Communications and Writing Skills

TEQIP Short Term Course on Research Skills and Methods
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That concludes my two-hour presentation. Any questions?

DID YOU INTEND THE PRESENTATION TO BE INCOMPREHENSIBLE, OR DO YOU HAVE SOME SORT OF RARE "POWER-POINT" DISABILITY?

ARE THERE ANY QUESTIONS ABOUT THE CONTENT?

THERE WAS CONTENT?
Sharpening communication skills has value beyond increasing public understanding. It can breach interdisciplinary boundaries within science and help colleagues with different viewpoints catch a glimpse of a bigger picture. Articulating vision and common goals has long been a cornerstone of leadership on the battlefield. Scientists would be wise to adopt a similar strategy. Being a good communicator is not a trade-off. It makes you a better scientist.
What makes a Successful Presentation

• Familiarity with the Audience
• Clarity
• Use of explanatory and intuitive figures and diagrams
• Preparation & Practice
• Method of delivery
• Closing remarks
Signal Transmission Analogy

Transmitter

Message

Signal and/or Noise

Receiver
Knowledge of the Audience

• Expert vs general audience

• Purpose of your talk
  – Whether you want to convey new results or
  – Teach a class or
  – Have a discussion etc.

• Communication with the audience
  – Need to tailor it to the size
  – formal vs. discussion format

• Be enthusiastic about the work

• “Don’t talk over their heads; don’t talk down to them”
Conference Presentations

• 12-minute oral presentations at conferences are typical.
• These are time-management problems. Treat them as such.
• The audience is usually bored and distracted (lunch, professional activities, meeting with colleagues).
• You must be interesting!
Importance of having a Structure

• Having a framework in mind is helpful.
• OUTLINE
  – Controls number of slides & provides balance
• Strong emphasis on “Motivation”
• Have a story to tell:
  – decide on underlying issue to be addressed
  – divide into logical, hierarchical sub-questions
  – talk should ideally be series of answers to these questions
• Introduce well and provide a good conclusion.
Motivation

- InGa(ZnO)3 has bandgap of 3.4ev1.
- Crystal Contains different layer of InO-2 and GaO(ZnO)+m 2.
- InO-2 layer has more conductivity than GaO(ZnO)+m layer2.
- Optical transmission of IGZO is high in region greater than 450nm 3.


A better slide

IGZO
\((\text{InGa(ZnO)}_3)\)

- Layered structure (\(\text{InO}^2\) and \(\text{GaO(ZnO)}^{12}\))
- \(E_g = 3.4\) eV
- InO layer has more conductivity than \(\text{GaO(ZnO)}\).
- High optical transmission above 450 nm
Another example

• Composition, Processing determine structure
• Structure decides Properties
• Application depends on properties
• Other factors such as doping etc affect the structure too
A better slide

Application

Properties

Structure

Composition

Additional Factors:
(geometry, size, strain, doping)
Make it Clear - Concept

• **Style & format**
  – use of color can be useful to highlight & organize
  – be consistent (audience knows where to look)

• **Read through the presentation and check if main points are well laid out**
  – Heading = WHAT or HOW
  – Summary statement = CONCLUSION

• **“Speaker Support”**
  – It doesn’t carry you -- you are the focus
  – It supports your message
• One can use a slide master.
• Use robust color schemes that will show up clearly in an exceptionally light or dark room. Avoid light colors on a light background.
• Use of appropriate fonts and animation.
• Use of numbering/bullets.
Using Powerpoint

• Use the spacebar to advance your presentation. It’s the biggest and most unique key. Back arrow is the most obvious key to go backward easily.

• To jump to a different slide within your talk, type the number and then hit enter.

• Typing ‘b’ will blank the screen.

• Pressing ‘ESC’ will exit you from slide-show mode.
Importance of Clarity

• Science talk is not a murder mystery -- don’t keep your audience hanging!
• Know the fuzzy borders between experimental evidence and speculation (affects how you formulate your sentences)
• One concept per slide
  – cluster examples rather than moving through series too quickly
• Make sure you can be heard!

Lack of clarity can frustrate your audience & you can lose them!
Figures & Diagrams

- Use a Clear title
- Highlight important areas
- Don’t overcrowd
- Appropriate axes, legends, type of plots and size
- Acknowledge the sources and give credit where due
  - references to published data and any borrowed information
Figures & Diagrams

Showing a lot of unreadable info “for effect” - bad!

If it can’t be read -- it’s a waste & it annoys the audience
Bad Figures/Images

X-ray Diffraction Pattern

SEM Image
Better way of using Pictures

Net moment = 0

On Sm doping

Net moment > 0

Cycloidal spin in Undoped BiFeO$_3$

Canted Antiferromagnetic behavior of Bi$_{0.9}$Sm$_{0.1}$FeO$_3$
Time management and content

• One must honour the time provided.
• It is important to pace the talk well.
• Appropriately divide time between introduction, main content of the talk and conclusions
• You can’t have too long Introduction or Conclusion for a 12 min talk.
Prepare & Practice

• Timing (how many slides & length of talk)
• Be especially good at introduction and first few lines
• Mock in front of friends is a good idea
• Beware of over-practicing
  – * Don’t memorize entire talk -- stiff & BORING!!
  – * 1X = 10-fold improvement
  – * 2X = twice as good
  – * 3X = polish
Important Points

• Talk to your audience (eye contact, conversational style)
• Engage your audience by asking questions
• Keep it interesting:
  – share interesting tidbits
  – give unique examples/analogies
  – humor disturbs slumber
• Tiny type kills (use at least 18 point font ... ?)

If you’re bored, you’re audience is snoring!
Method of delivery

VERBAL SKILLS
• Slow down!
• Don’t read your slides
• Vary voice tone (conversational)
• Genuine enthusiasm
• SPEAK-UP

BODY LANGUAGE
• Eye contact
• Stand straight - breathe
• Don’t overgesture with pointer, etc.
• Face your audience
A crystal structure describes a highly ordered structure, occurring due to the intrinsic nature of molecules to form symmetric patterns. A crystal structure can be thought of as an infinitely repeating array of 3D 'boxes', known as unit-cells. The unit cell is calculated from the simplest possible representation of molecules, known as the asymmetric unit. The asymmetric unit is translated to the unit cell through symmetry operations, and the resultant crystal lattice is constructed through repetition of the unit cell infinitely in 3-dimensions. Patterns are located upon the points of a lattice, which is an array of points repeating periodically in three dimensions. The lengths of the edges of a unit cell and the angles between them are called the \textit{lattice parameters}. 

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Closing the presentation

• Summary of conclusions or key take home messages

• Zoom-out (relevance or application of your work)

• Next steps (if appropriate)

• Acknowledgements
Post Presentation Q/A Session

• You have to think of you as an expert.
• Do not let the audience intimidate you.
• If you are uncertain, admit it.
• Do not give handwaving answers!
• Arguing off the top of your head is alright, if preface as such.
Post Presentation Q/A Session

• Some audience members might be on an ego trip. Do not get perturbed by it.
• If this persists, offer to “discuss this later after the session.”
• If the questioner wanted you to perform a particular analysis, feel free to address his/her concerns or explain why you didn’t, but do not allow monopolization of the Q&A.
Post Presentation Q/A Session

- Sometimes the question is confusing. Asking them to rephrase the question is certainly acceptable.
- Or, “If I understand your question, you are asking me. . . . Is this correct?”
- Make sure you answer the question!
- Feel free to ask, “Did this answer your question?” at the end of your answer.
Tables in a presentations

• **Tables are an effective way of presenting data:**
  – Use when you wish to show how a single category of information varies when measured at different points (in time or space). (e.g. angle vs peak in XRD data)
  – when the dataset contains relatively few numbers.
  – when the precise value is crucial to your argument and a graph would not convey the same level of precision.
  – when you don’t wish the presence of one or two very high or low numbers to detract from the message contained in the rest of the dataset.

• **Shouldn’t be too overcrowded.**
• **Important portions can be highlighted.**
A good and a bad table

<table>
<thead>
<tr>
<th>Region</th>
<th>% adults taking a holiday</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Anglia</td>
<td>50</td>
</tr>
<tr>
<td>East Midlands</td>
<td>64</td>
</tr>
<tr>
<td>Greater London</td>
<td>56</td>
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<tr>
<td>Humberside and Yorkshire</td>
<td>84</td>
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<tr>
<td>North</td>
<td>54</td>
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<td>North West</td>
<td>59</td>
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<tr>
<td>South East</td>
<td>60</td>
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<tr>
<td>South West</td>
<td>61</td>
</tr>
<tr>
<td>West Midlands</td>
<td>56</td>
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</tbody>
</table>

• No title
• No source of the information
• Row titles straddle two lines
• Each cell is bounded as if in a spreadsheet
• The alphabetical listing of regions results in a non-numerical ordering of data down the columns
Use of images

13A Plug Wire Fixing Screw
Scientific Talks - Summary

1. Know your audience.
2. Tell them a clear story and how it develops from one point to another.
3. Show them the evidence (figures).
4. Concepts can be presented by schematic diagrams.
5. Engage the audience, keep them awake.
6. Give them great delivery -- prepare, practice & SPEAK-UP!
7. Share your enthusiasm for your work.
8. Sell your message with a strong summary of conclusions.

Most importantly - Have Fun!
Writing Skills (Thesis/Report/Papers)
Scientific writing

• Aim: to transfer knowledge accurately and concisely
• It is an ESSENTIAL scientific skill
• It is difficult and needs constant practice
• It has style conventions that need to be learnt
• It is very creative and helps to generate/form ideas
• It can be fun! (being positive about writing helps!)
• If a report is worth writing then it is worth writing well!
What is the purpose of a thesis or article?

• To prepare the student to be a professional in the discipline.
• To communicate his/her research among the peers.
• The student learns and demonstrates the ability to conduct independent, original, and significant research.
Purpose

• **Its ideally shows that the student can**
  – identify/define problems,
  – generate questions and hypotheses,
  – review and summarize the literature,
  – apply appropriate methods,
  – collect data properly,
  – analyze and judge evidence,
  – discuss findings,
  – produce publishable results,
  – engage in a sustained piece of research or argument,
  – think and write critically and coherently.
Useful books on style and usage


Use of language

• Keep It Short and Simple! (clear, concise, accurate)
• Identify and simplify your main message
• Structure your report into logical sections
• Use simple short words and avoid technical jargon
• Remove ALL useless words, sentences, paragraphs
• Use active verbs and avoid nominalization
• Keep sentences short (less than 30 words)
• Write short paragraphs each based on a single idea
What does a scientific article ideally consist of?

• Again, one must have a story in mind about the topic to be written.

• The essential ingredients are
  – Title
  – Abstract
  – Introduction/Literature review
  – Motivation/Definition of the problem
  – Experimental/Modelling/Calculation Details
  – Results and Discussions
  – Conclusions
  – Bibliography
Title

• Must be short and simple
• Should provide a gist of the article
• Should typically not contain acronyms
Abstract/Synopsis

• Abstract is a short summary focusing on motivation, objective, brief methodology and salient results and their importance.

• Synopsis can be more elaborate and detailed, chapter by chapter details in a thesis.

• Answers to these questions should be found in the abstract:
  – What did you do?
  – Why did you do it?
  – What question were you trying to answer?
  – How did you do it? State methods.
  – What did you learn? State major results.
  – Why does it matter? Point out at least one significant implication.
Introduction Section

• Good start and end
• What is the purpose of introduction section?
  – Provide background Information
  – Expose the lacunas or gaps in the existing body of knowledge and state the problem undertaken
  – Show motivation of the study
  – The introduction should be focused on the thesis question(s). All cited work should be directly relevant to the goals of the thesis. This is not a place to summarize everything you have ever read on a subject.
  – Explain the scope of your work, what will and will not be included.
  – A verbal "road map" or verbal "table of contents" guiding the reader to what lies ahead.
  – Is it obvious where introductory material ("old stuff") ends and your contribution ("new stuff") begins?
• **Experimental Details:**
  – Design of Experiments
  – Explanation of the type of experiments conducted and their details for one to be able to reproduce the results
  – State any limitations

• **Explain the calculation approach**
  – What kind of softwares or algorithms were used, what were the assumptions made etc
Results and Discussion

• **Results**
  – Reporting of various kinds of data in the form of figures/graphs and tables supported by text
  – Observations made with appropriate references to the figures and tables

• **Discussion**
  – Comparison of the findings with the literature
  – Explanation of any new finding and propose possible reasons by means of either or all of analytical/schematic/textual methods
  – Inferences drawn in a broader context
  – Answers to the questions posed in the introduction
Discussion

• What are the major patterns in the observations? Any relationships, trends and generalizations among the results?
• What are the exceptions to these patterns or generalizations?
• What are the likely causes (mechanisms) underlying these patterns resulting predictions?
• Is there agreement or disagreement with previous work?
• Interpret results in terms of background laid out in the introduction - what is the relationship of the present results to the original question?
• Multiple hypotheses: There are usually several possible explanations for results. Be careful to consider all of these rather than simply pushing your favorite one.
• Avoid bandwags: Avoid jumping to a currently fashionable point of view unless your results really do strongly support them.
• What are the things we now know or understand that we didn't know or understand before the present work?
• Include the evidence or line of reasoning supporting each interpretation.
• What is the significance of the present results: why should we care?
Conclusions

• Summarize key findings and take home messages
• Don’t just say that I did this and I did that
• What is the strongest and most important statement that you can make from your observations?
• Refer back to problem posed, and describe the conclusions that you reached from carrying out this investigation, summarize new observations, new interpretations, and new insights that have resulted from the present work.
• Include the broader implications of your results. Do not repeat word for word the abstract, introduction or discussion.
Future work

• Would be good to have section for future work sharing your thoughts on what is missing and what could be done further to enhance the knowledge in the field.

• Include when appropriate (most of the time)

• Remedial action to solve the problem.

• Further research to fill in gaps in our understanding.

• Directions for future investigations on this or related topics.
• Acknowledge everyone who helped you technically and intellectually
• Mention the financial support
• Bibliography should be as per the journal format.
• Include all your data (tables, code, programs, Maths etc.) in the appendix.