

PREPARING STUDENTS TO GIVE TALKS

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Learning to make clear presentations is often an under-rated and neglected aspect of a student's scientific training. Good talks take time and effort to prepare. Developing a foundation and appreciation for these skills requires practice and guidance from the advisor.

1. INTRODUCTION

Undergraduate research experiences are becoming more prevalent as are the opportunities for undergraduates to present their work to a scientific audience. While much effort is placed in having undergraduates appreciate the nature of performing scientific work, little attention is given to developing the skills needed to convey this work to the research community.

Oftentimes, students are left to prepare final presentations without input or guidance from their research mentor. This usually results in a poor presentation, but more importantly, it gives a signal that “writing up” and “presenting” one's work are secondary to the process of research. This approach fails to convey the true nature of research, in particular the fact that one's work must be understood and appreciated by others in order to constitute a contribution to the scientific community.

The Culture of Scientific Research. Helping students give a good talk is part of the larger issue of introducing them to the nature of research. Students are used to the idea of learning from books, and they mistakenly believe that books and journal articles are the way to learn about current research. It is helpful to explain to them that journal articles usually take at least two years to appear, so if you only rely on published sources you will always be a couple of years behind. Researchers keep up with current results by conversing with colleagues, going to talks, and glancing through unpublished manuscripts (preprints). Of these methods, giving talks is the most effective way to efficiently convey the key aspects of your work, which is why the research talk is a vital part of the research process.

2. COMMON STUDENT MISCONCEPTIONS

Students can have many misconceptions about giving talks. It is helpful to be aware of these so that you can address them as they arise. Most student misconceptions about presentations stem from a basic misunderstanding about the purpose of giving scientific talks. The existence of a scientific community and the process by which research is practiced, communicated, prioritized, and funded, is new to most undergraduates.

I find it particularly helpful to emphasize early in the process that scientific talks are a means of communicating one's work and ideas with other scientists. That is, *the purpose of a talk is to lead the audience to understand and appreciate your work*. It is a point to which I continually refer when responding to vague or misinformed reasons that students believe motivate talks.

Some common misconceptions are:

The purpose of a talk is to impress. This often develops as a consequence of attending talks aimed at too high a level for the student. The student is swamped with unfamiliar terminology and discipline-related jargon which appear to be understood by the faculty. It leaves an impression that the speaker is very knowledgeable and that it is the fault of the student that they do not understand the talk. This misconception is further reinforced by the nature of the speaker, usually a visiting scientist giving a research-level talk to an undergraduate audience. Oftentimes, the student feels overwhelmed by the knowledge of the speaker when they really should be thinking that the speaker gave a completely inappropriate talk for his or her intended audience. I cite some specific examples and explain to my student what was bad about those talks.

The talk should be as “high-tech” as possible. High-tech and sophisticated use of software are often misconstrued as illustrating intelligence and knowledge. Students may be unduly impressed by style over substance (just take a look at popular music and movies), and often students reinforce each other’s misguided opinions in these matters.

The talk should begin with an outline. This is an example of the principle “just because everyone else does it, doesn’t make it right.” It is understandable that an outline is perceived as helpful, but it should soon become apparent that the structure of scientific talks does not deviate so much as to warrant the amount of time it takes to tell the audience “first, I will motivate the material, then discuss the experiment, give my results and conclusions, and end with a description of future work.”

Talks take little time to prepare. I consider this to be due to lack of experience. Students have been to many talks where the speaker seems to effortlessly describe complicated matters, unaware of the amount of preparation that went into the presentation. Also, students imagine that since they have spent a lot of effort obtaining their results, and they understand it well, they can easily describe it to other people.

3. PREPARING STUDENTS: A SERIES OF MEETINGS

The many aspects that contribute to the preparation of a good scientific presentation cannot be adequately discussed or emphasized at a single meeting with a student. It is a process that develops over the course of time, with different elements taking priority at different times. I have found that a series of five meetings with the student over the course of the preparation allows you to highlight the different issues in a natural and evenly-paced manner.

Initially, I emphasize the substance of the talk, leaving aspects relating to style for later meetings. The student does not give a practice talk until the fourth meeting.

1st Meeting.

I use the first meeting to identify the single result or key point which will become the focus of the talk. It may be that the student has performed several distinct pieces of work during their research time. However, they must resist discussing them all, unless they are intimately tied together and support the key point they wish to make. This is a difficult decision for students to make, but it marks the difference between a scientific talk and a classroom presentation.

Once the key point has been determined, the outline of the talk can begin to take shape. I explain that the process now becomes one of “working backwards” to get from the final result to a position where the general topic can be motivated in a meaningful way. I encourage the student to list the string of ideas or information that is needed to link the final result to a starting point that can be appreciated by the audience. I have them make a list of terminology and concepts that will be needed in order to “understand and appreciate” the final result. Then, together at first, we work backwards, from the specific to the more general, until a place has been reached where the talk can be “launched.” This starting point will become the motivation for the talk, and will vary according to the background knowledge of the audience.

Having identified the appropriate starting point, I have the student go away and sketch out more fully the steps that will take their talk from the initial motivation to their final results. Along the way, they should note which concepts and specific terminology they will need. The student should prepare a rough draft of their slides to bring to the second meeting.

2nd Meeting.

I usually begin by having the student summarize the major point that they wish to make during the talk. (This helps to focus the discussion.) Next, I ask the student to step through their first draft of slides, identifying any concerns that arose since the first meeting. We do this sitting at a table. I try not to say much until the end of their outline, and then I concentrate on how the material is motivated, how the pieces flow from one point to the next, and I attempt to identify any missing pieces such as implied facts, unexplained terminology, etc.

After doing this, we go over the number of key concepts needed to make the natural progression from the beginning motivation to the final conclusion. This is helpful in defining the pieces that are needed for the talk and also makes it easier to identify the intrusion of unnecessary, but interesting, facts. In fact, this is the key step in the early preparation as it breaks down the talk into a manageable sequence of steps.

Next, we discuss the format that the presentation will take. Personally, I prefer my students to use transparency slides, either hand-written or typed. (I find that PowerPoint exposes students to too many distractions with little accompanying benefit.) The medium of choice for talk presentations, be it transparencies, slides, blackboard, etc., is highly discipline-dependent, and part of the culture of the particular scientific community. This, too, is useful for the student to know.

The major goal of the second meeting is to define the series of concepts that will form the skeleton of the talk – from the first, motivating point to the final conclusions. Ideally, this should be no more than a handful of steps, and I hope the student will keep these in mind as they begin to prepare their slides. To reinforce the structure, I find it helps to go through the slides one more time with an emphasis on the inclusion of figures, diagrams, and photographs as well as graphs and tables. At the end of the meeting, there should be a clear structure and the student can go off and prepare the first set of slides in detail.

3rd Meeting.

I begin this meeting with a review of the slides. This time, an emphasis is placed on the layout of each slide as well as its contents.

At this time, I find it useful to remind my student of the purpose of slides, and to emphasize that slides should be considered tools which enable a speaker to present a clear and coherent argument—they are not a replacement for the speaker. With that said, we then work together to remove excessive wordiness, remembering that any full sentence on a screen is an invitation for the audience to read it and not listen to the speaker.

Once we have done this for a few slides, I ask them to complete this process on their own. Then, we turn our attention to the flow of the discussion from one slide to the next. Are points made in a clear manner, and is emphasis placed on aspects that will progress the audience into having a full appreciation for the conclusions? Most talks require a few key points to be made (the underpinnings of the argument), and this is a good time to identify them.

Finally, the total number of slides is examined. I usually budget two or so minutes of talking time for each one. If it appears that there are too many slides, it may be that some material needs further consolidation. I leave my student to revise the slides and we make arrangements for the first complete run-through of the talk at the next meeting.

For the next meeting, allow at least an hour for discussion in addition to the actual presentation (which is likely to run over the allotted time). If the presentation will be done using a computer, I ask the student to print paper copies of every screen because it is very difficult to discuss the overall arrangement and content by looking at a computer screen.

4th Meeting.

At this meeting, the student comes prepared to make their full presentation. I choose a room with the necessary equipment and of a size comparable to the actual venue. I find it helpful to talk a little before hearing the presentation. In fact, this is the perfect opportunity to discuss the mechanics of a scientific talk.

I start with, “All talks are introduced by a host.” I mention that in a conference setting, this is one of the roles of the session chair. I then list some of the other responsibilities of the host, such as ensuring that all equipment is working; that there is a pointer, a glass of water; checking with the speaker for any special requests; if necessary, clarifying the pronunciation of the speaker’s name and the title of their talk (which can sometimes change). Most students are unaware that the host will be the one who calls for questions at the end of the formal presentation and finally brings the talk to an end. I then go on to say that there are very many poor hosts, and that the speaker should be prepared for this all-too-frequent event.

The correct use of a pointer is also worth mentioning. Having the pointer in the hand that allows the speaker to face the audience and also point to the screen will maintain the important connection between the speaker and their audience.

Students can be very nervous about speaking, and I find it helps to discuss the first moments of their talk. I describe the scene to them: the host has just told everyone your name and the title of your talk, so now it is your turn to speak. What will be the first thing you say? Usually they have not thought about this, or they plan something inappropriate (such as introducing themselves again or telling a joke). So we discuss the motivating concept that we had previously settled on, eventually deciding on an opening sentence. I ask the student to say the sentence out loud once while we are sitting there, and ask them if they think it will capture the interest of the audience. That ends the preparations.

The presentation is then made without time restrictions. I try not to interrupt the talk. On a piece of paper, I make comments relating to the pace, content, and emphasis. (Sometimes, I record the length of time for each slide.) I look for places where the speaker can move more quickly, and places where greater emphasis is required. It is not uncommon for their presentation to last almost twice as long as the allotted time for the talk.

At the end, we sit together and discuss it, usually taking about an hour. I start with general issues about the organization and flow of the talk. At this point, the most important topics to cover are the order of the material, and the idea of transitions. It helps to lay out all the slides on a big table, so that you can refer to the order in which the material was presented. (Use either the actual transparencies or the paper printout if it is a computer talk.) It often happens that we eliminate transparencies or recognize the need for new ones.

Once the slides are in a reasonable order, we discuss how to group them to see the different parts of the talk. This leads naturally to the key features of a good talk: transition and flow.

4. TRANSITIONS ARE KEY

The single, most valuable tool for giving a good talk is the use of transitions. Transitions provide a means of summarizing key concepts and motivations before moving on. Using this method, the speaker can provide the context for the material they present. And it is transitions that allow the speaker to move smoothly and naturally through their presentation. Students like to run from topic to topic with hardly a pause or any indication that a key point has been made. They need help to understand how things look from the audience's perspective.

The next section is a condensation of the advice I usually give students. In the following section, I return to the discussion of how to help students make good transitions.

4.1. Elements of a Transition. Most talks are serial in nature. You build up an argument from beginning to end by bringing together pieces of information construct a conclusion. If one particular piece is missed by your audience, the effectiveness of your talk could be lost. Unfortunately, this happens very often. Members of the audience can miss a specific point. If they fail to appreciate that piece of the argument, it can derail the rest of your talk. This can happen if the essence of the argument is obscured by technical details or unfamiliar jargon, or by a moment's distraction by the listener.

Like all good story-telling, reinforcement is an essential ingredient, and transitions provide this. Pause at the end of each section of your talk, and using only spoken words, give a brief summary of the key point(s) of the previous section. This gives the audience another opportunity to understand your point, even if the exact details are a little vague. If they were lost, transitions can help them to recover.

The usual elements of a transition are:

- (1) Pause at the end of a section. (Be silent for a full two seconds.)
- (2) Facing the audience and using only spoken words, briefly summarize the essential point(s) of the previous section.
- (3) Describe how your ultimate goal requires another piece of information (new section).
- (4) Move on to that next section.

Again, the benefits of transitions are many: they help to keep the talk focused by stressing the essential aspects of the argument; they provide an opportunity to regain the attention of your audience; and they serve to ease the pace of the talk.

4.2. Recognizing and implementing transitions. I have found that it is not too difficult to have the student recognize where the transitions occur. On the other hand, it can be quite a challenge to get them to pause and give a little summary, which is necessary for implementing the transition!

To identify the transitions, the student and I lay out the slides on a table and group them so as to identify the different parts of the talk, as described in a previous section. Each part usually involves between one and three slides. Transitions are then needed to connect the different parts.

I used to think that the mechanics of a transition were reasonably clear, and the written description of a transition, given above, would be sufficient. Unfortunately, this does not seem to be the case, and I have come to believe that the problem is that people with little experience in public speaking are very reluctant to pause (be silent for a moment) and to summarize (repeat something that was just said). Perhaps there is a fear that the audience will be bored or insulted. It helps to reassure them that this is not the case. The audience is barely keeping up with the flow of information and will be happy to receive a little assistance.

My technique, which does not have the impact I think it should, is to demonstrate one of their transitions. I stand at the front of the room and put a slide on the projector. I say the last few words they said for that slide, then take one step to the side and pause. I then summarize what happened so far, give a very slight pause, and then state the ultimate goal and the next step. I stand silently and look around the room (so as to invite questions), and then put up the next slide. Students generally acknowledge that my performance convincingly demonstrated the need for the transition, but in the next practice talk they generally don't implement it too well. Perhaps I should make them try it a couple of times immediately after my demonstration?

5. THE 5th AND FINAL MEETING

Having discussed the use of transitions at the previous meeting, both abstractly and with specific reference to the student's talk, I begin the last meeting by discussing the importance of a strong beginning and end. Together we talk about how the presentation should begin, and what should be the concluding remarks.

This is a good time to remind them to have a clear opening sentence in mind, and how inappropriate it is to have a speaker re-introduce themselves and state the talk's title. I also suggest that "Thank you" is the best way to end the talk, since it is a universally recognized signal for the audience to begin clapping. Asking for questions from the audience is the domain of the host, and should not be done by the speaker except when demanded by the ineptness of the host.

I also discuss their plans for the last topic of their talk. The two standard methods are a summary of the results, or a description of planned future work. If the student has good

ideas for what should be done next, then they should be encouraged to finish with that as this usually leaves a good impression.

The final, timed presentation is made. I try not to interrupt the presentation, but I do ask a few questions as might occur in an actual presentation. If the talk gets off to a very bad start, I may interrupt to discuss what went wrong and then ask them to begin again. But once two or three minutes have gone by, I mostly just watch, taking notes as in the previous practice.

In the discussion afterward, my goal is to focus on the effectiveness of the transitions, reinforcing the idea that any weak section can be recovered if the transitions are done correctly. If the talk is too long, we discuss material which can be eliminated from the final talk. We also discuss possible questions that may arise from the audience, and prepare “back-up” slides to cover this contingency. If planning to make a computer presentation, the student must know that they are responsible for ensuring that their equipment is compatible with the equipment provided. And they should always bring a set of transparency slides of their talk as a back-up.

Finally, damage control procedures are discussed, but not dwelled upon. In the event of moving too slowly, we identify sections of the talk that can be minimized without losing the context of the argument. I have found that it is less stressful for a student if they feel that they have considered, and have a plan for, things that can go wrong during a talk. I try to have the student leave our last meeting feeling optimistic and comfortable about their talk.

6. CONCLUDING REMARKS

While the procedure I outlined consumes an immense amount of time and energy, it is also incredibly valuable for the student preparing their first major talk. The making of a good presentation *does* take a great deal of time and effort, and this simple fact is most starkly reflected in the amount of time you, as their advisor, commit to the task. There is no effective short-cut, and while such a process cannot be undertaken with all undergraduates, it is sure to be one of the most lasting and rewarding activities that an advisor can share with their students.

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