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Soft skills for mathematicians, L6-8

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Course contents

PhD course: **Soft Skills for Mathematicians**

Lectures:

1. Ethics and AI

2-3. Writing a scientific paper

4-5. Submission, revision and giving feedback

6. Writing/presenting a popular material

7. Writing applications

8. Oral presentations

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Popular texts: Important to think about

Decide readership (what background? - good to specify in text)

- Have specific (typical) reader in mind when writing

- Catch interest of the reader early

- Ask fascinating question, surprise or provoke

- Indicate interesting forthcoming material

$\Longrightarrow$ as scientific paper but even more! (These readers are rarely "forced" to read)

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Popular texts: General advice

- Skip details
- Explain using intuition – few or no proofs
- Don't lie but "avoid" unpleasant truths
- Explain using examples rather than being general
- Use figures and illustrations
- Use interesting special case rather than general case
- Be excited – use colorful language
- Illustrate relevance of result
- Make the reader believe they understand (even if details are complicated)
- Not too long. Ask yourself: can this part be left out?

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Other ways to popularize mathematics

There are many but I am not a specialist ...

YouTube

Interactive webbased

Games and edutainment

Popular talks or performances: very nice to bring some "props" (physical objects)

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Homework for next week

- Write popular scientific text, 3-8 pages
- Readership: high school student (natural science), and/or specific popular science journal
- Swedish or English
- Read text by Halmos and text about popular writing

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Writing an application: Who will read it?

Some difference between grant application and academic job application. Focus here is on similarities

Find out who will read the application

- Nearly always a panel with 1-2 expert(s) in your field and some non-experts

- Non-experts will read cover letter, CV, list of publications and summary/introduction to research plan

- Expert(s) will also read rest of application

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Cover letter (mainly when applying for positions)

Cover letter (mainly when applying for positions)

One page

Should summarize the application: publications and their impact, important talks, teaching skills, earlier grants, outreach.

A bit more personal – nothing technical

Why are you suited for the position/grant?

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CV and List of Publications

The CV

Not too long (often limited to 2 pages)

Include: contact details, academic degrees, job positions, scientific talks, grants and prices, teaching experience, number of publications and bibliometrics, referee jobs, organization of meetings, something that makes you special, reference persons with contact details (you must have asked them!), ...

List of publications

Reverse chronological order and numbered

Explain your contributions and author order (if applicable)

Papers first: published and submitted with ArXiv-link

Thereafter Proceedings, book chapters, ...

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When writing research plan

Why this problem?: Explain why problem is important

Why you?: explain why you are suitable to solve the questions at hand

Why now?: Why is the timing good? Perhaps a new results opened a new path, or there is a new application requesting result?

Present short term and long term goals

Mention preliminary results (fine as long as not yet submitted)

Long term goals may be more visionary and not guaranteed you will reach them: high risk – high gain

Highlight what is **new**, both in general but also compared to your earlier work.

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Common "mistakes"

Common "mistakes" candidates do (both in applications and interview)

- Too much details on research project and too little on "why" you study the problem
- Long term goals (for positions): mention also grant applications, supervision, develop new research direction, course development, initiate collaboration with colleagues, ...
- Focus instead on: Why should they pick you?
- Prepare for questions before interview: Why did you apply? 5 year goals? How can you contribute to department? Prospect for collaboration with colleagues? Do you have questions to us?

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Oral presentations: Preparation

- Many similarities with writing
- **Main difference**: Impossible to cover everything. Be simple!!

Purpose of giving talk: Catch interest and inform (Halmos)

- Who are you talking to? Affects presentation:
  - Focus on results or methodology
  - Mathematical level
  - Utmost generality or specific examples

Remember: you have worked with the problem several months (or even a year), audience have never heard about it

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Preparation, cont'd

Choice of medium:

- **Beamer**: Possible to cover more, risk of too quick presentation
- **Black/whiteboard**: slow, better for explaining mathematical result

Probably best with beamer complemented with black-board

- Try to catch the listeners interest

- Understanding problem is more important than understanding solution

Handouts: Possible to distribute handouts or paper before or after talk, or give link to talk. Tell in advance!

Three aspects affect structure of talk: subject, audience, time

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Preparation, cont'd

- Mention coauthors (and possibly funding bodies)
- Be simple and general in beginning – possibly more technical and specific (your own contribution) towards end

- Consider how much time you have when preparing talk

- Motivate problem

- Give the talk loud for yourself when preparing – takes longer time

- **Never** talk too long. Shorter is fine

- Some slides towards the end should be possible to skip

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Slides

- Don't use complete sentences

- At most one slide per minute

- Only important references at end (if any)

- Most important that listeners understand the problem you are addressing

Proofs: Better to present ideas in proof (recommended!) rather than formal proof

- Good to mention open problem towards the end

- If short talk: treat only one (important) problem, if more time: some related problems ok

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Slides

Each slide

- Informative title/heading
- use symbol "·", "–", ... to visualize list
- not too much information on one slide
- leave out details
- should only contain information you talk about!
- large enough font
- Page numbering or not?

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Oral presentation

- Try to catch eye-contact with all people in the audience – not always the same VIP person(s)

- Speak loud!

- Talk about a special case rather than most general situation

- You may have "speakers notes" on the side for your memory

- Unexperienced speakers are recommended to learn 1-2 sentences at the start by heart

- Don't speak too fast

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Oral presentation

- Make a slightly longer stop after saying important results

- Avoid repetetive "hang-ups"

- Reflect on good and bad examples when you hear other presentations

After talk: try to get feedback from supervisor/student colleagues – learning how to give talks is a process (ask them in advance)

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Summary

I have now given some advice on how to write, give talks and apply for grants/positions

My points need not (all) be suitable for you

Most important that you reflect on these issues. **And practice!**

Solving important mathematical/statistical problems is important, but presenting the results pedagogically is just as important