Summary of the discussion from Breakout Session: Communicating Experimental Results at the Conference on Laboratory Instruction Beyond the First Year of College II at University of Maryland, College Park

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Summary:
The general consensus coming out of the discussion was that writing skills and oral communication skills are equally important. However, it seems that students seem to be more aware that oral communications skills are important and it is much harder to convince them that writing skills are equally important. This may be because students have the opportunity to participate in more authentic experiences involving oral communication (presenting in a class, group meetings, local symposia, etc.) and that there are fewer such activities on the writing side with most experiences being artificial (this was discussed in great detail in the plenary talk by Cary Moskovitz). One exception to this may be JAULPI (http://opus.ipfw.edu/jaupli/). The discussion did not focus a great deal on the mechanics (how do you make a plot and what choices go into that, how do you make an effective diagram), but it was noted by everyone there that there was some form of explicit instruction on these issues in their curriculum at their home institution. It was also noted that it is important to provide one on one feedback, though it seemed that this was much easier to do in the context of oral communication. Much of the discussion focused on issues involving writing.

This document is intended to summarize the key points that were made during this session and to provide a list of potentially useful resources on this topic.

Oral Communication

• The general consensus was that students seemed to see the value in oral communication and there was a general consensus that this type of communication was more authentic.

• The general consensus was that it was much easier to provide structured feedback on talks throughout the process in a one on one setting. Everyone reported going through the talk with students before they gave it, which provides an opportunity for formative feedback early in the process, and then doing a debriefing after the talk to discuss what did and didn’t work.
• One aspect of oral communication that does not seem to be emphasized as much as it could (and perhaps should be) is how to give a short summary of what you are going (i.e. the elevator talk). These types of talks are important in terms of PR for science and seems to be a type of talk that students get very excited about (particularly the ability to communicate what they are doing to friends and family).

• Everyone noted that their departments provided some form of direct instruction on the mechanics of giving a talk and the process of putting a talk together. Some reported giving an overview of the general guidelines, while others were much more explicit on some of the mechanics (how do you make a graph, what choices go into that, identifying what you want to communicate, how to make a good diagram). The focus on the level and content of direct instruction depended on when it was happening (there was greater focus on the mechanics earlier in the curriculum and more emphasis was placed on the general guidelines of giving a talk later in the curriculum).

• At Colgate, they give a talk (slides with notes are attached at the end of this document) on talks to a class that is tied to their senior project. This talk focuses on the general guidelines and other faculty members are present to chime in on how they might do things slightly differently. A key thing that is communicated to students is that there is not specific best way to give a talk, but there are general guidelines for best practices.

Written Communication
• Much of what is done in writing instruction does not come across to the students as authentic, which may be why students do not put as much importance on it. It is important that this be done in a more authentic way. This was discussed in some detail in the plenary talk given by Cary Moskovitz.

• If writing is more authentic, then important components that are helpful in assessing the students understanding may be lost. One example would background theory. One suggestion (with the idea for this coming from a conversation with MacKenzie Stetzer) on how to deal with this was to require students to write up the derivation separately with a discussion on why it was being done. This would still give the instructor access to an important tool for assessing student understanding but in a way that is much more authentic.

• Individual conferences seem to be a good way to provide students more meaningful feedback beyond a simple checklist of changes that should be made but it needs to be required to get them to show up

• Students don’t really know what scientific writing looks like. It can be useful to have them read select articles from a journal like the American Journal of Physics to see the approach that is used and to provide approachable examples of what scientific writing looks like. This could be coupled with an activity where the students are asked to summarize the key points and share them with their neighbor or to identify things that were done well and things that could be improved upon.
• There was also a discussion on some of the specific writing issues that are observed, though no solutions were found.
  o Students often have difficulty finding or using the right word and instead tend to use words that are unnecessarily complicated. This could result in the use of inappropriate words to describe what they are trying to communicate, using the wrong technical words or using words that are overly technical.
  o It is important to be clear and succinct when writing, but this seems to mean something very different to students when doing scientific writing compared to what it means to them when writing in other disciplines.
  o It is difficult to get students to be quantitative. They will often say things along the lines of “the error was big” or “the experiment did not work” or “this effected our result.” However, they will not quantify how big the error was or specifying what about the experiment did not work or defining how the result was effected.

General
• It is important to give students feedback on what is being communicated, which can often be very different that what they intend to communicate. One possible way to do this is to have them work in groups with the task of communicating to others in the group the key idea (procedure, results, etc.) by giving them a few minutes to write several sentences describing the key idea. Once they of what they have done this, have them read these sentences to the group and get feedback. This process is repeated in an iterative fashion with them having fewer sentences to communicate the key idea. The idea is that after a few iterations, they have a very concise description of the key idea. Another idea was to have the a students read the writing of another student and then summarize the key ideas that they perceive to be communicated.

• It is important to have students critique each other. If there is a single experiment, this can be done by having individual students responsible for communicating different aspects of the experiment to the rest of the class or to a smaller group of classmates. If there are multiple experiments, the entire class can focus on the same aspect (i.e. data) of a single experiment. It was noted that it can be difficult to have students willing to critique another student, particularly when they are commenting on something that they do not know a great deal about but that this can be alleviated by starting early to set the right tone. It may also be helpful to get feedback from faculty members in other departments who routinely do this sort of thing (i.e. faculty in an Art Department).

• Peer feedback is not always effective and it is not clear how to make this form of feedback more meaningful in a consistent fashion.

Useful Resources
• To be added.
The point of a talk is to give people an appreciation for the work that you've done. The point of a class is to teach people how to do the work themselves. If you can teach people in 10 minutes how to do the work that you've been doing for an entire year, then either you're a better teacher than anyone who has ever lived, or your project needs a lot more work.

In this class, I'll be trying to teach you how to give a good talk, but I won't be doing it by example, because I'm not giving a talk. I'm teaching a class. If you can teach people in 10 minutes how to do the work that you've done, then you're done. The point of a class is to teach people how to do the work themselves.
Outlines are helpful for long talks, so even though this isn't a talk, we'll start with an outline.

The first thing I'm going to talk about is both the most important and the most difficult to teach. It's choosing what to put into a talk. The next two parts are much easier, and most of you would do quite well on them even without any help. But I'll share a few tips.

It's actually much easier to give an hour-long talk on a year-long project than to give a 10-15 minute talk. This may not seem possible to you now, but you'll understand it by the end of the semester. Short talks are really hard. Strive to convey an appreciation, but not knowledge. (That's why this isn't a talk.)

Before you make any viewgraphs, decide what you'd like your audience to have as the take-home message. What point do you want your audience to have when they are through listening? What point do you want them to go away with? Write the main message down before you make any viewgraphs. Decide what you'd like your audience to have when they are through listening. What point do you want them to go away with? Write the main message down before you make any viewgraphs. Decide what you'd like your audience to have when they are through listening.

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Sketch out what each slide will have on it, so you can think about what you'll say at each one. You can see that you want to sketch this out on paper and make sure that it really fits into your talk before going to the trouble of drawing it.
Once you have the storyboard, you can check in with your adviser and get feedback before creating the slides. Say roughly the same thing as is on this slide, but in different words, so that the audience experiences the difficulty of deciding what to pay attention to.

There’s no solid rule for the number of viewgraphs. 1-2 per minute may work well for some audiences, but you can vary the time per slide. For example, if you are going to combine the content from two viewgraphs into one, it may be wise to give the audience a break and let them process the information before going on to the next point.

Audiences remember images more than words, and they can look at them while you are talking. Videos can be even better illustrations if they are appropriate.

Saying roughly the same thing as is on this slide, but in different words, so that the audience experiences the difficulty of deciding what to pay attention to.
Keep your audience in mind when you are creating your viewgraphs. Don't make the mistake of thinking that they are notecards. Present things orally that are best presented orally; use viewgraphs for things that are best presented visually. Use lists sparingly; you're interested in getting people up to a single conclusion, not lots of lists that really need to be seen.

An outline is important. But it's not obvious that you need to use a whole viewgraph sharing it. The outline is sort-of like asking whether there's a Fourth of July in England. Or how many moons have 28 days. This is sort-of like asking whether there's a Fourth of July in England. Or how many moons have 28 days.

**MAYBE?**

*Should your outline be one of your viewgraphs?*

**YES!**

*Should you have an outline?*

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**Additional tips and warnings:**

- Slides should not be able to stand on their own.
- Slides should not direct the thinking process.
- Not useful for detail.
- Many of the conclusions are not taken from the posters. Not just taken. Many of the conclusions are formed before the posters are given.
- Slides are not note cards.
If this is your outline, you haven’t really added any information by showing it.
Strangely, the plainer the background, the less likely your audience is bored of it. Avoid the fancy ones.
If you use a figure from a published paper, you may need to add your own larger axis labels.

Don't forget to cite the source.
Toss out unnecessary equations; your audience will want to understand everything. Assume that the audience can do the algebra, so just show the starting and ending points.

Never read the letters in an equation. Force yourself to say what they stand for. This way, your audience isn’t left puzzled about what “F” means.

There’s no “right way” to give a talk — you create your own style. There are no rules about your style. Your audience will understand if you explain things clearly and simply. Silence is better than “um.”

But we have some suggestions:

- Start with an introduction. Introduce yourself and your topic.
- Make clear what you know. What do you need to find out?
- Talk about your audience. What assumptions can you make about their knowledge?
- Make your points clear and concise. Do not feel you need to write on the board.
- Practice your talk. Try it again and again, then hand off your notes.

Try it again and again. III. Practicing Your Talk

Mathematical equations
Practice out loud. Use a funny accent if necessary.

The day of the link

This is the easy part (really)

TV: Presenting Your Back

And, of course...
Don't look like a zombie or stare at a patch of ceiling tile. Hands off pockets. Get a good friend to tell you about your habits. Don't look like a zombie or stare at a patch of ceiling tile. Hands off pockets. Get a good friend to tell you about your habits.
A blank slide at the end is a nice touch. This lets the audience know when answering questions. You can have additional prepared slides after the blank slide to use. You're really done and provides a neutral background for Q&A.