



# Scientific Writing in Seminars & Theses

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We made an effort to achieve completeness and limit mistakes in this version. Still, we invite feedback on ambiguity, typos, missing contents, etc. to: [juergen.kreyling@uni-greifswald.de](mailto:juergen.kreyling@uni-greifswald.de)

## 1. Aims of scientific writing

### 1.1. Definitions

We separate between **scientific writing**:

i.e. a process that applies scientific principles and standards in order to work on our even solve a question or problem. Scientific writing in that sense is much broader than actually writing down words, it is a process to generate knowledge

and a **scientific work**:

i.e. the written result of scientific writing, which is achieved by applying scientific standards and principles. A scientific work is a product.

*(Peterßen, 1994 S.11 as cited by Grätsch, 2004)*

### 1.2. Criteria

Scientific writiting...

... deals with a **clearly defined topic**.

... offers **new insights**

... should be of use for others

... contains information, which allow to verify its hypotheses (**veryfiability**).

*(Eco, 1998, as cited by Grätsch, 2004ff)*



### 1.3. Requirements

- **Objectivity:** all steps can be traced and confirmed (applied methods and external sources of information)
- **Reliability:** The results are trustworthy and reproducible.
- **Validity:** Limits of the validity of the observed effects and interpretations are set by the topic and clearly stated (but not more!).

*(according to Grätsch, 2004ff, chapter 1)*

## 2. Literature search

The first step in scientific writing is informing yourself about the state of the art concerning your topic.

Start general! Good starting points are textbooks or other over-arching presentations. Of course, encyclopedias and Wikipedia ([www.wikipedia.org](http://www.wikipedia.org)) can be helpful during this stage. From there, successively continue towards specialized literature, the so-called primary literature (see 2.3). First, you need to get an overview as basis before you dig deeper into your specific question(s).

### 2.1. Search strategies

Use a **broad set of search strategies** in order to cover all facets of your topic. Some hints:

- Collect relevant references to other sources from textbooks and other overviews.
- Have a look at neighboring books in the shelves of the library; the books there are sorted by topics.
- “review”-papers contain compact and competent overviews of specific topics. Search for relevant reviews and check their references (you can directly search for review papers in the **Web of Science** (see 2.3. for details) by adding a row for “Document type” in its search mask and selecting “review”).
- Forward-search in **Web of Science**: find papers, which are citing an article that is central to your topic (possible, as soon as you have identified such an article for your topic).
- Try also: “find related records“ of such an article that is central to your topic in **Web of Science**: This search returns articles which share references with the one you start off from. Those will probably be on similar topics (but take care, these searches sometimes end in a limited pool which rather shows that the authors themselves did not have a full overview about their topic).
- Try alternative keywords – search for synonyms, e.g. using the internet or the Microsoft Word function to find such synonyms.

If you start a longer-term project, consider managing your literature by a specialized software such as CITAVI, for which we have a campus license, or free software such as Mendeley (see 4.9. for further information).

### 2.2. Getting an overview

Textbooks are ideal starting points for getting a general overview about a given topic. Use the catalogue of our University’s library to search for relevant books (Figure 1) at: [https://lhgrw.gbv.de/DB=1/LNG=DU/SID=307459d8-0/LNG=EN/ADVANCED\\_SEARCHFILTER](https://lhgrw.gbv.de/DB=1/LNG=DU/SID=307459d8-0/LNG=EN/ADVANCED_SEARCHFILTER). Some breadth is needed for a good overview, so start off rather broad searching for relevant keywords in title and keywords ([TTT]).



Figure 1: The search mask of the Web-OPAC of our library.

## 2.3. Primary literature

**Primary literature is the original publication of a scientist's new data, results, and theories which contains all necessary info to judge its validity, reliability and objectivity.** The most common form of primary literature are **articles in scientific journals**. Being rigorously peer-reviewed, they offer quality-controlled information. Theses and dissertations can also be viewed as primary literature but lack such a quality control and should therefore be treated cautiously. Relevant primary literature can be found in the reference lists of textbooks or review papers. The alternative is a direct search in *Web of Science* (see below for details, or e.g. *GoogleScholar*).

This direct search for primary literature is a mandatory step in the search for the up-to-date state of the art! Information from the primary literature is needed, because authors of textbooks and reviews might have set different emphases concerning their topic than you, meaning that they might have filtered out information that is important for you.

Always do this direct search **AFTER** a general search. Without a broad overview about the topic, you will otherwise end up in a sea of information, which can easily get overwhelming. You first need to become able to structure and filter the returned information; otherwise, this will quickly become frustrating.

We consider the *Web of Science* the most important source to search for primary literature. It is an online-database subscribed by Greifswald University and free to use in the IT-space of the university (all workstations which access the university network). This database is run by a commercial company, *Thomson Reuters*, and can be accessed via: <http://apps.webofknowledge.com>.

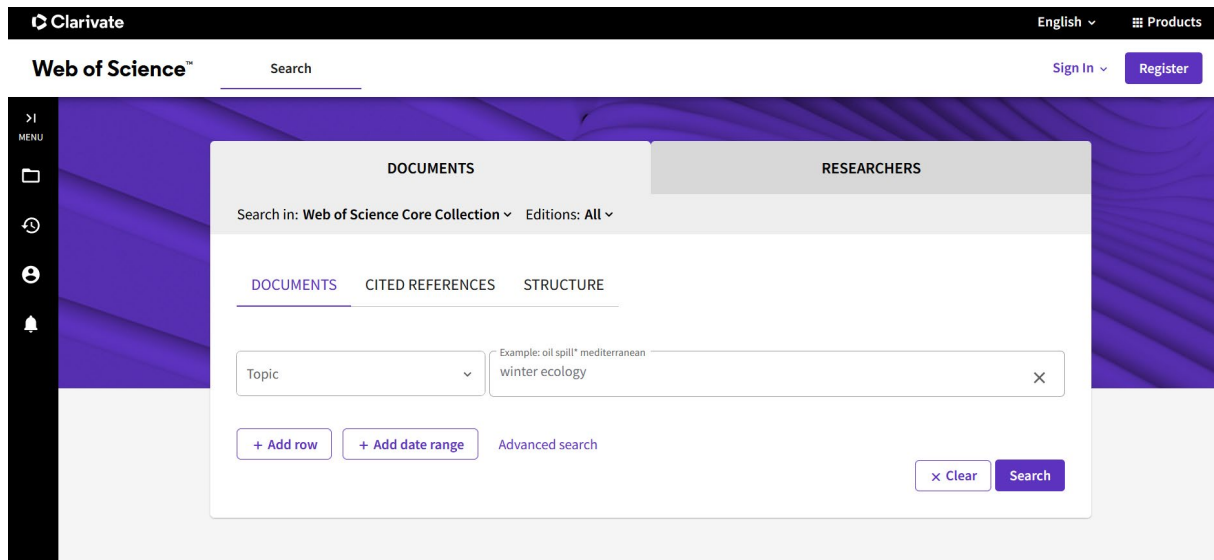


Figure 2: Search mask of the *Web of Science*.

The most important search in the *Web of Science* is the search for keywords in the “Documents” Search (Figure 2). A basic search for keywords under “Topic” yields hits of those keywords in the title, abstract, and keywords of the papers to be found. You can further search for authors, journals, specific years etc. For a forward search, use the “Cited Reference Search” next to the “Documents” search. This will yield papers, which cite a specific paper of your interest. If starting with older references from textbooks, a forward search can help you getting to the current state of art.

Further information can be obtained via the “help”-button on each frame. Tutorials and introductions to the Web of Science can be accessed via “Training Portal” (at the very bottom of the window). Here, we only provide a brief summary of the essentials:

- Complex search strings can be created by the use of Boolean operators, e.g.: “biodiversity AND (function\* OR service)”. Note that \* stands for any letter(s) in that word, here yielding both “functions” and “functioning”, for instance.
- You may limit the searched fields to title only if getting far too many results.
- You may limit the search to certain languages, but English will usually return by far the most and best hits.
- Within the Web of Science, you can read the abstract and see the cited references of every article.
- Putting relevant papers into the “*marked list*” (tick the box in front of the article and press “Add to marked list”), you can easily export several references at once to any literature management software (e.g. CITAVI, Mendeley, etc.).
- You can combine different searches by adding rows to the search mask.
- The Web of Science provides links to the full texts. This does not always work; see below for how to find out which journals are available online at our university (“Electronic Journals Library”).
- You can save your search online or locally (*search history*).



### Hints for searching and finding

- If you have identified an author with several relevant publications concerning your topic, try searching for her\*him directly and check if there is more. Sometimes they publish relevant stuff under slightly different keywords and titles.
- Check your search terms against the keywords (title & keywords) of relevant papers and use any new terms for another search.
- Search broad, especially to get started. Otherwise, you easily end up in dead ends.

### Online access to journal articles

The Electronic Journals Library (EZB) can be accessed via <http://rzblx1.uni-regensburg.de/ezeit/search.phtml?bibid=UBGRW&colors=7&lang=en> (Figure 3).

Enter the name of the journal you are looking for in the field “Titlewords”. You can also enter parts of titles such as “ecol\* lett\*” for Ecology Letters.

The search will return the journals found and indicate their availability, for example, the search string “ecol\* lett\*” will yield 11 hits. Consider the color indication: Green means publicly available, yellow indicates subscribed by the university (usually available via IP authentication) and red is not available. In the latter case, you need to find other ways to get the paper. (1) Check if it exists as print-out in the library (see OPAC), (2) explore the copy ordering via the library (<https://ub.uni-greifswald.de/serviceangebote/benutzung/fernleihe/> unfortunately in German and coming with costs!), (3) simply search the internet for the full title, (4) check the homepage of the author for a full text, (5) check out ResearchGate, or (6) send an email directly to the corresponding author and ask for a pdf (usually authors are quite happy about your interest and will send a pdf within few days, but this does only work well for younger papers with still active corresponding authors, starting at around year 2010).

Figure 3: Search mask of the Electronic Journals Library.

## 2.4. Further search

You will usually end up with many relevant books and papers after all these steps. Keep checking their reference lists for new items and continue like that. Not finding new and relevant papers in the reference lists is a good hint that you have covered the relevant literature! Just do not give up too quickly and always go for an own basic search in Web of Science, because otherwise you



might end up in a self-referential circle of authors which know each other well and keep citing themselves.

### 3. Reading – Sorting – Condensing

To filter, to simplify, to condense, to summarize, and to generalize complex topics is an art in itself! There is no point in just adding everything; the author has to be the filter, which allows the reader to understand a complex topic. This requires a good overview about the topic. This is the most demanding phase of scientific writing!

#### 3.1. Get the Overview

Start reading with the books and review papers. Have a short look into the abstracts, figures, and maybe the introduction and conclusion of the primary literature. For now, you simply need to get an overview!

#### 3.2. Sort & Analyze

For the next step, you need to sort and analyze your material. It can help to extract/excerpt the content of the single papers. Structure your excerpts by mind maps, by simply counting the frequency of subtopics, or by your hypotheses. This shall result in a first structure of your work.

#### 3.3. Set priorities & structure

Along this rough structure, you now need to set your own priorities. Criteria to do so might include:

- your task (e.g. the relevance for your own Bachelor's or Master's thesis),
- your interests,
- topicality within a broader discussion, and
- availability of literature (under-represented topics might be of high interest!).

#### 3.4. Concentrate your material

By now, you have come up with a rough, logical structure and have set your priorities. Based on this, you now filter out those references that are no longer needed and concentrate on those, that really are to the point. At this stage, check again for consistency and consider performing a few more, very specialized and concentrated literature searches. Have the guts to sort out - discrimination and selection are explicitly expected scientific skills (*Peterßen, 1994, Grätsch, 2004*).

#### 3.5. Get the message across

You need to find the logical lines of reasoning to get your message across. Develop a red line along which you can build an interesting story. Look for the most convincing figures in the primary literature which tell your story, and try to visualize the important processes in own graphics.

#### 3.6. Check critically

The most important question now is: Does the logic work? If yes, it will be easy to follow the text or presentation, as there are no cracks and weak arguments. The story explains, why the topic is of importance to you (and your audience), it leads to questions and answers them as good as the state of the art permits.





## 4. Writing

Scientific writing for a seminar, writing a thesis, or writing a publication is all similar. Writing something is training for the next one! Writing longer texts is unfamiliar for many people and sometimes appears to be a big hurdle. No matter, try to get started anyhow and do not put emphasis on the single words and phrases. The text will be reworked anyhow, and little might stay where and how it was in the end. Scientific writing is a matter of practice; it will get easier each time you do it! If you do not make progress at some point, simply continue somewhere else and get back to that tricky point at another time. Have familiar people read your text, such as other students, friends, relatives. They do not have to be in this science, your text should also be informative to people from the outside. Take their critique and try to improve on their points.

### 4.1. Structure

#### 1. Abstract

- A very short version of all that follows below, usually 200-400 words and even for a Doctoral dissertation it should be max. one page. A rough recommendation:
  - 1 sentence introducing the general topic and why it is of interest
  - 1 sentence defining your specific question
  - 1-2 sentences describing your methods (no need to go into details, keep at short)
  - 2-3 sentences on the main results
  - 1-2 sentences on implications of the results, finishing with a general conclusion

#### 2. Introduction

- The introduction introduces the topic and sets the basic background for the scientific questions tackled in the text. It does so based on the relevant literature and sets the frame for your work concerning topic, region of interest, general questions and hypotheses. A good introduction is similar to a mini-review and tells (1) why do you deal with this topic now and why it is also of interest to others? (2) what are the most interesting points (and unknowns) in the current scientific debate about this topic? And (3) what will your work offer to answer the open question(s). Data papers, i.e. papers that present new, primary data from observations, experiments, or modeling, contain **hypotheses at the end of the introduction**. Hypotheses are testable expectations, which are as concrete as possible (do not state “I expect a difference”, but “I expect a to be bigger than b”). Why you expect exactly this, should logically follow from the information given in the introduction. The suggested structure for the introduction would therefore be: one paragraph on the overall importance of the topic, the general background, and the gap of knowledge to be filled by this work. This is followed by one paragraph on each hypothesis, which introduces the state of the art and explains the expectations formulated in the hypotheses. The hypotheses should logically follow from these introducing paragraphs, but should stand together in one paragraph at the end of the introduction. That final paragraph may start with a very short summary of the applied methods (do not go into detail, that's the purpose of the methods section).
- For **review papers**, the whole structure is different and they usually do not contain hypotheses. The introduction is used to specify the question or topic of the review and the rest of the (usually very short) intro tells why this question is relevant now and stops by giving a short overview about the following structure of the paper. The chapters specified below do not occur in a review, the subsequent text is rather structured by topical subchapters where the state of the art is presented and critically scrutinized. Based on this, new insights are developed and open questions are identified.
- Published results and ideas from other papers are commonly referred to in present tense (simple present).



- The subject of all sentences should be their ecological message, not the cited authors (rather “Biomass production increases with warming (authors A with year, authors B with year)” than “Author A has shown that biomass increases with warming.”)

### 3. Material & Methods

- This chapter presents all the information needed to make your work reproducible. Based on the presented information, an informed reader should be able to completely redo your study. The methods section can contain references to other papers for relevant methodological or statistical details, so you do not have to explain all details here but can refer to existing protocols and method descriptions. This part is essential for the reader to judge the limits of validity of your results.
- Length of this chapter varies strongly, depending on complexity of material and methods used in your study. Only weak rule: as long as necessary and as short as possible.
- At the end of this chapter, you also need to describe the applied statistical methods in sufficient detail to allow for reproducibility. Simply imagine that someone is asked to repeat what you did. What does this person need to know?
- The methods section is usually written in past tense (simple past).

### 4. Results

- Content of the results section is a neutral and objective description of your results which are relevant to answer your research question(s)/ hypotheses. The important results (those relevant for answering the research questions) should be visualized in figures and described in the text. Avoid any interpretation of your results! Interpretation is done in the discussion section. This strict separation is important in order to separate (objective) results from (at least partly subjective) interpretation of these results.
- Good descriptions of results are sentences with the following structure: Start with the response parameter and describe, what happened to it under conditions (e.g. experimental treatments) that you also should state here. Stick to the ecological message, the statistics support this message, but the statistics are not the results themselves! Therefore, the statistical details are simply put into brackets at the end of the sentence. Always try to specify the direction and effect size of the described effects if they are statistically significant. If an effect lacks statistical significant, treat this as no effect and do NOT report effect sizes are directions of effects for non-significant results – this separation is the only task of the statistical testing. Again: statistical test summaries such as p-values are no results themselves, but they tell you where to go into effect sizes and directions and where not. Cite the relevant figures or tables at the end of the sentence together with the statistical results – Figures and tables are NOT the subject of the sentence.  
A positive example: “Biomass production over the growing period increased by 24% in response to warming in comparison to control conditions (ANOVA:  $F = 25.3$ ,  $p = 0.003$ ; Figure 2)”.  
And NEVER: “The ANOVA showed a significant treatment effect in biomass.”
- Own results are described in past tense (simple past) in the results and discussion sections.
- The single hypotheses offer an excellent structure for the results section: Write one paragraph per hypothesis and include all different response parameters, which provide insights into this hypothesis. Subheadings may help.
- Visualize all important points of the results, ideally with one (e.g. composite, if you have several response parameters) Figure per hypothesis. Data should be shown only once, so avoid putting the same information into a table and a figure. This does not imply that a single dataset can only be shown once, but each visualization needs an own logic and





point of view.

## 5. Discussion

- The discussion should deliver an interpretation of the own results based on relevant literature (insights from published literature are commonly given in present tense, your own results are referred to in past tense!). The discussion section places the own results in context with the published state of the art concerning your topic.
- You are expected to offer potential explanations for the observed effects and may also formulate new hypotheses and research questions. All this, however, should be based on the data and existing literature or logical argumentation.
- A logical structure for the discussion section is, once again, the order of the hypotheses (see end of introduction). This means that each hypothesis is revisited and you evaluate if your expectation fits to the data or not. This is then further checked against existing literature concerning the specific topic and potential explanations why the data does not fit expectations is provided (if it does not fit expectations).
- We generally recommend one paragraph that deals with challenges and options for improvements towards the end of the discussion. This part should always be constructive and focus on how to improve similar future studies. Even when dealing with challenging data, try to answer the question: What can still be learned from this dataset?
- The final paragraph of the discussion or even an own, short, chapter contains the **conclusions**: Here, you should tell what your insights imply with regards to the overarching questions (=> see first paragraph of the introduction!). Start with a very short summary of the core insights of your work and point out their implications for the bigger picture. It does not make any sense to bluntly state that more research is needed – be specific about directions and topic of this future research!

## 6. Reference list

- The reference list contains essential information about the cited references (and only the cited references!). See below on formatting reference lists.

The logical flow is given by the structure of the work. Shorter papers (<10 pages) do not require a table of contents.

## 4.2. Style

Good and comprehensible scientific papers are the product of a long and intensive process before getting published. Critical revision is extremely important to get the message across (e.g. Lertzman, 1995).

In a nutshell: Find your red thread! Without a red thread, you will lose the connection between the single paragraphs. Oral presentations of the topic often clarify any missing link: As soon as you do not know the link to the next slide, something in your logic might be missing. A basic recommendation is using the hypotheses as the general structure of your paper.

### Neutral scientific language:

- Avoid common speech and slang!
- Formulate neutral and not judgmental. You may present your own judgement, but only after objectively laying out all facts and arguments. Therefore: no judgement before late in the discussion, or even no judgements at all!
- Keep using your introduced concepts/terminology throughout the text! Do not vary your wording, e.g. always use “grazing exclusion” throughout the text, do not mix this with “plots without grazing” and “area with no access by grazers” and “surveys with cows being absent” etc. Repetition is needed for clarity, and clarity is much more important than variety in scientific papers!



- Select meaningful abbreviations and keep using them consistently after their first introduction. Intuitively understandable abbreviations (e.g. Contr<sub>fertil</sub> for a fertilized control) are much better than cryptic abbreviations (e.g. treat<sub>1</sub>). The use of abbreviations does only make sense if their usage enables improved comprehension. If that is not the case, do not use abbreviations.
- Pay attention to orthography! Use the spelling correction tools of your word processing software and ask friends for proofreading.
- Aim at smooth formulations, which allow for a nice flow of arguments! This is a tricky point. Reading good papers and practicing will improve your writing. It will get better and easier with each new paper.
- Use short sentences.

### Foot notes

Are superfluous in the natural sciences. Either something is important enough to be stated in the text, or not. Note that other disciplines have different traditions and, as always, there is no rule without an exception, as long as there is a good reason for this exception.

### Layout

Use fonts with serifs in papers, because they increase readability (e.g. Garamond, Times New Roman, etc.). Figure and table captions should be set off from the rest of the text either by use of smaller font size or serif-free fonts such as Helvetica or Arial.

As a general rule: Use few font types. Either one type throughout or one with serifs for the text and another one without serifs for captions, titles, and subtitles.

Use few different options for setting off text and do not use them in parallel. Either Italics or Bold is the most common option. Underlined is nowadays most often used for hyperlinks, therefore rather avoid other uses of it.

### Typesetting

Setting the text in aesthetically pleasing manner, which facilitates high readability, is an art, which has been improved since the invention of letter pressing 500 years ago. Typesetters are highly-trained specialists, authors of scientific papers are not. Have a look into edited books or well-set journals to get a feeling. Further reading on this topic: e.g. Merriam-Webster (2008).

*Scientific Names* (genera and species names) are set off in italics. Additional information such as agg., spec., spp., c.f., etc. are not part of the scientific name and therefore not set off in italics. Author names or abbreviations are also not set off: *Pinus mugo* subsp. *uncinata* (Ramond) Domin.

*Parameters* are commonly also set off in italics (also true for equations in the text), in order to improve readability.

### Figures and tables

Figures are always accompanied by explanatory captions below the figure. Figures have no title. Tables are always accompanied by explanatory captions above the table. Together with their captions, figures and tables should be comprehensive on their own (only in case of very complex and long explanations, you may refer to the text). The caption should contain a very short summary of what is shown (commonly a depended variable on the y-axis and an independent



variable on the x-axis). All used abbreviations need to be explained in the caption. Results of the relevant statistics should be given alongside stating sample sizes, and information what is displayed (e.g. mean or median, type of error bars, ...). If sensible (in particular if axes are shared), use composite figures. All axes need labels and, if applicable, also units. The general rule: Keep figures as simple as possible. Answer the following questions: How can the effect to be depicted be visualized as simple as possible? Is all data needed or can you average across non-significant interactions? Color is generally not needed, grey scales and filling patterns can contain almost all information. If not, rather consider simplifying the figure! If using color, make sure to use color sets that are also distinguishable when printed in grey scales and make sure that they are color-blind friendly (about 10% of all males cannot well distinguish between red and green).

Tables consist of columns with titles and rows. Commonly, they are displayed with three horizontal lines (Table 1).

Table 1: A simple table.

Site	Grasses (species richness)	Trees (species richness)	Mosses (Species richness)
A	45	66	234
B	76	12	2
C	113	7	14

### 4.3. Citing

Correct citing is the basis for scientific writing, because it allows for scientific progress that builds on existing work of others. Beyond trusting an author's statement, citations are needed to allow for verification of this statement (similar to own results for which methods and results have to be laid out clearly). Citations are needed for direct citing (which commonly are presented in quotation marks) and also for indirect citations to results, conclusions, or generally, for any statement that is based on an external source.

### 4.4. Citation style – requirements

Citations should:

- facilitate easy finding of the cited source,
- facilitate explicit finding of the cited source,
- save space,
- not disturb readability,
- be direct (citing the original source).

### Citation style – text

As a common convention, references in the text are strongly abbreviated and full bibliographic references are provided in a reference list at the end of the text. This saves space and repetitions, thereby facilitating a better readability.

The most common way of referencing in the text is by author names(s) and year:

One author (Author year)

Two authors (Author 1 & Author2 year)

Three or more authors (Author1 et al. year)

Authors could also be used as subjects of sentences (but as stated above, the ecological statement should usually be the focus, not the author): “According to Miller et al. (2014), ...”. References to different papers of the same author(s) in a single year are identified by lower case letters after the



year (e.g. Smith 2009a, b). If more than one reference is used to back up a single statement, these references are first ordered chronologically, starting with the oldest source, and then alphabetically (e.g.: “...(Muller 1996; Herbert & Paul 2002; Strong et al. 2002).”).

We recommend to provide page numbers when citing textbooks, because otherwise it is hardly possible to relocate this statement in the source within a sensible amount of time.

Note that multiple reference styles exist, Basically, every single scientific journal has its own style and states it on its website under “guidelines for authors” are the like. So decide for one style and consistently use it throughout the paper. We recommend styles like the one given above and do not recommend the referencing by numbers as done by e.g. Nature or Science. Numbers save space, but author names and publication years usually are familiar to the experienced reader who can often tell from them which paper is cited even without checking the reference list.

## References to figures and tables

References to figures, tables, or other information such as appendices, are generally handled similar as references to literature: Each figure and table is cited chronologically as it appears in the text. Each figure or table shown in the paper therefore also needs to be mentioned in the text. Figures and tables should generally NOT be the subject of the sentences: “Biomass production increased by 23 % in the warming treatment compared to control (Figure 1).” And not: “Figure 1 shows that ...”).

## 4.8. The reference list

In the reference list, which is commonly the last section of a paper directly after the main text, ALL sources used in the text need to be listed. Vice versa, only the references which are cited in the text have to appear here. So do not list sources, which you have read but did not cite in your text.

Sorting of the references:

- alphabetically by the first author
- if the authors are identical, sort further by the publication year from old to young
- if authors and publication years are identical, add lower case letters behind the year and sort those by the occurrence of the reference in the text (e.g. Smith 2000a,b).

Note that some (highest-ranked) journals in the natural sciences (e.g. Nature, Science, PNAS) apply a different citation style: Here, the references are sorted only by their occurrence in the text and are displayed in the text simply by superscript numbers, which also appear in the order of their occurrence in the reference list. This saves space in the text, but also reduces the amount of information during reading, because an experienced reader usually knows the cited references simply by author and year of publication. Therefore, stating author and year saves time otherwise needed to look up each single source in the reference list while reading.

## Common citation styles for...

### Papers in scientific journals

Author(s) (with their initials behind their family names) – year of publication – title of the paper (only first word capitalized) – journal (all major words capitalized) – volume – pages



## Books

Author(s) (with their initials behind their family names) – (if applicable with the addition “(eds)” for edited books – year of publication – title of the book (all major words capitalized) – publisher – place of publishing – pages

## Chapters in edited books

Author(s) (with their initials behind their family names)) – year of publication – title of the chapter (only first word capitalized) – title of the book (all major words capitalized) – editor(s) – volume (if applicable) – publisher – place of publishing – pages

## Websites (according to sprache@web)

References to websites are generally problematic, because they can change any time and might no longer be available tomorrow. Furthermore, websites might be strongly biased in terms of their contents. This is why peer-reviewed papers in scientific journals and books by well-known publishers, which apply strict editing rules, are generally more trustworthy. Note that you yourself have to verify the cited statements! Still, websites by authorities such as state or federal ministries, EU, UN etc. can be important pieces of detailed information and should then be cited in the following ways:

### a) single HTML-pages

Author(s) (with their initials behind their family names) – year of publication – title – URL – date of last access

### b) page of a frameset

Author(s) (with their initials behind their family names) – year of publication – title of the single page – URL of the single page – In: – title frameset – URL frameset – date of last access

### c) single PDF-file

Author(s) (with their initials behind their family names) – year of publication – title – URL.pdf – date of last access

## Layout of the reference list

If not defined by your publisher (check out the detailed rules provided by every single scientific journal!) or your supervisor, the layout of the reference list is a matter of taste. The list should be simple to read and should allow for the unequivocal finding of each source. Most importantly, it should be formatted consistently throughout. Select one style and stick to it!

The single styles differ by the separators between the single arguments (the “– “ in the common styles above can be “,”/ “;”/ “()”/ “:” with various solutions where to use which); how the initials are set, and the order of the single arguments (e.g. publication year after author or at the very end).

## Examples

Stumpp, M., K. Wesche, V. Retzer, and G. Miehe. 2005. Impact of grazing livestock and distance from water points on soil fertility in southern Mongolia. Mountain Research and Development 25:244-251.  
[Style of the journal Ecology]



OR

1. Stumpp, M., Wesche, K., Retzer, V. & Miehe, G. Impact of grazing livestock and distance from water points on soil fertility in southern Mongolia. Mt. Res. Dev. 25, 244-251 (2005). [Style of the journal Nature]

OR

Stumpp M, Wesche K, Retzer V, Miehe G (2005) Impact of grazing livestock and distance from water points on soil fertility in southern Mongolia. Mt. Res. Dev. 25:244-251 [Style of the journal Oecologia]

OR

Stumpp, M., Wesche, K., Retzer, V. and Miehe, G. 2005. Impact of grazing livestock and distance from water points on soil fertility in southern Mongolia. - Mt. Res. Dev. 25: 244-251. [Style of the journal Oikos]

Consider using reference management software for uniform and consistent formatting of your reference list. Those apps allow for direct import of the search results from e.g. the Web of Science and can help you avoid tedious copying and formatting sessions. Note that even with such an app, you still need to check for correct capitalization of names and titles or setting off scientific names in italics. Well-known apps are “ReferenceManager” and “Endnote”, which come with costs. At Greifswald University, you have access to CITAVI (for further information search the internet for “uni Greifswald citavi”). A free and open source app would be Mendeley (<https://www.mendeley.com/>), which also connects well with LaTeX.

## 5. Use of Artificial Intelligence

Artificial Intelligence can help in all steps outlined above, but needs to be used critically (these algorithms hallucinate more often than one thinks, see e.g. [https://en.wikipedia.org/wiki/Hallucination\\_\(artificial\\_intelligence\)](https://en.wikipedia.org/wiki/Hallucination_(artificial_intelligence))).

Guidelines for the use of artificial intelligence (AI) in student papers, theses and doctoral dissertations are in preparation at our university and the following summary is based on early discussions about this topic at our faculty (which is not a binding rule).

We distinguish between creative and non-creative use of AI:

- In **creative use of AI**, algorithms are used to generate new creative content from large amounts of data, thereby expanding the intellectual content of the source material. Such uses are creative in nature. These can be, for example, new texts, images, videos, compositions, voice imitations or computer programs. Using ChatGPT to answer content-related questions is an example of creative use of AI.
- In **non-creative use of AI**, existing content is analyzed and simply presented in a new way without creatively altering the content, i.e. the intellectual content of the source material is retained. Such uses are mediating or derivative, not creative. Examples include the reformulation, summarization or restructuring of existing content, simple text and image editing, translations (e.g. also using ChatGPT), the use of search algorithms, pattern recognition or species identification apps.

**Any creative use of AI must always be stated. The non-creative use of AI must be stated in certain cases.** The same AI can be used for creative or non-creative purposes, as appropriate; in this case, the only relevant factor for classification is the sense in which the AI has been used.





The use of AI in research and teaching is revolutionizing the handling of large amounts of data and leading to greater efficiency. It is therefore important to understand the problems that can potentially arise from its use. In the case of non-creative use, these problems include the fact that the truthfulness of each answer has a statistical probability (i.e. the answer is not true with certainty) and, in the case of creative use, the possibility of misuse and plagiarism. So-called **'AI hallucinations' can occur in both creative and non-creative use of AI**: in the former case, they generate false, invented or unfounded new content; in the latter case, they alter or distort the meaning of existing information. The possibility of AI hallucinations must always be taken into account in scientific work and, if possible, eliminated by appropriate methods (i.e. checking all suggested references in the original literature).

Note that **Content entered into publicly accessible AI portals is also publicly accessible to other users of these AI portals**. Therefore, internal university AI portals (<https://open-webui.wolke.uni-greifswald.de>) are preferable when using unpublished scientific data. In any case, the **possible use of unpublished data in AI portals must be discussed with the supervisor in advance**.

The following **recommendations** are drawn from the points above:

1. The non-creative use of AI for familiarization with new subject areas and for effective learning is ok.
2. The non-creative use of AI for linguistic and stylistic improvement of presentations and written work is ok.
3. The non-creative use of AI only needs to be indicated if it goes beyond the usual scope of search algorithms or stylistic corrections of texts and images. If larger text modules are translated using AI, this should be indicated. If AI is used for pattern recognition, in determination apps or similar applications, the corresponding tool and the probability of the statement's accuracy as estimated by the AI should be indicated.
4. The creative use of AI for examinations and performance assessments during studies (seminar presentations, seminar papers, practical reports, homework assignments, exercise sheets) is not permitted.
5. The creative use of AI for theses, research papers or research presentations is permitted, but the tools used should be specified (type, nature, version of the AI tool, including URL). This also includes the creative use of AI in data creation and data analysis, which should be specified in the Methods section. Your own contribution to the work does not include the parts generated by the creative use of AI, but only their use in the context of your own intellectual work. Only your own contributions will be used for assessment.
6. The creative use of AI to generate text modules in theses, research papers or research presentations should be documented in each individual case by means of a literal quotation ("xyz") immediately followed by the type, nature and version of the AI tool, including the URL and date of retrieval, as well as the specific query (prompt) made to the AI.
7. Responsibility for the presentation of research results, for their accuracy and for the correct citation of primary sources cannot be transferred to AI. The rules of good scientific practice of the University of Greifswald apply.
8. The use of AI does not release you from the obligation to cite any sources for the input data if these are based on external intellectual work (i.e. represent external intellectual property).
9. The use of unpublished data in AI portals must always be discussed in advance with your supervisor (and, if applicable, with cooperation partners). Internal university AI portals are preferable for such purposes (<https://open-webui.wolke.uni-greifswald.de>). Research data that



is subject to ethical guidelines or other data protection guidelines (e.g. directly or potentially indirectly personalized data) may generally not be used in publicly accessible AI portals.

10. In written theses, a statement should be provided indicating whether and to what extent AI tools were used to create the thesis and where these are documented in the thesis. This applies to both creative and non-creative use of AI.

Please note: Unauthorized or undocumented use of AI methods in student papers or theses will be considered an attempt at deception if proven. This also applies retrospectively if the evidence is only provided at a later date in the future.

## 6. Presentations

### 6.1. Structure

Similar to a written paper (see above). Results and Discussion, however, are often treated together in oral presentations as you start to interpret when showing your results. Nevertheless, we urge you to always start with a neutral and objective description of what is seen before entering the interpretation of any figure. Of course, this can (and should) be done on the same slide showing the result. The reference list commonly is strongly shortened.

### 6.2. Pictures

Don't overdo! Pictures can be very helpful, if they fit to the topic and assist understanding, in particular concerning systems studied and methods used. But they can easily become distracting otherwise. If using pictures on each slide, e.g. in side bars, stick to one well-fitting picture throughout rather than randomly showing nice and colorful and distracting things.

### 6.3. Visualizations

“A picture paints a thousand words” – at least if it is easily understandable and transports the intended message. Any visualization needs to be illustrative concerning the message that you want to show, otherwise it is worthless! The visualization therefore has to transfer the content(s) well. “Well”, here, does not mean detailed and complex, but simple and intuitively understandable. The visualization should directly support your message, and nothing else. So avoid any distractions and keep your visualizations as simple and clear as possible. This said, it should be clear that a “good” visualization in a paper may be a “bad” visualization in a presentation – you may want to create new figures just for the presentation!

In “friendly graphics” (Tufte 1997, as cited in Payer 2000) ...

- Words are written out – avoid cryptic abbreviations
- Words are written from left to right, not from up to down. An exception: y-axis labels are commonly angled by 90° and then run upwards.
- Little hints allow for a more intuitive understanding (e.g. arrows, lines, very short text boxes).
- Do not contain shading or patterns - use clear colors if no direct labeling is possible.
- Colors contrast well with each other - never use red-green contrasts (about 10% of the (male) population will not see this). Keep technical limitations of the facilities in mind: old, weak projectors, small screens, direct sunshine, etc. might demand additional effort concerning contrasts. If possible, test your presentation in the destined room beforehand.
- Apply common capitalization rules with lower and upper case letters and avoid setting labels in upper case letters only (ROARING EFFECT!).



- Are as simple as possible and reduce complexity and detail. Take your time to introduce more complex visualizations, use the options of your presentation software for subsequent assembly of complex graphics.
- Use color (if needed at all) consistently (throughout the full presentation).

## 6.4. Text

Use as little text as possible in presentations. Use headwords or short phrases rather than full sentences. Test your font size – suitability depends on the size of the room and the presentation screen. As a rule of thumb: 20 pt at minimum. Font types without serifs are better readable from the distance. Different coloring of the text is usually not helpful (as an exception, the use of consistent colors in text and graphics can be supportive - but make sure that they contrast sufficiently with each other.).

## 6.5. Connections between slides

Bridging between the slides is one of the more important issues in a good presentation. If the transition is not clear to you, the presentation will not work well. In that case, you should question your structural flow and red thread of your storyline. For the detection of such issues, you should practice your presentation several times. Generally, you should not follow the slides (“let’s click and see what comes next”) but you should know what comes next and introduce the upcoming slide even before you show it.

## 6.6. Style

### Length

**Stick to the time limit!** Making sure to stay within the time limit, you have to practice, practice, and practice. The best talk is useless if the presenter does not make it to his\*her conclusions within the available time! At scientific conferences, you will simply be switched off at the end of your time slot... Many people speak faster under pressure, test presentations of 32-33 minutes often fit into 30 minutes in the real presentation. Still, this is something you need to check out for yourself.

### Language

You need to keep the balance between scientifically correct and consistent formulations and being entertaining. There is no basic divide between those two demands, but maximizing both is a fine art! If in doubt, rather maximize the content over the entertainment in scientific presentations. Get rid of fillers such as “er”. They are unnecessary, if you know the content to be presented, so practice until you know what to tell at each slide.

Certain technical phrases such as the term used to describe a treatment level should be used very consistently in order to maximize clarity for the audience.

### Body language

Face your audience and make eye contact to as many people as possible as often as possible. This helps you to detect problems in understanding and potential technical problems (too low voice, slides not fully shown on the screen, ...).

Find your position. This does not mean that you should not move during a presentation, but knowing where you want to be is important. You should be in the focus, the presentation on the screen should only support you! Make sure to find a solid position, do not lean on to something, stand straight on both legs.

Try to keep your hands visible for the audience without doing distractive actions such as fingering your hair, ear, nose, etc.



Use a pointer, do not point with your fingers. A pointer (electronic, wooden stick, even a pen if nothing else is available) furthermore gives you something to hold on to.

## 6.7. References in a presentation

There is no common rule to this! For transparency and accountability, however, we recommend to make references in a similar way as in any written paper. References could either be listed in one slide at the end of the presentation analogue to the reference list of a paper, or they can be shown in an abbreviated form on each single slide. We prefer the latter because it is more direct (the audience cannot scroll down to the reference list during the presentation). Then, however, a strongly abbreviated form of referencing is needed, e.g. Author(s) (et al. if more than two) – year of publication – abbreviated journal title. If you know that there could be duplicates here, add volume and starting page.

## 7. References

Eco, U. (1998): Wie man eine wissenschaftliche Abschlußarbeit schreibt. Doktor-, Diplom- und Masterarbeit in den Geistes- und Sozialwissenschaften. C.F. Müller, Heidelberg.

Grätsch, R. (2004ff): [www.arbeitschreiben.de](http://www.arbeitschreiben.de) – der Leitfaden für das Schreiben einer wissenschaftlichen Arbeit für Schüler, Studenten und andere Interessierte, <http://www.arbeitschreiben.de> – 12.10.2010

Lertzman, K. (1995): Notes on Writing Papers and Theses. Bulletin of the American Ecological Society of America. 76: 86-90. Also available online at [https://www.fh-muenster.de/wirtschaft/downloads/personen/baaken/Notes\\_on\\_Writing\\_Papers\\_and\\_Theses\\_GREAT\\_TIPS.pdf](https://www.fh-muenster.de/wirtschaft/downloads/personen/baaken/Notes_on_Writing_Papers_and_Theses_GREAT_TIPS.pdf) – 08.11.2017

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Payer, A. (1944 - 2000): Einführung in Formalien wissenschaftlicher Arbeiten. -- 1. Einleitung. 16.6.2000. <http://www.payer.de/wissarbeit/wissarb01.htm> – 12.10.2010

Peterßen, W.H. (1994): Wissenschaftliche(s) Arbeiten. Eine Einführung für Schüler und Studenten. 4. Auflage, Ehrenwirth, München.

sprache@web (1998-2008): Zitieren von Internet-Quellen, <http://www.mediensprache.net/de/publishing/pubs/> In: Online-Publishing, <http://www.mediensprache.net/de/publishing> – 12.10.2010

Tufte, E.R. (1997): Visual Explanations: Images and Quantities, Evidence and Narrative. -- Cheshire: Graphics Press.

### Recommended Further Reading in English:

Gopen, G.D. & Swan, J.A. (1990). The science of scientific writing. American Scientist 78: 550-558. Also available online at <http://www.docstyles.com/library/ascience.pdf> – 12.10.2010