Master traineeship - recommendations

Your master traineeship is probably your first real experience in research. It will differ from more traditional academic work significantly. Here are a few recommendations to help you tackling this new kind of work, and some checkpoints that are worth verifying.

The advises below are mainly meant to help you preparing your traineeship report and its oral defense. However, they apply without any change to all scientific publications that you may have to write and present later on. You may find out that many scientific publications you are studying are not closely following these guidelines. You will discover that many papers are poorly written and difficult to understand as well.

Warning

Although it should not be needed to remind this, experience unfortunately shows that it is important to outline that **plagiarism** as well as faked scientific results are unforgivable scientific offenses. Both plagiarism implementation and plagiarism detection are made easy by Web search engines. Quotations from other sources are possible as long as they are unambiguously identified as such in the document: text that is copy-pasted from other sources should be quoted, figures that are borrowed should be labelled as such in their caption, and scientific references or web links should be added in all cases. Faking scientific results is of course against scientific deontology. As a rule, a serious scientific publication should always give enough details to make it possible to reproduce scientific results independently, so as to avoid any suspicion of treachery.

Scientific research

First of all a scientific work should be rigorous, objective and precise. Scientific subjects may not be so well defined by nature of scientific exploration. Traineeships are short duration projects and they should be quick enough to grasp. A clear understanding of the objectives of the work is critical to a successful research work. Never hesitate to come back to your supervisors for more explanation as long as the objectives followed are not well defined nor well understood. It may happen that the problem tackled is revised after preliminary studies. If the problem turns out to be too wide, too complex, too fuzzily defined, it has to be split, restricted and contained until it becomes tractable. Scientific innovation often proceeds by very small steps on well-defined problems. Large breakthroughs hardly exist and usually follow long years of study of a specific problem. Do not fear to bring a too modest contribution, as long as it is well understood and objectively evaluated. Rather fear a vague contribution whose conclusions are difficult to draw.

Introduction

The report is usually headed by an abstract or accompanied by a summary. It HAS TO contain:

- a clear description of the objectives of the work;
- some information on the methodology used; and
- a hint on the main results obtained.

The reader of the abstract should know unambiguously if the reading of the complete report is of interest for her.

Both your report and your oral presentation should begin with an introduction, which must be accessible to non-specialists. Remember that readers of your manuscript and jury members are scientists, but not necessarily familiar with the (very narrow) domain of your study. The introduction HAS TO describe:

- motivations: why is the work of interest / importance;
- objectives: what is the exact objective of this work, usually much narrower that the context to which it belongs to;
- challenges: what are the difficulties; and
- paper organization: what are the steps followed to reach the objective.

Positioning and related work

A preliminary study is always necessary when tackling a scientific problem to clearly know what are the similar problems that have been studied and how they were addressed. You can only defend the novelty of

your method/work if you have a clear view of the related work. This study has to appear in your manuscript and it may be a non-negligible fraction of the work done. In the time-limited defense, this study should be summarized in one or a few slides only (because you need to focus on your contribution), but it should not be omitted to show that you have a clear view of your research field panorama. In a written report, related work can be summarized at the beginning, after the introduction and before describing the method developed. It makes it easier to motivate the method and position it with regard to other studies. However, in many cases it is not easy to analyze the existing work without having properly introduced the scientific area details. Therefore, related work are also commonly summarized at the end of a report, in a "discussion" section, shortly before the conclusion.

Contributions

You now need to describe your contributions. This is the most important part of your report / oral presentation and you should make it very clear what is your contribution versus what it is not (reuse of other work / results / tools). **In your defense, do not hesitate to boldly state "Contributions" as the title of a transition slide to let no doubt on what was not your personal work** (which came before). Your contribution should clearly be related to the objectives that you stated in the introduction. Numbering objectives and referring to them explicitly through these references can be a good option.

Your work may include an experimental part. For all experiments, it should be clear what is the objective (what is measured and why), what is the method (how is the measurement made) and what the results are (analyze your results and conclude). Never deliver a raw curve / table, assuming that the reader will draw the same conclusions as you do when you see it.

Assessment and results

All work should be evaluated. A theoretical work will be grounded on demonstration and an applied work will need some experimentation or simulation. You need to provide objective evaluation criteria and to give a critical evaluation of the results achieved with regard to these criteria. Your evaluation should clearly refer to the initial objectives of your work: were they fulfilled? To what extent? If not, why?

Do not neglect any part of your work. Some works are mostly theoretical. Others require heavy experimental efforts or code development. Talk of all contributions. **A rigorous experimental set-up or a complex software development is an achievement**. You are also encouraged to talk of negative results when they lead to lessons learnt (on how to proceed next time, to update the experimental set-up…). Research is also made of dead ends. Nobody can tell whether you will solve the initial problem that you are addressing (or even whether it is solvable). Identifying dead-ends and documenting them so as to avoid exploring them again is also a valuable scientific result.

The conclusion must contain a brief factual summary of the results found. It should open up on some more general (and sometimes personal) appreciation of the results and their meaning (What are they suggesting? Do they call for more / different analysis?). It should provide some perspectives for future work.

Oral presentation

For an oral presentation, all points above should be followed on with a clear focus on your personal contributions and results found. Be careful on the strict timing. A half-defense cut short by time limitation is extremely damaging. It is commonly observed that you should not try to pack more slides than you have minutes for presentation. Some slides will take, 2, 3 or even 4 minutes to present. Some transition slides will take less than a minute. But on average, you cannot expect more than one slide per minute (this is already quite packed actually). **Do not overload slides with too much content**. Write short sentences. Use large fonts. If everything cannot comfortably fit in a slide then split content over two of them.

Always focus on the major results and contributions. Do not hesitate to state that "details can be found in the manuscript" if you do not have enough time to present them.

For a successful presentation, it is critical that you make as many repetitions as needed. Check that you are comfortable with your talk and that it fits in the allocated timing. Check that the slides clearly appear after projection (be careful of color transformations and under-sampling caused by video-projectors).

It is good practice to prepare some backup slides on details that could not fit in the presentation agenda but that are likely to be of interest to reply questions from the jury.

Master traineeship - checklist

- Clarity: your contribution has to be well understood and objectively evaluated.
- Abstract: has to contain (i) objectives; (ii) methodology; and (iii) main results obtained.
- Introduction should be accessible to non-specialists. It includes (i) motivations; (ii) objectives; (iii) challenges; and (iv) paper organization.
- Positioning with regards to related work is a must.
- Personnal contributions (vs reuse of other works / results / tools) has to be very clearly identified. It is the main part of the report / defense. Contributions may be of many kinds (a deep bibliographic study is a significant contribution).
- Experiments objectives and methods have to be describe prior to results. Results need to be analyzed and concluded.
- All scientific work need to be evaluated. Describe evaluation criteria and methodology.
- The conclusion must contain a brief factual summary of the results found. It should open perspectives.

Additional check items for oral presentation

- Strictly control presentation timing. Make repetitions as needed.
- No more slides than minutes allocated for presentation. Never more than 3-4 minutes on a single slide.
- Do not overload slides. Make short sentences and use large fonts.
- Make choices and prioritize items. Omit details for the sake of clarity and time control.
- Check that the slides clearly appear when video-projected.