Good Scientific Practice in mathematics - Part I

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RTG 2553, March 2025

[1]Based on talks by Valentina Vasilov (March 2022) and Johannes Sprang (April 2023)

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Goals of the first part:

- What is good scientific practice?
- General introduction to the topic.
- Important rules and regulations (DFG/UDE).
- What to do if you encounter misconduct.
- Where to find further information.

What is good scientific practice?

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- **Virtues/Values:** important beliefs or ideals of a community that serve as motivation for action – *general, universal*
- **Norms:** action-guiding rules – *specific, concrete*

Virtues/Values	Norms/Actions
Honesty	I should acknowledge any help/contribution of others.
Reliability	I should meet the deadline for my report.
Courage	I should talk to my advisor if there are any problems.

Virtues and Values in Research:

Case study:

The day before an important job interview, you discover a critical error in one of your key publications. Although you work for several hours to fix the error, you do not succeed. In your already prepared presentation you wanted to talk about exactly this work. What do you do?

Please identify the relevant virtues in the case study and describe some possible options for action that can be derived from the relevant virtues.

Virtues/Values	Norms/Actions

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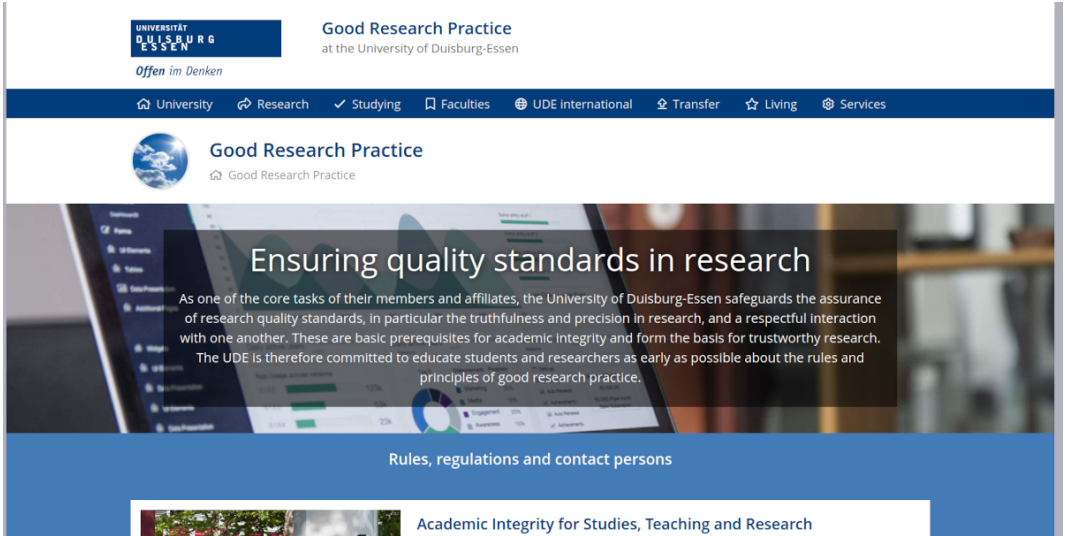
DFG: „Guidelines for Safeguarding Good Scientific Practice“.

- 19 Guidelines for Good Scientific Practice.
- Guideline 1-6: Principles
- Guideline 7-17: Research Process
  - Guidelines 7-13,17: (quality assurance, research design, ethical frameworks, methods, documentation, research data)
  - Guideline 14: Authorship
  - Guideline 15: Publication medium
  - Guideline 16: Confidentiality of review processes and discussions
- Guideline 18-19: Complainants and respondents

https://www.dfg.de/en/research_funding/principles_dfg_funding/good_scientific_practice/

Good research practice at the University of Duisburg-Essen

https://www.uni-due.de/en/good-research-practice/



Good research practice at the University of Duisburg-Essen

https://www.uni-due.de/en/good-research-practice/

UDE ombudspersons

Please contact the UDE ombudspersons for a confidential consultation if you have any questions, in the event of conflict or in case of allegations of research misconduct:

- Prof. Dr. Peter Friedrich Hoyer
- PD Dr. Ursula Telgheder
- Prof. Dr. Andrea Vortkamp

You can reach the secretariat for good research practice using the following e-mail address:

gwp-sekretariat@uni-due.de

Further contact persons

- Zentrale Ombudsstelle für Studierende
- Ombudsman für die Wissenschaft (DFG)
- Ethics Committees at UDE:
  - Ethics committee at the faculty of Medicine
  - Ethics committee of teh Faculty of Business Administration
  - Ethics committee of the Institute of Psychology, Faculty of Educational Sciences
  - Ethics committee of IZfB
  - Ethics committee of the Department of Computer Science and Applied Cognitive Science, Faculty of Engineering
  - Ethics committee of the Faculty of Social Sciences

Academic investigating committee

In the event of a suspicion of academic misconduct, the ombudsperson active in the respective case transfers the proceedings to the academic investigating committee. The commission is responsible for clarifying the facts and investigating the allegations of research misconduct. If it finds misconduct, the commission prepares a report for the rectorate and proposes measures to be taken. However, the first point of contact for information on misconduct is always the ombudspersons.

To the committee →

Please find here further information for...

Good research practice at the University of Duisburg-Essen

Principles for safeguarding
good research practice
at the University of Duisburg-Essen
('Principles of good research practice')[1]

Dated 13 July 2023

On the basis of Section 4 (4) of the North Rhine-Westphalian Higher Education Act (*Hochschulgesetz*; HG) in the version modified by the Act amending the North Rhine-Westphalian Higher Education Act (*Gesetz zur Änderung des Hochschulgesetzes*) dated 12 July 2019 (Gesetz- und Verordnungsblatt NRW, p. 377), as last amended by the Act dated 30 June 2022 (Gesetz- und Verordnungsblatt NRW, p. 780b) and as part of the implementation of the 'Guidelines for Safeguarding Good Research Practice' code of conduct from the German Research Foundation (DFG), which became effective on 1 August 2019, the University of Duisburg-Essen has issued the following regulation for all its members and employees.

Preamble

With these 'Principles for safeguarding good research practice', the University of Duisburg-Essen (UDE) is complying with statutory obligations, according to which all researchers, research support staff and students at UDE are required to maintain integrity in research. These principles form the

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Ombudspersons

Tasks of an Ombudsperson:

- **Advising:** The Ombudsperson provides confidential advice on matters of research integrity.
- **Mediation:** Where conflicts related to good scientific practice occur, the Ombudsperson assists by means of solution-orientated conflict mediation.

Should adhere to ethical principles:

- Independence
- Neutrality
- Confidentiality
- Informality

Ombudspersons at our university

In the event of infringement of good scientific practice or in the event of suspected scientific misconduct, the mediators at the UDE could be contacted directly:

UDE ombudspersons

Please contact the UDE ombudspersons for a confidential consultation if you have any questions, in the event of conflict or in case of allegations of research misconduct:

- Prof. Dr. Peter Friedrich Hoyer
- PD Dr. Ursula Telgheder
- Prof. Dr. Andrea Vortkamp

You can reach the secretariat for good research practice using the following e-mail address:

gwp-sekretariat@uni-due.de

The German Research Ombudsman:

https://ombudsgremium.de/?lang=en

Whistle Blowing

Published: March 1998

How to blow the Whistle and still have a career afterwards

C. K. Gunsalus JD

Science and Engineering Ethics **4**, 51–64 (1998) | Cite this article

1781 Accesses | **33** Citations | **8** Altmetric | Metrics

Abstract

Filing charges of scientific misconduct can be a risky and dangerous endeavor. This article presents **rules of conduct** to follow when considering whether to report perceived misconduct, and a **set of step-by-step procedures** for responsible whistleblowing that describe how to do so once the decision to report misconduct has been made. This advice is framed within the university setting, and may not apply fully in industrial settings.

Guidelines

(1) Consider alternative explanations.

(2) Ask questions, do not make charges.

(3) Figure out what documentation supports your concerns and where it is.

(4) Separate your personal and professional concerns.

(5) Assess your goals.

(6) Seek advice and listen to it.

Case study

While you are working on your PhD thesis you find an old paper written in Russian which appeared in a little-noticed conference proceeding in the 60s. After reading it in detail you realize that a more recent paper of another person looks like an English translation of the Russian paper without mentioning the original work. What do you do?

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- These slides are based on a talk of Valentina Vasilov (March 2022, UDE).
- DFG: https://www.dfg.de/en/research_funding/principles_dfg_funding/good_scientific_practice/
- UDE: https://www.uni-due.de/de/gute-wissenschaftliche-praxis/
- https://ombudsman-fuer-die-wissenschaft.de
- Gunsalus, C.K. *How to blow the Whistle and still have a career afterwards.* Sci. Eng. Ethics 4, 51–64 (1998).
- Word Cloud created with: https://wordart.com/create.

Good Scientific Practice in Mathematics – Part II

Ulrich Görtz
(based on previous workshops by U.G. and Johannes Sprang)

RTG 2553, March 2025

GSP – what does that mean in practice?

- research (e.g., how to deal with result you want to use but do not have time to check in detail, or do not understand? How to deal with mistakes?)
- writing (proper attribution, how/when to write down ‘known results’, …)
- publishing (authorship, predatory journals, …)
- applying for a job (being honest in one’s CV, publication list)
- resolution of conflicts
- other aspects (less prominent in this workshop;
  e.g., refereeing, reviewing, advising students, hiring, conflicts of interest)

Workshop, not a lecture

In the second part of the workshop, we would like to give more specific examples and discuss particular questions around good scientific practice.

Often, these questions do not have a clear answer. What one should do:

- Try to identify possible issues, and make a conscious, informed decision,
- do not simply choose the solution that’s easiest / comes with the least work for you.
- Talk to others (your advisor, peers, mentors).

Research, scientific honesty

Goals of research

- advance the field of mathematics
- understand an open question yourself
- communicate new insights
- get a degree / a job

Scientific standards

- obtain correct results with complete proofs
- obtain new/‘original’ results
- obtain ‘interesting’/‘relevant’ results
- keep up with others’ work, acknowledge/reference properly
- publish your results in understandable/accessible form

Documenting the research process

Why and how should you document your research? – goals, requirements?

Some aspects:

- General requirement of scientific method: ‘reproducibility of results’ – clearly, mathematics is different from (natural) science here.
- It sometimes (often?) does require an effort to document things in a way so that (at least) oneself is able to understand them when coming back to the files after several months. At least when you write a text you want to publish, then that effort should be made.
- In most cases, in theoretical mathematics, a paper (or thesis) should contain the ‘complete’ documentation of the proofs of its results.

Choice of research topics

… in relation to other people working on the same subject.

When is it (not) OK to work on a problem that someone else is working on?

- Surely OK: Work on the Birch/Swinnerton-Dyer conjecture
- not OK: ‘work out’ an idea someone else told you about as her/his current project

Risks for yourself? (PhD thesis must contain ‘new contribution’)

(Ideally (and usually), for PhD projects the advisor will take care of this.)

Overlap in topics

What to do if you notice overlap with your research and someone else's?

Strategies for resolution

- Work together
- Discuss with the other party how each of you could focus on different aspects
- Ignore it and try to be the first to 'prove the theorem' (risky …)
- Switch the topic (could be frustrating; but could come back later)

Controversies around originality of work

… and how to protect yourself.

- Let people know what you are working on.
- Keep your eyes open what others are doing.
- Acknowledge work by others.

While not in all cases, mostly such controversies are handled ‘on a benevolent basis’, and that should be your first aim.

Writing

What should be your goals when writing a thesis/a paper?

- documenting research results for oneself (quality assurance; archiving thoughts for coming back later)
- documenting one’s research results for others, advancing mathematics
- submit one’s work to a peer review process
- get a degree, add items to one’s list of publications (… to find a job)

Writing well/accessibly

(Only indirectly related to Good Scientific Practice. If there is interest, we could have another workshop on “mathematical writing”.)

Slogans:

- Keep in mind your prospective readers.
- If in doubt, an additional effort should be made by the author, rather than putting it on the reader.

Writing - plagiarism

Copying of another person's ideas, text or other creative work, and presenting it as one's own.

Types of plagiarism:

- Copying word-by-word (never do this in math texts, even with a reference)
- Translating word-by-word (never do this in math texts, even with a reference)
- Presenting work of others as your own / omitting proper attribution
- Structural plagiarism
- also: Self-plagiarism, present previous work as new

Slogan

If your text could not have been written in the way it is written without a certain source, you must make this clear to the reader.

Plagiarism – other aspects

- Can I use a figure/illustration from another paper? (scanning vs. redoing it …)
  Delineation of *good scientific practice* vs. *legal constraints*.

ChatGPT …

Is it legitimate to use help from “artificial intelligence”?

- AI based text production (e.g. ChatGPT)
- Help with/inspiration for proofs
- Let ChatGPT polish a text of yours
- Ask ChatGPT for help with TeX (commutative diagrams, TikZ figures)
- Use AI powered search engines to find references
- Also: automatic translation …

Does this have to be mentioned?

Differences between articles, grant proposals, job applications?

References

Why/when give references?

Generally: attribution for work of others.

- supply parts of the proofs that you do not do yourself,
- preliminaries/known results that you include in your manuscript,
- acknowledge work by others on the same topic,
- put your own work into context,
- delineate your work from work of others (e.g., different conventions).

Slogan

In a (PhD) thesis/paper, there is an implicit claim that everything that is not attributed to a different source, is original work by yourself.

Best practices

Do not postpone ‘adding references’, but do this from the beginning!

Use LaTeX’s `\cite` and `\ref`,

and possibly more advanced tools (BibTeX, Zotero, Obsidian, LogSeq, …).

Separate *learning* from *writing down* known results

- learn the topic, typically from different sources,
- later (not on the same day), write down *your own account*, with all books closed,
- spend time in particular on those things that you found difficult.

Good/bad references

Problematic:

- omitting relevant references
- superfluous references to make your work seem more important; exceedingly long lists of references
- references to one's own papers to increase number of citations
- imprecise references to long works (but when would this be legitimate?)
- references that 'hide gaps' in your papers (references to statements of results without proofs)

Where should references point?

- usually: first occurrence – give credit to the person who proved the result,

  if appropriate/necessary add further references (*see also …*) for more accessible sources
- for ‘standard’ results: look for a standard reference (in algebraic geometry, e.g., EGA, SGA, Stacks project).
- if possible, prefer *well-known, easily accessible, trusted* over *obscure, hard to find, many typos/small mistakes*.

Be careful with references to unpublished work, private communication.

What are examples when no reference is needed?(‘Classical’ results that go by a common name, e.g. the theorem of Riemann-Roch)

Do I have to check all references?

Specifically: Can I (/when can I) use results whose proof I do not understand?

- depends on the situation, and should be avoided if possible; but sometimes is ‘necessary’
- at least try to get some intuition, learn a few examples, etc.,
- check with others (your advisor …) whether the result can be trusted.
- Sometimes a fact you need can be taken as an ‘axiom’.

What about results that have not yet been published in a journal / as a preprint?

Known results

When to write down ‘known results’ (thesis vs. journal publication)

…and ‘obvious’ generalizations

- Can serve to make your text self-contained (service to the reader).
- Allows to give a ‘nice’ summary, improving on the original exposition.
- Allows adapting things to your setup/notation conventions.
- Who takes the responsibility for the correctness?
- What is the proportion of ‘known material’ vs. ‘new results’ in your manuscript?
- Is it (or is it not) in your interest to make your paper/thesis longer? (and should this play a role?)

Known results – slogans

- *Copy and paste* is never appropriate.

  Almost always, you will want to use your own notation, add some comments, emphasize points that will become important later in your paper, etc.; if none of this applies, then a citation might be enough.
- Especially in a thesis, giving your own detailed account of some ‘known results’ in more detail can be a good idea.

Claiming results without giving a proof

Why can this be problematic; when is it OK?

Straightforward computations could be omitted

Further Aspects:

‘Gatekeeping’, possibly diminishing others’ future work

Related: “… we will come back to this in later work”

Acknowledgments

People and institutions that have supported you ‘mathematically’ in writing the text at hand.

Thesis: your advisor.

Publication coming out of a thesis: your advisor, the institution.

Publications, in general:

- people (discussions, pointers to the literature, …, if ‘substantial’)
- formal: third party support, host institutions of visits (or possibly conferences, if relevant to the publication); (typically not the institution where you are employed)

Dealing with mistakes

What do you do, if you

… find a serious mistake in papers by others?
(usually: get in touch with the author; before that, you may first want to think about whether you can fix the problem).

… find a serious mistake in your own papers?
(try to fix it …, maybe: notify referees, publish an erratum)

Delineation:

- honest error,
- negligent error,
- misconduct.

Authorship

Who should be named as an author of a publication?

- ‘fame’ vs. ‘responsibility’
- As a rule, authors are listed in alphabetical order. There are very few exceptions to this.
- Sometimes: Appendices, can have their own authors

What could be a scenario when the advisor of a thesis should be a coauthor of a paper resulting from the thesis?

The way this is actually handled depends very much on the subject area…

How to deal with problems in joint projects?

(1) You disagree with (some of) your coauthors about what should be included in the paper / the writing style / where to submit the paper / …

(2) You cannot spend as much time on the project as you would like (and as your collaborators might expect)

(3) One of your coauthors promises to take on some task, but then does not react anymore

Choice of journal

- reputation of the journal
- general audience vs. specialized
- editor who will (probably) handle the paper (and select referees)
- have similar papers (topic, length, ‘quality’) appeared in the journal?
- publisher (commercial, semi-commercial, non-commercial, predatory journals)
- open-access
- typesetting quality
- time until decision/publication, “backlog”
- the copy-editing process

The process of submitting a paper

1. (if applicable) Discuss the ‘final’ manuscript with your advisor
2. (optionally) Send the new version of the ‘final’ manuscript to a few people to get feedback
3. Put your manuscript on the arXiv server (and maybe wait another two weeks for feedback)
4. Submit your paper to a journal (but to ONLY ONE journal at a time)
5. (make sure to get a confirmation your manuscript was received)
6. … wait…
7. After 6 – 9 months, it is legitimate to inquire when you can expect a report
8. If your paper is rejected, hopefully you got some feedback that you should take into account, revising the paper. Then jump back to step 4.

Do not get frustrated!

The process of submitting a paper, continued

9. If your paper is (provisionally) accepted, submit a revised version soon (and maybe wait some more …)
10. After the definitive acceptance, congratulations! You can now list the paper as *accepted for publication* or as *to appear in …*
11. When you receive the proofs after the ‘copy-editing’, carefully check the proofs sent to you.
12. If applicable: Negotiate about copyright (publisher/author), pay the open-access fee, order printed copies (probably old-fashioned)
13. Put a link on your web page and update the arXiv record

Applying for a job, writing a grant proposal

(being honest in one's CV, publication list)

- Submitted $\neq$ positive report $\neq$ accepted for publication ($\approx$ published)
- be transparent about non-peer-reviewed publications
- be transparent about 'guest status' vs. 'employed'
- be transparent about role in third party funded projects

Do mention 'special circumstances', in particular child care duties and similar things.

Consequences of violations of the rules

…in theses. (See §14 of the ‘Promotionsordnung’.)

- you might not be awarded a degree,
- of the degree could be revoked,
- (in theory) a fine could be imposed,
- other parties could take action (your employer, the DFG, …)

…in publications.

- the manuscript could be rejected (if it has not yet been accepted),
- or the paper could be revoked (if it had been published),
- other parties could take action (your university, the DFG, …)

…in applications.

- you might not get the job,
- in extreme cases, you might lose the job after being hired.

Resolution of conflicts

What to do if you notice misbehavior? / or are accused of scientific misconduct?

Talk to

- Your advisor
- RTG mentors
- Gute Wissenschaftliche Praxis at the University of Duisburg-Essen
- Ombudsperson at the German Research Foundation DFG

Further topics in Good Scientific Practice

…less relevant in “pure mathematics”

- ‘dual use’ (technology (or research results) that can be used for both peaceful and military aims),
- data/source code handling.

…less relevant for PhD students

- grading exams,
- refereeing papers,
- reviewing grant proposals,
- conflicts of interest (/conflict of commitment),
- advising students,
- hiring.

Sources /Acknowledgments

Thanks to J. Heinloth, J. Kohlhaase, J. Sprang for interesting discussions on the topic.

References/pointers

- DFG, Leitlinien / Kodex, Ombudsperson
- AMS: Backlog list (Nov. 2024)
- Ethical policy for the Journals of the London Mathematical Society
- Ethical guidelines of the AMS
- `https://en.wikipedia.org/wiki/Ethics_in_mathematics`
- Slides by M. Schüssler, MPI for Solar System Research,