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Scientific Life

Guiding STEM graduate students to better speaking skills

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Training to enhance the effectiveness of oral presentations is often neglected in science, technology, engineering, and mathematics (STEM) fields. In this article, we summarize our experience of teaching a semester-long class in speaking skills to STEM graduate students and advocate for the critical importance of these skills to professional success.

Between us, we have attended well over 1500 oral presentations in STEM fields. A few sparkled. Some were bearable. However, too many presentations left audiences bewildered or apathetic, even when the science they conveyed should have been riveting. Thousands of attendees wasted thousands of hours. Can we do better than that?

Our course

Our Iowa State University (ISU) graduate course, 'Improving Your Professional Speaking Skills' (PLP 628), germinated from watching too many scientists struggle to present their work effectively. We latched onto the idea that acting-class methods could be repurposed for training young scientists in oral presentation skills. Initially armed with a few books [1–4] and a video[i], we launched the first ISU graduate course aimed at enhancing speaking skills for STEM trainees. The 15-week-long course has now been held annually since 2011. Enrollment comes from all STEM fields and ranges between ten and 20 students.

PLP 628 simulates an introductory acting class because oral presentation is a performing art. Learning how to deliver engaging presentations demands planning, practice, and passion. We use multiple feedback loops to reinforce key teaching points (Figure 1). In line with actors' training, we emphasize teamwork and a critical but supportive classroom atmosphere.

Each student delivers six presentations per semester: two versions of a 2–3-min talk, of a 5–7-min talk, and of a 10–12-min talk. The latter two pairs include responding to audience questions. Each student is assigned a practice partner (this form of peer-to-peer coaching is a common feature of acting workshops[ii]). Practice partners are accountable to each other for live practice sessions and constructive critiques. We switch practice partners after every pair of in-class presentations; thus, every student has three different partners during the semester. After every in-class presentation, students receive a video of their presentation as well as a summary of written peer evaluations based on a simple rubric. Version 1 of each pair of presentations is followed by individual, 30-min-long, in-person coaching sessions with the instructors; students subsequently use the peer feedback and coaching to hone their version 2 presentation. That totals to six rounds of feedback and three instructor coaching sessions per student. We intermix the student-presentation sessions with workshops led by a musical-theater instructor and a master classroom teacher, as well as discussions assessing strong and weak points of selected faculty seminars.

PLP 628 shares many features with speaking-skills courses for STEM graduate students in other places, such as Ann Stuart's intensive curriculum for neurobiology students at University of North Carolina [5].

Lessons we have learned

As initially naive trainers, we have learned empirically through the years. In course evaluation comments, most students have stated that they made real, even dramatic, progress in becoming clearer and more engaging communicators. Some enthusiastically extolled the value of the course for furthering their careers, even years later.

Students have also made it clear that coaching by the instructors was critical to the effectiveness of the course. During the coaching sessions, students reprise their presentations and we stop them when we need to make suggestions for improvement. Furthermore, we have found that speaking-skills trainees face challenges in two intertwined areas: style and content.

Style encompasses what a presenter feels and projects

Managing anxiety

Actors learn relaxation techniques (breathing, facial exercises, wall-sitting, and many others) to subdue fear. Although these exercises are especially helpful for students who lack prior presentation experience, they are vital to making further progress as a speaker; thus, we demonstrate and model them early during the semester. In addition, a professional actor or acting coach can be a valuable partner in helping STEM students learn how to loosen up enough to perform at their best [5,6].

Overcoming reluctance to accept and provide constructive criticism

Given the highly personal exposure of presenting, it is critical that students perceive the classroom as a safe space for giving and receiving critiques. Some students may be initially reluctant to make constructive critiques; thus, we preserve the anonymity of written peer comments.

Mastering body language

This arena encompasses stance (balanced, facing audience), movement (deliberate),

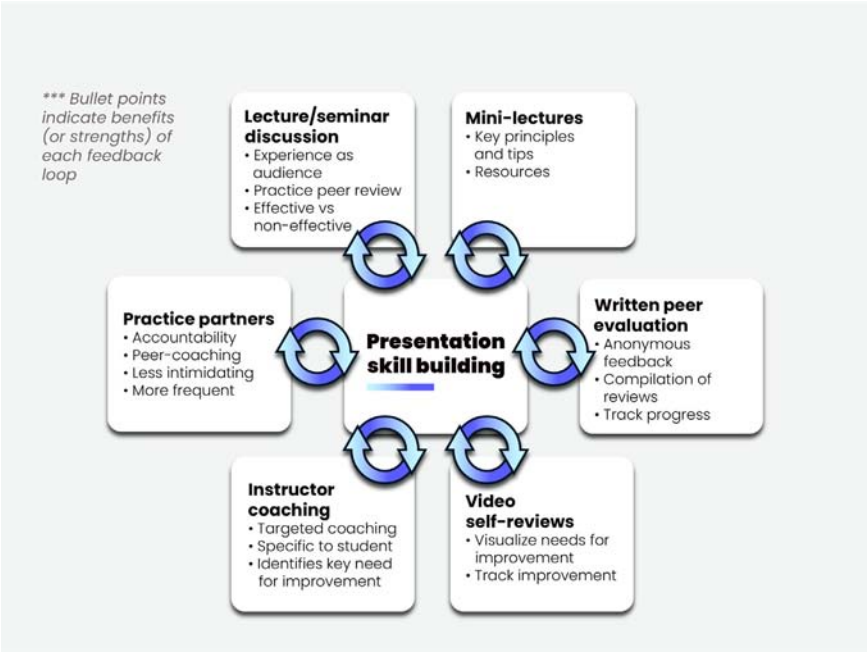

Figure 1. Feedback loops for presentation skill building. Our speaking-skills course uses multiple feedback loops to reinforce the development of effective presentation habits.

voice (volume, speed, enunciation, modulation, and conversational tone), eye contact (on the audience, shifting every 4–5 s), gestures, energy level, and enthusiasm [1,4,7]. Pauses (2–3 s between sentences and even between clauses) are transformative because they help an audience keep up and remind the speaker to breathe. We emphasize to students that preparing a persuasive presentation means mastering body language as well as technical content. Meeting these challenges is like learning to ride a bicycle: it takes practice, persistence, and patience to minimize wobbles and move forward smoothly.

Content relates to the conception, planning, and design of compelling presentations

Many scientific talks wither and die because the presenter fails to connect with a diverse audience. STEM trainees may habitually present their science to their own lab group or to the researchers in their subfield. Helping students to escape this narrow-focus trap can be a tough challenge. Speech coaches and consultants emphasize that the level of audience engagement reflects a speaker's efforts to reach them [1,2,6,8]. Connecting with diverse audiences calls for imagination and empathy. We contend that, with focused preparation, students can tailor a talk, however technical the topic, to engage any audience (Figure 2).

Emphasizing storytelling

Framing a presentation around one or more stories keeps audiences engaged [4,8,9]. We are all programmed to tune into stories. We urge students to find the stories in their research, then map out a plan to tell them in a logical way [9]. The more diverse the audience, the greater the need to use relatable stories and analogies.

Maximizing simplicity, readability, and visual appeal

By enhancing their slides, we help students to energize their stories. An excellent primer on slide design is Susan McConnell's 2011 iBio video[i].

Embracing practice

Practice is the crucible for growth in speaking skills. Practicing should be efficient: assemble the story lines and visuals, master the content, incorporate the elements of physical style (much like rehearsing a dance), practice in front of people whom you trust to provide constructive critiques, and focus on minimizing your weaknesses. We preach that practicing talks using a structured, efficient approach should become a career-long habit.

How long does it take to become a highly persuasive and engaging speaker in STEM fields? Fifteen weeks is merely the start of a longer road. However, instructors can help students awaken a passion for this soft skill. Passion fuels trainees to demand continuous improvement from themselves, and one semester gives them the tools they need.

Broader perspectives

Despite a rising chorus of pleas for scientists to become better presenters [3,6,8,10], STEM graduate courses in oral presentation skills remain rare [11]. Given the multiple benefits they can deliver (enhanced career advancement, stronger collaborations, greater competitiveness for research funding, and a more positive image of scientists among the general public), it is puzzling that so little attention is paid to this aspect of STEM training.

Despite the increased visibility and availability of science communication training opportunities, skepticism persists among educational institutions, faculty, and even students about the importance of speaking skills training. Course-based training is often undervalued compared with traditional STEM courses. Students may absorb a skeptical outlook from their advisers.

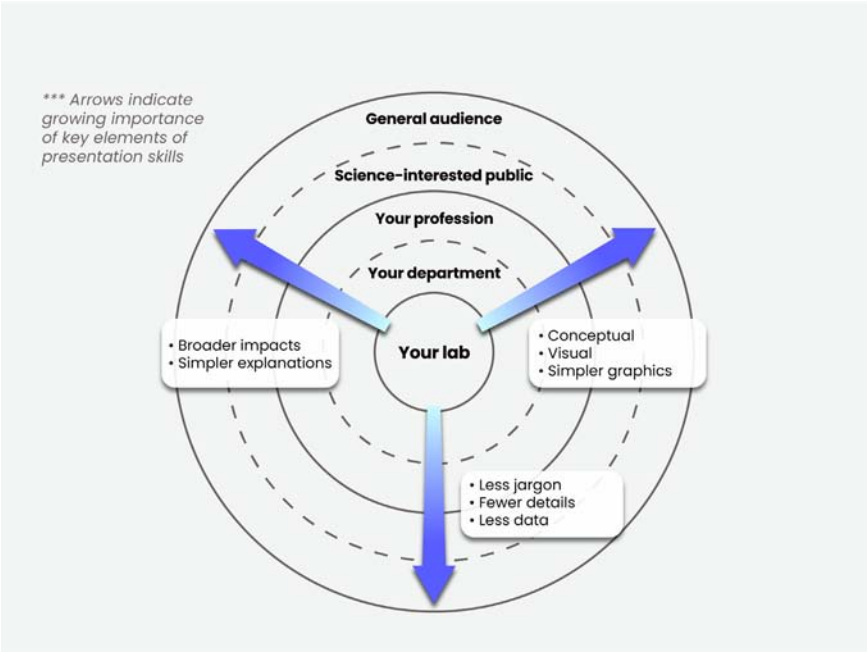

Figure 2. Communication challenge circles. As your audiences become more diverse, your presentation should be reconstructed to engage them effectively.

Training initiatives, such as 'three-minute thesis' competitions[iii], workshops[iv], and elite presentation forums, such as TED talks[v], have multiplied in recent years. Despite these increased opportunities, we doubt that short-term training experiences can have as durable an impact as semester-long courses.

Admittedly, we lack hard data to back up that claim. There is a pressing need for critical assessment of the effectiveness of different modes of speaking skills training in STEM fields. Bankston and McDowell [11] acknowledged this deficit and proposed longitudinal studies of the impact of communication-skills training programs.

Teaching a semester-long speaking skills course is time-intensive. However, compared to the work that goes into planning and conducting an average STEM laboratory course, the commitment is small. Are speaking skills as important as lab skills for professional success? We certainly think so.

We found that we could become effective instructors with minimal training (although with considerable experience as audience members). We borrowed ideas from several veteran Speech Communications faculty at ISU, who train primarily undergraduate students, before starting our graduate-level course. However, we are convinced that the speaking-skills needs of STEM graduate students are sufficiently distinct from those of undergraduates to require targeted training.

We advocate for semester-long training in speaking skills to help scientists polish a vital but often overlooked skill set to raise their own competitiveness and help them communicate the excitement and emotional power of science to people unlike themselves. We have seen very encouraging results, and so have our students.

Even so, speaking-skills training for STEM graduate students remains a lonely outpost in the soft-skills landscape. Bankston and McDowell [11] argue that it deserves to be a required full-semester course in every STEM field curriculum. Can we afford to continue neglecting it?

Resources

[i]www.youtube.com/watch?v=Hp7Id3Yb9XQ

[ii]www.actingstudio.com/acting-classes/meisner

[iii]https://threeminutethesis.uq.edu.au/

[iv]https://aldacenter.org

[v]https://www.ted.com/talks

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