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Resources for Undergraduate Research

Technically Speaking

By Lew Ludwig, Denison University

I have been preparing students for oral presentations for more than eight years. I have also taught five sections of the Technical Communication class at Denison University, where each of the 25+ students improve their oral communication skills by giving three mathematical talks. Over the last eight years, I have attended numerous student presentations at regional and national meetings. I can safely say that I have seen hundreds of student presentations. I recall talks that were memorable due to their high quality and a number of talks that were memorable due to their poor quality. Interestingly, in each case it is the *name of the school* that I remember, not the *name of the student* representing that school. With this in mind, it is important that we prepare our students for their presentations as they are representing not only themselves, but more importantly, their institutions and therefore, us.

There are a number of resources available in print and on the web for preparing students to give oral presentations. The two I use most are Joe Gallian's *Advice on Giving a Good PowerPoint Presentation* (Math Horizons, April, 2006) and my website, *Technically Speaking* (http://techspeaking.denison.edu/, NSF #0632804). The former gives a nice checklist of do's and don'ts for student talks and the latter provides video examples of different presentation issues and how to address them.

Based on my experience and observations with student presentations, I would like to expand on these two works by focusing on three questions one should ask of any student presentation.

1. Why should I care about this presentation?
2. What are the three big ideas?
3. Is the audience listening or reading?

I have found these three areas to consistently be among the most common issues for student presentations.

Why should I care about this presentation?

As with most modern day mathematics, the topics presented by students in fifteen-minute talks are usually highly specialized in some branch of mathematics. Students must understand that the average PhD mathematician, much less a student in the audience, will have little to no experience with their talk topic. The beginning of a talk should address this by setting the context for the work being presented. Why is this work important? What other work has been done in this field? How does the work being presented fit into the larger context of work in this field? Are these new findings, a new approach to a known result, or just an interesting expository topic?

By answering these questions, the presenter is helping the audience construct a framework to better understand and enjoy the talk. Even if the audience does not understand everything, at least they will know the context of the presentation and why the information presented was important.

What are the three big ideas?

When teaching students about a new topic, how do we emphasize the important parts? What do we do to make some pieces of information stand out more than others? We repeat them. Yes, we say the same thing more than once, but maybe in a slightly different way. That is, we repeat things that are important to help students remember them.

You get the point. Unfortunately, many student presenters do not. I have seen well-rehearsed talks where each topic or item was addressed once and only once. It didn't matter if the idea was brand new and the key to the whole talk, or just an off-handed comment about a specific example - everything got the same weight. These talks left the audience confused and frustrated. If the audience didn't understand the main point of the talk in the first pass, too bad, they were not going to hear it again. This forces the audience to play catch-up for the rest of the talk, in an effort to understand the main idea or they just give up listening in frustration and look at their schedule, hoping the presenter of the next talk will not do the same.

Here is a good test for students to determine if they stressed the big ideas enough. Have a friend listen to the talk and then have the friend take a little "quiz" by listing the three big ideas from the talk. If the friend cannot discern these, the student has not stressed the main points enough.

In short, it is important to repeat the important ideas. Important ideas should be repeated.

Is the audience listening or reading?

Have you ever noticed that in some talks, you do more reading than listening? Once, while driving with my then seven-year old daughter, Rachel, I heard a voice from the backseat say, "Dad, did you ever notice when you see words on a sign or billboard, you can't help but read them?" I now call this phenomenon the Rachel Effect. It is human nature that when text is placed before us, we start reading. When a full page of technical information is placed in front of an audience, the talk has transformed from a talk to a "read." As Joe Gallian notes, the slides are reminders for the presenter of what to talk about, not for the audience members to read.

Why do students turn talks into "reads?" As mathematicians, we expect our students' written work to be technically correct and complete. We have little tolerance for generalized statements or overlooked special cases (e.g., What happens if $x=0$?). The derogatory phrase "hand-waving" often comes into play. We set these high standards, because referees hold us to the same standards when we submit our works to peer-reviewed journals. To many, it is the precision of mathematics that makes it so beautiful.

While precision is all well and good, it must be relaxed in a fifteen-minute talk. How often have you attended a talk where a technically precise definition was given, but you had no idea what the speaker was talking about? In fifteen minutes, it is difficult to digest technical definitions, so students should focus on conveying the general idea instead. I work in knot theory. I could define a knot as:

A subset K of a space X is a knot if K is homeomorphic with a sphere Sp.

Or I could describe a knot as taking a length of rope, making any number of tangles in it, and then connecting the two ends of the rope to form a closed loop in space (a prop would make this all the better). I would not use the latter in a research article, but I could use it with a group of college students or Congress members to quickly convey the idea of a mathematical knot.

We have to let our students know when to be mathematically precise and when this precision can be relaxed. Don't let the Rachel Effect affect your students' talks!

In closing, I hope you will consider these three questions the next time you are preparing a student for a mathematical presentation. Make it a talk where I remember your school not because I was confused and frustrated, but because I was engaged and informed.

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