Tips For Effective Scientific Communication

[Comic description:]
1. A person clicking on a computer screen.
2. The same person saying, "YES!!"
3. The same person raising their arm in triumph.
4. The same person saying, "FINISHED ANOTHER PARAGRAPH, DID WE?"
5. The same person saying, "I AM A WRITING GOD!"

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#1. Identify your audience:
This will control the level of your presentation and the amount of background material you need to orient everyone in the audience.

#2. Identify the main points you want to convey in the time you have:
You can reasonably convey only 2-3 main points in a 20- or 30-minute talk.

#3. Create an outline of your talk (or paper):
This will build in the logical organization of your presentation and help you decide what figures and other supporting evidence you need to make your points.
How To Write an Outline

Example of basic (Level 1) structure of scientific outline:

I. Introduction (Get the reader's/viewers attention; states key idea(s) or thesis; provides essential background)

II. Procedures (Provides background on key experimental/theoretical methods)

III. Results (Presents key results that support ideas discussed in Introduction)

IV. Discussion (Interprets results; Discusses results in the context of prevailing models)

V. Summary and Conclusions (Reemphasizes key results and how they support thesis; Discusses new directions)
How To Write an Outline

Example of a more detailed (Level 2) structure of scientific outline:

I. Introduction
   A. Attention-grabbing, “big picture” statement of issue
   B. Key previous results leading to state of the field
   C. Unaddressed problems
   D. Preview of key points of talk/paper

II. Procedures
   A. Experimental methods
   B. Theoretical methods
   C. Data processing
   D. Error analysis

III. Results
   A. Key results 1
   B. Key results 2
   C. Key results 3

Provides more details of internal organization of each section
How To Write an Outline

Example of an even more detailed (Level 3) structure of scientific outline:

I. Introduction
   A. Attention-grabbing, “big picture” statement of issue
      i. Interesting diagram to show
      ii. Interesting quote to give or reference to include
   B. Key previous results leading to state of the field
      i. Specific papers that will be referenced
      ii. Previous ideas that will be emphasized
   C. Unaddressed problems
   D. Preview of key points of talk/paper

II. Procedures
   A. Experimental methods
      i. Experimental diagram to show
      ii. Procedural flow chart #1
   B. Theoretical methods
   C. Data processing
      i. Flow chart describing data analysis
   D. Error analysis

Provides specific details figures, quotes, references, sentences, etc. to support section
(1). Your talk or paper will be logically organized from the beginning

(2). It is less likely that there will be unnecessary information in your talk or paper

(3). Outlines allow you to break up your presentations and writing projects into more manageable sections that you can tackle individually

(4). You can use the same outline for presentations and papers of different lengths
More Tips: #4. Present One Key Idea Per Slide

State your key idea in the slide heading.

If you find a slide that doesn’t have a key point, eliminate it!

If you find a slide with more than one key point, separate into multiple slides.

Use the header to state the main idea of the slide, and use the body of the slide to support that idea

Use well-labeled graphs and figures to illustrate your key points…this makes the slide more real and interesting to the audience.
#5. Avoid Information Dense Slides

Write only key ideas succinctly on slides, avoid text heavy slides

Too much text....

Literature Review:

- Heinder developed a dynamic analysis of the temperature-dependent IGBT. The temperature dependent IGBT elements were described in terms of the instantaneous temperature. This model was validated with model and data from the literature of the silicon chip manufacturer using SABER circuit simulation software.

- Adams performed an analysis of the interactions between the heat sources, including the effect of the thermal conductance of the walls and the influence of convective heating which physical effects and level of detail are needed to accurately predict thermal behavior of discretely heated enclosures.

- Chen, Wu and others have been modeling of thermal and electrical behavior using several commercial softwares (I-DEAS, Maxwell, Flotherm and Saber) and 3-D, transient approaches.
#5. Avoid Information Dense Slides

Write only key ideas succinctly on slides, avoid text heavy slides.

Don’t include overly busy images…include only information you plan for the audience to understand in the < 2 minutes the slide will be visible.

Use animation to bring information onto slides one at a time for information dense slides.

Too many distracting images.
The Nike laser system uses discharge pre-amplifiers.
(Courtesy US Navy)

Sample normalized signals from the two-beam optical drive.
(Courtesy C. Michael)
#6. Provide Appropriate Information for Figures

Avoid copying a graph from a formal article – they have a different style, e.g., labels are generally too small

Use color and make lines thick, labels legible

Label axes and highlight important features with arrows

Use tables sparingly – if used, highlight important parts

Remove unnecessary information from graphs/figures
Define parameters used

Provide physical explanations of different terms in equation

Provide an intuitive explanation of what the equation means

Combine the equation with a picture that illustrates the physical principle involved

If you must use mathematics in your presentation, slow down, and talk the audience through each equation...
#8. Avoid Distracting Text, Colors, and Effects

Your goal is to convey your ideas, so avoid distracting text and effects!

Don’t overuse PowerPoint animations and sounds!

Make sure there is good contrast between text and background

Use simple (or no) backgrounds on slides

CP
- Parity invariance fails, combine it with charge conjugation to create a new invariant
- Converts the right-handed anti-neutrino into a left-handed neutrino—exactly what we observe in nature
- Neutral kaon experiment
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Don’t over use colors on your slides

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Superconductivity is an electronic state of matter that exists below certain currents, magnetic fields, and temperatures.

- $I_c$ - Critical Current
- $B_c$ - Critical Magnetic Field
- $T_c$ - Critical Temperature
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Don’t overuse colors on your slides

Avoid red/green and red/blue color combinations

Strive for easy reading
#9. Keep the Audience Engaged

Face and maintain eye contact with the audience

Don’t read your talk!

Be enthusiastic!
  If you’re not excited by your results, don’t expect the audience to be!
#10. Try to Minimize Distractions While Presenting

Avoid nervous mannerisms
  e.g., pacing, bobbing, waving arms, jingling coins

Use a laser pointer or stick directed at screen to point
  Don’t use your hand to point to the screen…you’re blocking the screen
  Don’t wave the laser spot around on the screen

Train yourself to speak slowly and distinctly—practice!

Try to minimize “filler words”
  e.g., “uh”, “like”, “um”, “okay”