

Whiteboarding Your Way to Great Student Discussions

by David Henry, Julie Henry, and Stephanie Riddoch

Group learning has been embraced by many middle school teachers as a critical component of teaching and learning about science. Teachers have developed techniques to facilitate group learning, but sometimes wish for a better method to keep students on task, allow the teacher to track the progress of individual groups, and promote higher-level thinking and discussion. We have found that large dry erase boards, sometimes called *whiteboards*, are a powerful tool for facilitating discussion within groups of students. When each group receives a large whiteboard and specific instructions about how to use the board to record their thinking, we have found that students' discussions are more animated, on topic, and demonstrate higher-level thinking.

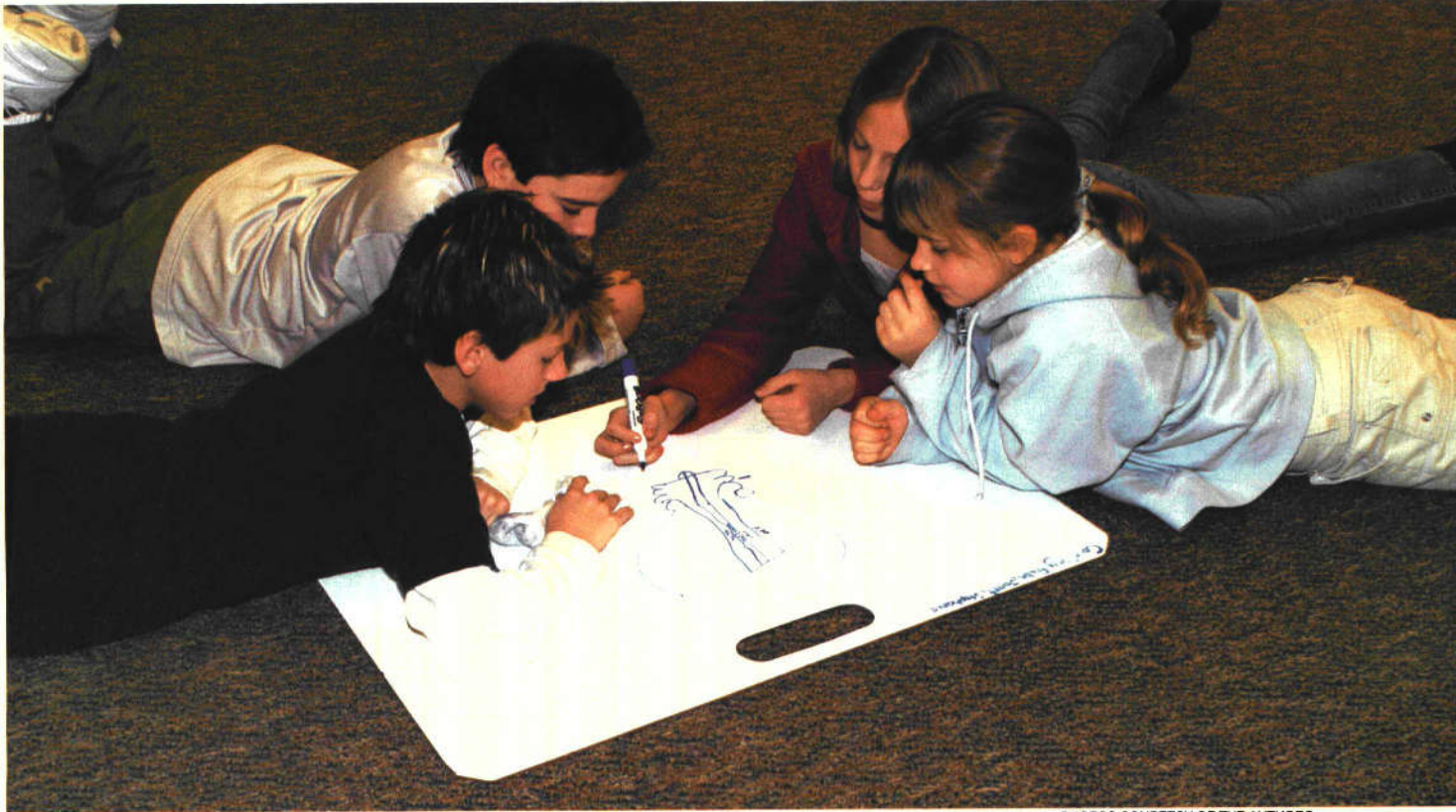
When students share ideas in groups, they are practicing one of the key elements of science—communicating scientific ideas. NSES Teaching Standard B reminds us that teachers should “orchestrate discourse among students about scientific ideas” (NRC 1996). This is the central purpose of whiteboarding.

Examples for use of whiteboards

We use whiteboards when we want students to share their thinking and come to a consensus about an idea. Groups of three to five students can gather around a whiteboard, share ideas, and take turns recording the group's ideas on the board. The teacher should pose interesting questions or tasks. It often helps to have students write down their ideas individually before coming together as a group with the whiteboard. The teacher can instruct students to collaborate as a team or perhaps to take turns being the discussion leader, fact-checker, illustrator, or scribe. At the beginning of a unit,

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whiteboarding is effective in eliciting students' prior knowledge. For example, in a unit on electricity, students can be asked to write down the conditions they think are necessary for a lightbulb to light. After an experiment, whiteboards help students draw conclusions from data.

Most importantly, the whiteboards create an atmosphere in the classroom where ideas are student-generated, leading to students constructing their own evidence-based knowledge.

At the conclusion of a unit on batteries and bulbs, we engaged our students in an open-ended activity using

whiteboards. Through earlier experiences, students had developed understanding of how a simple, single-filament lightbulb is constructed. On this day, a three-way lamp was demonstrated for students, showing low, medium, high, and off. The guiding question given to students was, "How do you think a three-way lightbulb is constructed?" They were instructed to answer this question using their prior knowledge about single-filament bulbs and to draw a diagram of the inside of the three-way bulb and label the different parts. Students worked in groups of three or four and were given 20 minutes to complete their whiteboard. This activity is documented in the photographs accompanying this article. During the whiteboarding activity, the teacher circulated throughout the room giving encouragement, clarification, and guidance to the groups. After the whiteboard discussions, students were motivated to make confirming or contradicting observations of the three-way bulb in the subsequent activities.

Benefits of whiteboards

When students see their thoughts or another student's thoughts in writing, the ideas become more concrete. Students are more likely to develop a critical opinion about the ideas, to agree and disagree. Many teachers currently have smaller whiteboards in the classroom, usually about one square foot. While these small boards have many uses,

Guidelines for using large whiteboards in your classroom

- Model the expected group behavior
- Give clear, specific guiding questions for inquiry
- Demonstrate how you want the whiteboard divided, but avoid dividing by person
- Give plenty of space to the groups as they work
- Give two or more colors to each group
- Circulate and assist all groups
- Allow time for group sharing and closure (at least 10 minutes)

we have found that they are not adequate to facilitate group discussion. The large size has many advantages. Students tend to write larger on the large boards, making it easier for all members of the group to participate. This larger size also lets the teacher quickly see and understand the group's thinking and give the group feedback. A large board also gives enough room for students to divide the board into sections. This is valuable if you have multiple focus questions, or if you want students to have both a diagram and a written explanation. Another benefit is that the work can be large enough to share with the whole class during discussions.

A whiteboard is different from a piece of chart paper in that the work can be easily modified as students' ideas emerge and are refined through discussion. The ease of modification means that students may be willing to write or draw something that they are not quite sure of and expose it to group discussion and possible revision. We have observed that students' ideas are more easily exposed, discussed, accepted, discarded, and modified with the flexibility of a whiteboard. If teachers need to assess the work on the whiteboard, these images can remain on the whiteboards for later analysis, captured through digital photos, or copied onto paper to be handed in. Individual work before and after whiteboard work can also be assessed.

What are whiteboards?

The large whiteboards we use are 24" × 32" and are cut from a 4' × 8' sheet of white economy tile board. Our local building supply store sold the sheets for about \$10 and made the cuts for us. We also cut handles in the top and rounded the corners of each board with a jigsaw and band saw. (See Resources for more detailed directions on construction and other sources for whiteboards.) Use the boards as you would use any dry erase surface. All dry erase markers and cleaners will work on these boards. We recommend the low odor markers available in bulk for about \$1 each. Bold colors like black, red, green, and blue are the easiest to read. If each group has four colors, then the group can use color to add another dimension to their work by emphasizing different ideas or parts of their diagrams. Make sure to remind students to replace caps when the markers

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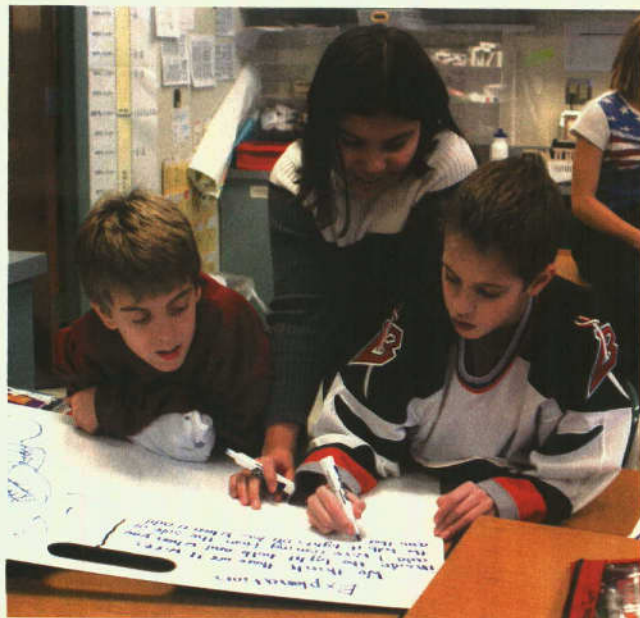
are not in use. White socks work great as erasers and can also store the markers.

Making whiteboards work for you

As with any new teaching technique, students must be introduced to this method of group work. When we introduce whiteboards to a class, we first model the group dynamic for the entire class. We invite a few volunteers to the center of the room and have them engage in a discussion using the whiteboard. At different points, we ask the models to "freeze" and show the class how the group is working together to determine what goes on the board. This modeling is needed periodically as a

reminder of how groups should work together. An emphasis should be put on listening skills, critically thinking about another student's idea, and patience in explaining one's own ideas. The first few times that students are asked to use whiteboards, the teacher should model the kinds of things that might appear on the board in response to a particular prompt (bullet points, diagrams, concept webs, and so on).

You may need to rearrange the classroom space to accommodate the whiteboards so that students can share the responsibility for writing. Three to five students can col-





laborate comfortably around one whiteboard lying flat on a table, desk, or on the floor. It is often helpful to divide the whiteboard into reasonable sections. Initially, students may want to divide the board so that each group member gets a square. In such instances, we spend a little time with the group to help them appreciate the importance of discussing one another's ideas and coming to a consensus if possible. This is a great opportunity to help students with their communication skills. Redirecting students and suggesting better divisions, such as including tables, diagrams, and explanations, may also help students focus on group, instead of individual, ideas as a developing community of scientists.

When students are working, scaffolding is needed to get students to improve their ability to focus, discuss, and share ideas on the board. *Scaffolding* means that the teacher pays close attention to what students are able to do independently and provides carefully constructed instructional supports to help students become more capable in their learning. One way that scaffolding can be used with whiteboards is to provide more specific guiding questions. Students can also be taught to share their ideas succinctly, to listen carefully to other's ideas, to look for commonalities, to talk through differences of opinion, and to represent consensus ideas on the boards. Teachers may find it helpful to list this sequence on a chart and to cue students to follow the sequence while they refine their group skills. As students become more skilled in a particular technique, the teacher can withdraw the supports and allow students more independence. Whiteboards become a tool in the scaffolding process, as the teacher can easily see what all the groups are doing and determine if more clarification is needed. When the groups are working on their whiteboards, the

teacher's role is to act as facilitator by asking questions, probing for more detail if it is needed, and encouraging creative, novel ideas. Teachers should be careful not to get stuck helping one group as it is important to be available for brief exchanges with all of the groups. As teachers circulate and observe students' responses, they should feel free to stop the entire class and provide more guidance or structure as needed.

Sharing whiteboards

After groups have completed their boards, the boards should be shared with the rest of the class, facilitating whole-class discussion, understanding, and closure. This can take place in many ways.

- **Museum walk:** Students silently walk from board to board to get a chance to see everyone's work. Then the teacher leads a discussion about what they noticed.
- **The circle:** Students form a circle where all groups hold their boards for the others to see. This allows all students to see all the boards at once. This technique creates an atmosphere that encourages discussion between groups. The teacher should avoid being the center of attention and stand on the outside of the circle. Allow students to ask and answer each other's questions without teacher intervention. The exchange can get quite dynamic if the teacher does not jump in to provide the right answer or to resolve discrepant explanations.
- **Presentations:** Groups take turns presenting their board to the rest of the class. Each group displays their board, briefly explains their thinking, and answers questions from the rest of the class (see photograph above).

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References

National Research Council (NRC). 1996. *National science education standards*. Washington, DC: National Academy Press.

Resources

How to construct and care for whiteboards—<http://epc.uncg.edu/resources/howto/whiteboards.html>

Whiteboarding in the classroom—<http://physicsed.buffalostate.edu/>

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