Value collaboration for joint sense-making about phenomena and solving problems	Take over the group Hide behind group

Figure 1.
Colwell-Johnson's sample sticky notes and circle of trust community norms poster

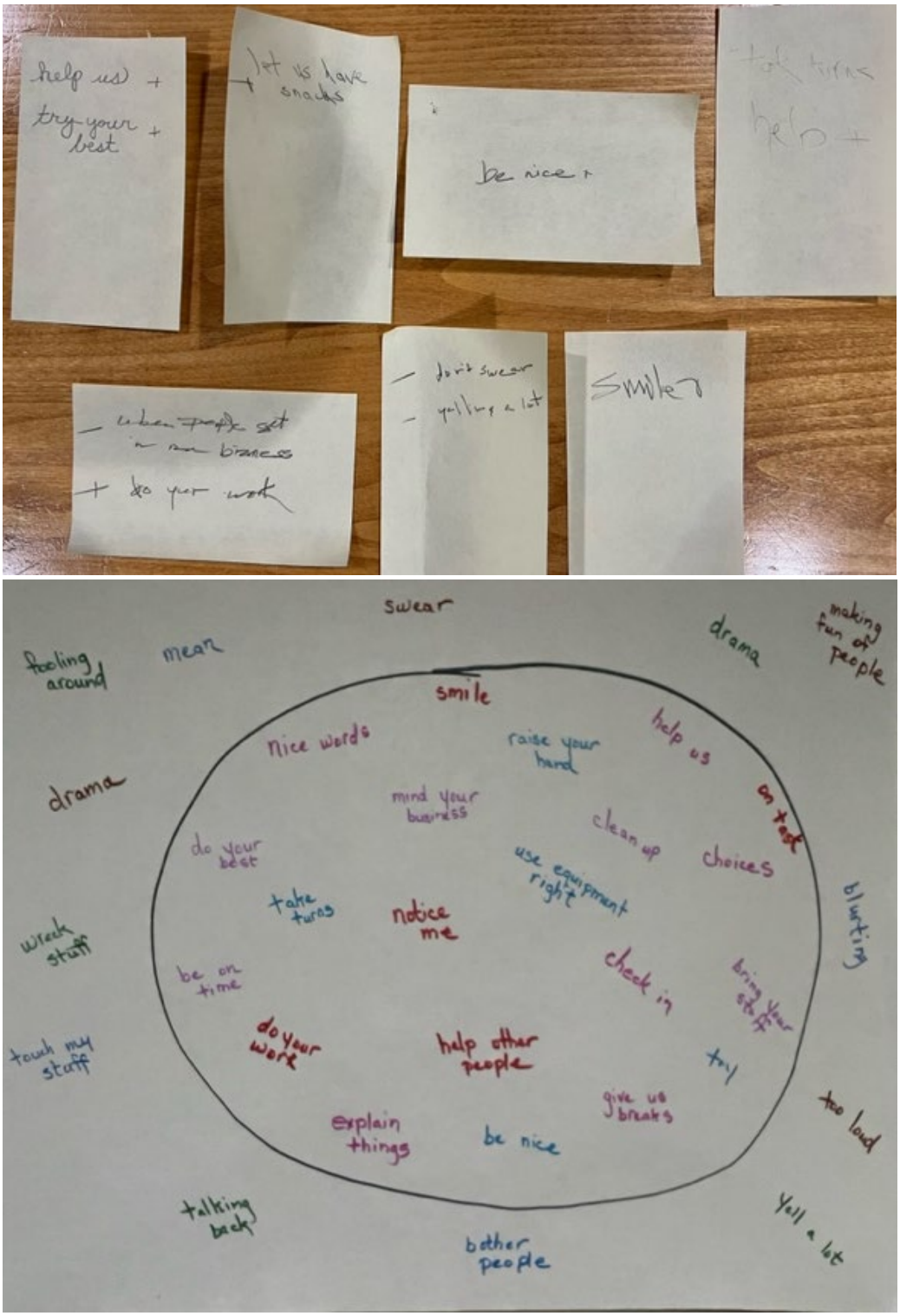

Figure 2.
Taylor's Driving Question Board