Discourse Tools Amplify Students' Ideas and Build Knowledge

By Emily Miller and Tyson Brown

Scientists engage in academic discourse to thoughtfully share, consider, and evaluate each other's ideas about natural events that happen in the world. This article describes a lesson in which the teacher uses discourse tools from WIDA (*https://wida.wisc.edu*) to support second-grade students in the language-rich practice of argumentation. The lesson is part of a project-based learning unit that integrates the *Next Generation Science Standards* (*NGSS*) and the *Common Core State Standards* based on the driving question, "How are all living things the same?" Students had to argue from evidence that there are patterns of survival for all organisms, using the class' mealworms, guinea pigs, and later, bean plants as focal organisms.

Our team developed this tool with Wisconsin Center for Educational Research's (WIDA) program, with support from a NSF grant. We have found this approach to discourse and the accompanying tool helpful and want to share it with a wider audience interested in equity in science for ELs. The teacher perspective in the theory-meets-practice-world is often secondary, especially with respect to education for bilingual students. In this article, we present the story of discourse tools and the approach to implementation as it is co-developed by the teacher who is integrally informing research-based design.

BACKGROUND ON DISCOURSE TOOLS

Student discourse can be leveraged to engage all students when students are in pairs, small- or whole-class groups, or on their own during classroom activity. It is essential that students engage in academic discourse, the deeper sense-making around an academic topic in their classroom setting, especially if they are to acquire English and facility in the language of a discipline, such as science. Discourse tools can help students clarify their thinking and build students' shared science knowledge through academic discourse. Discourse tools are used by the teachers during whole-class discussion, although they can be explicitly taught to students and reinforced and integrated in student-led discussion.

During academic discourse, students may express ideas that are incorrect. To make sense of a phenomenon, each student builds on their experiences and intellectual resources, and so ideas may seem reasonable to them but be canonically incorrect. Teachers can have a hard time responding to such ideas, knowing that it makes sense to the student. The class benefits from considering and evaluating each idea and doing the heavy cognitive lift of soliciting evidence to discard it while validating the student's sense-making. In addition, the class endeavor of careful consideration of this "wrong" idea is invaluable to the student who offered the idea! He or she has the opportunity to be viewed as a productive member of the classroom community. Thus, discourse tools are useful to support a *sense-making* stance in which the teacher considers each idea to be valuable.

Discourse tools are equitable when every student idea offered is

Students participate in a classroom discussion about living things.

considered as potential material for the final knowledge product (e.g., the shared model, an agreed-upon explanation, or analysis of data). As a result, the teacher's work is not guiding students toward the right answer. Instead, through teacher support of discourse, the class learns to consider each other's ideas and experiences equitably, and then privileges evidence to evaluate the ideas in a respectful and transparent way within the classroom community.

Equitable discourse tools start with the premise that the teacher will do *something* with each idea. The tools simply offer a set of actionable choices for collective use of the idea: "help students listen carefully to another student's idea," "help students deepen their reasoning," or "help students clarify their idea." The tools are broadly defined but without the scripting of phrases, which can sometimes feel like a checklist, rather than authentic action. In this way, the teacher uses the idea to motivate discussion among students and deepen learning of the phenomenon. Stu-

dents, in turn, offer *more* ideas because they do not have to be concerned with presenting an incorrect idea. As such equitable discourse reflects *NGSS* vision by engaging students in student-centered sense-making to explain or predict a phenomenon or solve a problem. Equitable discourse draws on *Common Core* ELA standards by engaging students in adopting others' perspectives and supporting ideas with reasoning and evidence.

ECOLOGICAL CLASSROOMS

Consider a classroom where ideas presented by students are thought of as useful to others in the room. Ideas are like tools, they have affordance for building something important to the community. A classroom system provides rich affordances from students' ideas. Student discourse shapes and re-shapes the knowledge being built. Using the perspective of affordances gives new insight into how to support ELs. When we focus on the idea's usefulness for shared sense-making and science endeavor, rather than the correctness of the ut-

terance or the correctness of the idea, there is an authentic reason to share and be heard.

Equitable discourse uses an ecological perspective toward discourse. In ecology, each component of an ecosystem, such as a forest, offers multiple affordances or possibilities for action within the system. Take, for example, a tree in the forest that has fallen over because of wind. The fallen log offers opportunities for use in the ecological system. It could be used by a mammal, say a raccoon, for shelter, and insects will consume the rotting log. Fungi, including colorful mushrooms and toadstools, grow on the log and turn the log into soil, which provides nutrients for plants. Similarly, in a classroom, student ideas may have multiple affordances and enrich the ecology of the classroom and promote learning.

DISCOURSE TOOLS IN ACTION

The following vignette illustrates an interactive, meaning-focused second-grade

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Discourse tools in English and Spanish.

science lesson in Ms. Lozano's classroom. It also demonstrates how teachers and students can use supports to reason effectively together, even with students who are developing English. The lesson highlights how the supports and strategies easily and naturally fit into this science classroom discussion. Notice how the tools help the teacher respond to students' ideas. The tools are not phrases to memorize and check off, but rather drive possibilities for use.

Note, not all of the discourse tools need to be employed during discussion. Sometimes teachers focus on using one tool at a time. They may seek to use a tool that they find they employ less automatically to increase their repertoire for supporting equitable discussion.

Ms. Lozano's second-grade students know a lot about the class guinea pig, Squeaky. Even Mai and Axel, her two newcomers, could talk in English about Squeaky's behavior and his daily needs. The 17 students had taken photos and then recorded simple observations and questions they had about Squeaky. One stated, "Squeaky likes cilantro," and another asked, "Does Squeaky like music?"

The students had been observing mealworms for two weeks, and Ms. Lozano decided to use their extensive guinea pig knowledge. She gathered the students together on the carpet. Ms. Lozano began her discussion by silently placing pictures on the floor, one of a student, Isaac; one of the guinea pig; and one of a mealworm. The teacher checked with Isaac, "Do you need water? Do you need food?" And she placed a picture of water and another of the class snack that day, cheese crackers, next to Isaac's photo. Isaac enjoyed being part of the example. Ms. Lozano asked her students to bring out something from the cage that Squeaky needed to live. Another student,

Tom, was selected to participate in the activity and pulled out a carrot. The teacher then placed a carrot picture next to the guinea pig saying, "Squeaky needs food." Next, second-grade student Mai showed the class the water bottle from Squeaky's cage and she said, "Squeaky needs water."

"People need water. The guinea pig needs water, and he gets water from the water bottle. Do you think mealworms need water, too?" Ms. Lozano pointed to the picture of the mealworm, paused, and then repeated the question.

1. Help Students Deepen Their Reasoning
Pao answered quickly and definitively, "No, they don't need water." Ms. Lozano pressed for more information: "Why do you say that?" Pao said, "These don't have any water in there." Ms. Lozano held up the mealworm container, so all of the students could see inside.

2. Help Students Listen Carefully and Think About One Another's Idea
Together the class wrote down and stated everything in the mealworms' container: oats, carrots, and cardboard. Pao peered inside again, demanding, "Do you see water? No."

Alvin didn't agree, "Yes, they do! All living things need water to drink. Or else they die." Ms. Lozano waited, and then said, "Can you say more about that? Can anyone build on Alvin's words?"

3. Help Students Apply Their Thinking to Others' Ideas
Nevaeh said, "Animals and plants die with no water. There was this plant that we had. And it didn't get water for a while and died. If our mealworms didn't have water already they would all be dead." Some of the

students were impressed. They whispered, "Evidence!"

Pao thought this made sense, but was unsure how to resolve the issue of no water in the container, suggesting, "They can get water from the river." Ms. Lozano said, "Did you take the mealworms to the river?" Pao shook her head.

4. Help Students Deepen Their Reasoning
Isabella helped out, "Maybe at the beach." Lilia didn't agree, "It would take them days and days and days, and they wouldn't like it at the beach. The beach is really cold and sometimes hot." Miguel added, "We didn't take them to the beach!"

Ms. Lozano kept the discussions respectful, and often asked the students to repeat or rephrase what another student had said. For instance, she asked Seleti to repeat what Miguel had said.

5. Make Ideas Public
Seleti said, "Miguel said they did not get water from the beach because we didn't go there." Ms. Lozano checked with Miguel, "Was that right, Miguel?" He nodded and smiled.

Ms. Lozano checked for consensus that all living things need water. After a turn and talk, students agreed on this point.

6. Emphasize a Particular Idea
Ms. Lozano passed out sentence strips, and asked, "Where do the mealworms get their water?" She assigned partners to look in the mealworm containers on the tables and write down their claims on the sentence strips in words or pictures. She gave one member of each group a "What's your evidence?" popsicle stick. That person was responsible for making sure they all used evidence in their claims.

7. Help Students Apply Their Thinking to Others' Ideas

Kurt said to his group of four, "They don't have water in the container, but they have to have water. Maybe they got it in the carrot. They eat the carrot, but they can get water, too. They can get the water in the juice." Axel held up his evidence Popsicle stick, "What's your evidence?" Kurt shook his head, but Lilia answered, "There is juice in the carrot. Juice is kind of like water; it's like a different type of water. That is the where they get the water, in the carrot." Jal said, "I don't get what you're saying." Lilia took out a carrot to show the group. She scraped at it with her fingernail to show the moisture. "See, water." She said, "Juice water."

CONCLUSION

The classroom knowledge-building system is similar to the ecological system in that the richness of the system comes from the different possibilities the components offer. In the vignette, some ideas seem off track. But from a sense-making stance, they are important additions to the collaborative sense-making work. The discourse tools help the community be persistent with making sense, and through focusing effort on making use of ideas, they open spaces for equity in the discourse of knowledge-building. ●

Emily Miller (*emilycatherine329@gmail.com*) is a senior researcher and bilingual science specialist at CREATE for STEM in East Lansing, Michigan. **Tyson Brown** is an editorial director at National G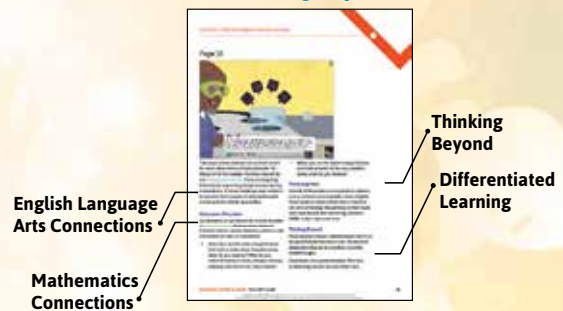eographic Society in Washington, D.C.