

Ways to Improve Whiteboarding

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[Greg's update in Sept. 2000:

1. I would add circle whiteboarding (whiteboarding in the round) as an option for doing a worksheet where kids seem to have it pretty well understood or if you want to do a quickie.
2. I would set up a pole at each lab table with a pendulum clamp on the pole. Hang the boards and have students quickly present their solution. Again, this breaks up the pace. It also works for deployment labs or smaller activities.
3. Keep the kids on their toes. Whiteboard of the week is my #1 tool to keep interest up. I take digital pictures of the group and their board -- works great.]

Whiteboarding consists of 3 main parts:

- The whiteboard itself
- The presentation and defense in the face of peer scrutiny (not teacher scrutiny - we are not peers of students, are we?)
- The scrutinizing by peers in the form of audience questions

In my first year of whiteboarding I ran into some problems that I found were common to other "rookies". These were:

- Visual quality declined as the year progressed
- Equality in presentations declined (1 student would not participate in presentations)
- Apathy toward the process (due to monotony)
- Students consistently did not ask questions

The following are a number of field-tested methods that I employ during the year to improve whiteboarding, thus increasing the quality of scientific discourse, which results in greater comprehension of physics by students. The most effective strategies are listed first.

Ways to improve presentations and questioning

#1: Whiteboard on Whiteboarding

Early in the year, after a couple of whiteboards have been done, have students whiteboard (WB) about what makes a good WB presentation. Also have them do a WB on what the audience should do and what kind of questions could be asked. Usually students come up with a few ideas about question types, and I summarize all classes and report on it the next day. This allows me to make sure that we have all the types of questions I want to see! I divide the question types into 4 categories: Clarity, Helping, Quiz, and Expand the Ideas. I post these results as banners at the front of the room, above the chalkboard, to remind questioners of what they could ask. I post the presenter results in the back of the room as a reminder to them.

#2: Whiteboard of the Week

I select the best WB, write up a little review of it (a la Siskel and Ebert), post the review with names of the presenters on the board, and put it on the "WB Wall of Fame". I give each student a copy of the review to take home. I plan to incorporate a digital camera so I can take a picture of the group and their board to post in the room or the trophy case outside our room in the hall. Kids love it. I leave the board in a special place in the room for all to see on a daily basis for the week.

It also motivates and helps others to see what is good quality work and presentation. Not just pretty boards get acclaim - also great defenses of the work.

#3: Student Evaluations

This was a tough argument at the modeling workshop in River Falls. Do we or don't we? Do the scores count for something? I don't know. I am hesitant to get caught in all that paperwork. My time is better spent focusing in on the conversations and ideas that are being floated about. Again, from some action research I did, I have the students evaluate each other. I make a 1/2 sheet of paper with a rubric on it based on what the students said was important from our earlier WB on whiteboarding session. I evaluate them once or twice using carbon paper for multiple copies. They really appreciate the feedback. After the second time, I assign a group to evaluate another group. They use the rubrics, and each member who presents walks away with feedback. I get a copy for my records. This puts students in charge - they really listen to each other more than us anyway! I do not do this all the time, just when things start to slip. By then, I have only students evaluate students, giving me a copy of the results for my records. I have not used these as part of their grade, but it could be easily done.

#4: Assign Questioners

We did this in River Falls, but it took me two years to apply it to the classroom. The day you give the assignment, assign each group as the lead questioners for another group. For example, tell the red group that they will be in charge of questioning orange. This means you have to tell students what problems they will present the next day. Students report that it was great to know beforehand what they were presenting so they could spend more time on those problems and make sure they had it correct! Along with their WB creation, they must work together to come up with one question per group member (or 2 per group - whatever). I have students write their question on the top of their page as part of the homework assignment and check it as part of their homework. I have not done it, but another option might be to have students write their questions on a 3x5 note card with their name on it and turn it in for additional credit or as a separate assignment. We have already discussed the types of questions students can ask (clarity, helping, quiz, expansion), so they have an idea of what to ask. Have the questions directed or addressed to a different member of the presenters to defend. This really works well if you take some time to discuss questions and questioning.

If whiteboarding is becoming monotonous, the following are ways to change the pace.

#1: Happy / Frowny faces.

I use this one at the end of units quite often. Students are given a card of heavy stock paper, (yellow color) with a big smile on one side and a frown on the other. Whiteboards are assigned and created as normal. All the boards are put on the front chalkboard ledge and I stand at the front of the room, leading a description of each board. After my description of what they have written, the students vote: smile or frowns. If frowns, a discussion ensues with the frowner asking the WB creators a question, usually a "Why did you...." Students appreciate being able to field questions from the safety of their seats. This is very effective in getting through boards at a quicker pace, but not too conducive to question generation and expanding the ideas. As I said, I use this one primarily for review worksheets.

#2: Random selection of problems.

Usually students enter class and see a whiteboard with their WB assignment already determined. Once in a while, to change the pace a bit, I will write a cryptic message on the board, usually in reference to Star Trek (example - "Freefall, the Final Frontier" or "Inertia - The Undiscovered Country"). I get out my Star Trek Playing Cards (a scene on each one with a picture and description) and I have each group select a representative to come forth and boldly go ... "where no one has gone before." Each group rep picks a card and the number on the card corresponds to the

worksheet problem they have to do. Before presenting the card I have them read the card and show the picture. Use your creativity here.

#3: Lucky draw picks the problem.

This is a variation on the above card idea. Students again select the cards, but they get to pick which problem they want to do according to the order of the cards chosen. I always throw in a "death card" (Spock, Klingon, Romulan) and make that group do the "hardest" problem. Again, it's a fun way to shake things up a little.

#4: Random prize for the secret problem board

I have a ton of the old U.S. Navy physics formulas and facts sheets. Note - they still make these! Just ask the recruitment officer to send you some! I predetermine a problem set and award that group with their very own list of physics formulas. I make a big production out of it (well, not too big), and we have fun "collecting" the formula cards. Yes, this is a spin-off of the old secret word game.

#5: Out of Order

Remember that these worksheets are pretty cleverly designed. If you do get good questions from students, the best board to show next might not be the next one in sequence. For example, I did worksheet one from the Circular Motion Unit and the order of Boards went 1, 3 & 5, 2 & 6, 4, 7 & 8, 9 & 10. It made more sense, based on what the kids were thinking about. If you are doing a good job running a WB session, you will mix up the order now and then because you are in tune with the students and their thinking.

#6: Cut down the number of worksheets.

I extensively rewrote the worksheets in the first 5 units so that there were one or two fewer per unit. I tried not to skip any of the ideas behind the questions, attempting to keep the concept generation in sequence. I added questions I will ask to my personal key to make sure all ideas are covered properly. Unit 3 really got cut down - now there are only 4 worksheets. This takes time, but it really helps move things along. But be careful not to cut for the sake of moving faster - cut with serious intentions and understanding of the way ideas are developed in mind.