Prof. Dr.-Ing. Markus Rabe

Recommendations for Scientific Work
Definition

Working scientifically means:

- to work on the base of the scientific state-of-the-art in a specific research field
- to discuss the scientific opinions of other researchers
- to develop thoughts of one's own
- to represent these thoughts in a way that is understandable to experts
- to follow formal rules (e.g. structure, illustrations, references)
PROCEDURES OF SCIENTIFIC WORK
Characteristics of Scientific Work

- Objectivity
- Clear definition of terms
- Verifiability and reproducibility
- Completeness
- Logical structure, comprehensibility
Steps of Scientific Work

- Choice of the topic (if topic is not given)
- First definition of the topic (terms, sub-topics, ...)
- Time schedule for the work
- Information procurement, literature research
- Information analysis and compression:
  - Read – archive – systematize
- Development of own results
- Information dissemination (paper, presentation, speech)
First Definition of the Topic (1/2)

- Elaborate:
  - Definition of the major terms in the topic
  - Definition of the topic itself
  - Delimitation of the topic
  - Classification of terms used
  - First collection of solution ideas (catalogue, mind map, ...)

- Targets of first definition:
  - Definition of the major terms in the topic
  - Orientation within the topic
  - First brainstorming, become familiar with the topic
First Definition of the Topic (2/2)

- Result:
  - First systematization and structuring of the topic
  - Not definite yet, but starting point for literature research

➢ Later changes of written text are not an exception but the rule!
Time Schedule for the Work

Build a detailed time and work schedule, early!

- Prepare the schedule early! You might find that you need more time than you thought
- Orientate at the due date and schedule backwards
- Include buffer time in your plan (especially for literature)
- Differentiate an internal and external time schedule: you might not be able to work full-day just for one task, or you might need to wait (for literature, for meeting the supervisor, ...)

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## Time Schedule - Example

<table>
<thead>
<tr>
<th>Activity</th>
<th>Internal schedule</th>
<th>External schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orientation, ideas, phrases</td>
<td>3 days</td>
<td>1 week</td>
</tr>
<tr>
<td>Literatur research</td>
<td>2 weeks</td>
<td>3 weeks</td>
</tr>
<tr>
<td>First version</td>
<td>1 week</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Rework, final editorial, surrender</td>
<td>1 week</td>
<td>2 weeks</td>
</tr>
<tr>
<td>Sum</td>
<td>4 weeks, 3 days</td>
<td>8 weeks</td>
</tr>
</tbody>
</table>
Information Procurement: Literature Research

- Conventional methods (printed material)
- Electronic databases (online or offline)
- Direct online information (Internet)
Information Procurement: Conventional Methods

- Print media:
  - Dictionaries (general or technical; often with notes on further standard literature)
  - Library catalogues (alphabetical, systematic, ...)
  - Bibliographies (on topic, sub topics or super topic)
  - Scientific journals (state of the current research)
  - Textbooks

- Conferences

- Literature hints from lecturers

- Use “snowball system“ (danger: extensive use leads to more and more outdated publications! Use snowball system also to find related conferences, journals etc. and then look for recent publications there)
Information Procurement: Electronic Methods

- **Electronic databases:**
  - Important means to find relevant literature
  - Full text queries possible (also abstracts)
  - Some practice necessary to find (only) relevant information
  - Relevant databases need to be identified (general, topic specific, public (free and charged), associated to research groups, ...)

- **Electronic media (esp. Internet):**
  - Quality: Who guarantees for the content?
  - Retrievability, persistence, invariability
Information Procurement: Questionable Literature

- Try to avoid:
  - Private publications
  - Unpublished papers (if necessary, reference with clear status like “submitted to ICE’13 conference in Milan“, „accepted for publication by IJATM“)
  - Information that is difficult to access (diploma works, master thesis, project reports). Project reports allowed if available through persistent sources.

- Never acceptable:
  - Information that cannot be trusted, has no identification, no responsible author (standard Web pages, Wikipedia)

- Of course, you may use this material for your research, but then look for suitable papers to substantiate it.
Information Analysis: Overview

- Before starting to read, have a look at:
  - Title
  - Abstract / summary
  - Author and institution(s)
  - Year of publication
  - Table of contents
  - References
Information Analysis: Before Reading

- Write down some questions: what do you want to learn from reading?
- Note down keywords you are searching for
- Make a first table to classify papers and the reported content (e.g. by application, by methods applied, by goals, ...). Later revise table, when you have learned more from your reading.
Information Analysis: Reading

- **First: fast reading**
  - Read text “diagonally”, thereby paying attention to relevant keywords. Mark relevant text with a pencil (or, if it’s your copy, with a colour marker)
  - Avoid spending too much time in continuous reading

- **Second: intensive reading**
  - Read relevant (i.e. marked) text passages intensively
  - Mark, annotate and/or excerpt main passages
  - Compile your prepared table
  - Write down the answers that the text gives to your questions
  - Does this text open new, additional questions?
Information Analysis: Excerpts

- Summarize the argumentation structure of the text
- Quote central statements literally (and then use quotation marks for it)
- Note down page numbers
- Comment text

➢ Do it right the first time!
Information Analysis: Filing

- Be aware that your filing system will grow, continuously!
- You should be able to re-locate at any time the material that you have processed once
- Suggestion: start to order sources by authors, alphabetically
- For significant work, set up some literature database with bibliographical details, keywords and the bibliographical data (including where you found the original copy, e.g. Library, own books or journals, ...)
- Develop additional sorting terms, develop a hierarchy of terms
PRESENTATIONS
What is a Presentation?

- The presentation is a lecture, which is supported by visual means.
- Visualization through:
  - symbols
  - graphs
  - charts
  - Colours
- Means of Visualization:
  - Blackboards, flipcharts, posters
  - Video screen presentations
  - Handouts
Planning of the Presentation

- Formulate the topic:
  - Analyse circle of participants
  - How many participants?
  - Task, function, age of the participants?
  - Previous knowledge and qualification of the participants?
  - Expectations, needs and interests of the participants?
  - Possible objections of the participants compared to the content?

- Set presentation aims:
  - Topics which are official and formulated openly
  - Unofficial / personal aims
Preparation of the Presentation (1/2)

- Prepare the content:
  - Collect (brainstorming, materials)
  - Select (put priorities, judge material)
  - Schedule for presentation, content for opening and main part, leitmotiv (“red line”)
  - Visualization
    - Pictures, graphics, statistics, animations, ...
    - Check whether used mediums reach the aim
    - Avoid to write too much
  - „Less can be more“. Not all information needs to appear on the visual aids.
Preparation of the Presentation (2/2)

- **Test run of presentation:**
  - Check whether your presentation is fluid
  - Especially, take care when introducing new thoughts (changes from slide to slide should be motivated!)
  - Speak and measure time on trial

- **Organizational preparation:**
  - Date, time, duration, place of the event
  - Invitations to participants
  - Choice of a suitable lecture room
  - Check functionality of the media (before! the lecture)
  - Prepare handouts
  - Intellectual and physical fitness of the speaker
Course of the Presentation – Proposal to structure

- Opening
- Main part, e.g.
  - Starting situation, constraints
  - Methods applied
  - Results achieved
  - Interpretation of results
  - Recommendations and conclusions
- Summary
Course of the Presentation – Opening

- Target of the opening:
  - Attention, interest, sympathy
  - Lead the audience to the topic

- Activities:
  - Welcome participants, introduce yourself
  - Name theme and targets
  - Name main structure points
  - Fix "rules of the game" (discussion, questions)

- Initiate Interest:
  - Rhetorical question, provocation, current event, anecdote
  - Suitable starting slide
Course of the Presentation – Main Part

- Target of the main part:
  - Maintain attention and interest
  - Conduct and convince audience

- Pay attention to:
  - Clear and open structure of the statements
  - Not losing the leitmotiv
  - Simple, pictorial language, no too long sentences, few relative clauses
  - Demonstrate the concrete use for the participants
  - Use media (charts, flipchart, ...)

- Note: Structure and ways of argumentation will vary according to topic and aim (scientific speech, project report, marketing presentation)
Course of the Presentation - Conclusion

- Target of the conclusion:
  - Summarize your results and findings
  - Farewell or lead to the further sequence (e.g. discussion)

- Tips:
  - Participants frequently remember best the contents of the beginning and the end of your speech
  - Explicitly formulate closing remarks (e.g. written) and study by heart
  - Finish with a visually impressive slide or a “punch-line” that can be remembered
WRITTEN WORK
(HOMWORK, THESIS, ...)

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Definition of Terms

- What is the exact meaning of the term?
- What does the term NOT include?
- Are there different definitions for one term in literature? (which? why?)
- Define connection to and delimitation from similar terms
- If applicable, study the historical development of a definition in order to clarify
- Explain content, state of the art, areas of application of the term
Formal Design of Written Work

- Coversheet:
  - Theme
  - Author
  - Company/Institute/Consortium
  - Kind and relation of work (e.g. “Homework for GPM course 2011/2012”)
  - Date

- Table of contents

- Text part

- Directories:
  - References / Literature
  - (List of tables, figures)
  - Register (in lecture books, manuals, and similar, only)
Appearance (1/2)

- Use a suitable binding (if possible, ask for preference)
- For short papers (not more than 20 pages), you may staple
- Title and author should be visible outside (extra label, use foil to bind)
- Use “successful” fonts (e.g. Times for body text, Arial for headlines and figures) and apply them continuously
Appearance (2/2)

- Set a visible structure of text. Good results by spacing lines a bit more than single (e.g. 14pt – depends on the font size) and giving additional 3-5pts before each paragraph (when using MS WORD, define your “default paragraph”!)

- Be careful with bold/underline/italics, and use it, systematically. For example, use bold for headlines, underline figure/table references in the caption (fig. 17), and italics to highlight text.
Coversheet

- Essential information on the cover sheet
  - name, registration number
  - theme of the work, date
  - university, faculty, subject, lecturer
- No exotic fonts!
- No "artistic" representations!
Structure Proposal (Homework Size)

New ways for Using fruit Use in Cake Production

Table of Content
1 Introduction ..........................................................................1
2 Definitions ............................................................................2  
2.1 Fruit and Vegetables.......................................................2  
2.2 Bakery Goods ...............................................................2  
3 Current Cake Production .....................................................3  
3.1 Typical Cake Products and Related Goods ...................3  
3.2 Fruits Used in Current Cake Production .................5  
3.3 Abandoned Cake Products ...........................................6  
3.4 Reported Consumer Wishes ........................................7  
3.5 Conclusions and Requirements to new Fruit Cake Products ........................................7  
4 New Product Proposals ......................................................8  
4.1 Lessons Learnt from Former Abandoned Products ......8  
4.2 New Products from the Consumers’ Point of View ......10  
4.3 Productions Means ......................................................12  
4.4 Cost and Profit Estimation ..........................................15  
5 Summary ...........................................................................17  
List of the Abbreviations .....................................................18  
List of the Tables and Illustrations .....................................18  
Bibliography ........................................................................19

Introduction

Review of StoA

parts should be balanced in pages

„My Work“

Summary
General Items: Introduction

- Motivation:
  - What is the work about?
  - Why is this important?

- Goals of your thesis:
  - What do you wish to achieve at the end?

- Course of your work:
  - How do you perform your research?
  - How do the research steps build upon each other?

- Caution: no (!) results in the introduction!
General Items: Summary

- Shortly report the results that you achieved
- Summarize the major conclusions – do **not** introduce any new conclusions or results!
- Do not again introduce the topic (but, you may give major findings from the state-of-the-art analysis that underline the importance of your work)
- Write a story. Each sentence should motivate the next one
- Have a clear convincing statement at the end (which then should be clear from the argumentation above)
Main Part

- Main part should clearly identify 2 sub-parts:
  - State of the art
    - Definitions
    - Literature review
    - Introduction of methods you intend to use
    - Analysis of facts that you will build upon
  - Your own new contribution to science
    - Clearly mirror the structure of your thoughts in the TOC

- Make the table of contents readable!

- Detailed structure depends heavily on the specific topic.
Table of Contents – Structure (1/2)

- A structure level must have at least two structure points!

  False:
  2. Methods of requirements planning
  2.1 Formation of simple values
  3. Implementation of the planning methods

- In English documents, it is recommended to use capitals in headlines, and same in table of content

- Avoid any punctuation in headlines
Table of Contents – Structure (2/2)

- Decide if you write text between a headline and the next sub-headline or not, and then apply it always (at all levels):

  2. Methods of requirements planning
     (text: always or never)
     2.1 Formation of simple values
Figures/Illustrations/Tables

- Tables and illustrations must be readable and complete:
  - No microscopic fonts
  - Use good quality pictures (be careful with bitmaps)
  - Clear legend, if otherwise not understandable

- Each figure needs a number and a caption:
  - Always use the same style for figure captions (underline, bold, italics, font size, ...)
  - Recommendations: Use bold for “Figure” and the number, and then standard text for the caption itself. Use font 1-2 points smaller than standard text
References for Figures

- If figure is not drawn by you, give a reference.
- If you have drawn the figure yourself on the base of a given figure in the literature, specify it (“after [15]”).
- Figures without any reference are assumed to be your own work (if not, this is a counterfeit!!).
- Each table and illustration has to be referred to the text:
  - “The dashed line in figure 17 indicates ...”
  - “There are multiple products to be manufactured (table 17)”
Style of Writing

- Do not use “I” and “we”, but “The author”, “The consortium”, or use passive form. Samples:
  - In the next chapter I present the state of the art \( \rightarrow \) in the next chapter the state of art is analysed
  - I have the opinion, that the statement of Miller is wrong \( \rightarrow \) The author does not follow the opinion of Miller that...

- Do not use “spoken” language

- Avoid any “internet style” abbreviations, except they are usual today in the relevant scientific field (allowed: ERP)

- If using an abbreviation for the first time, write in in full and then give the short version in brackets. Sample: Computer Aided Design (CAD)
„Red Lines“

- Always be aware that you need to “tell a story”
- Use paragraphs with care. A new paragraph should start a new thought
- Within one paragraph (= one thought) each sentence should clearly build upon the previous one. The reader should be clearly led in his or her reading.
- Each new paragraph should either directly build upon the previous one, or you should state what’s going on (“Based on the three major constraints specified in the previous three paragraphs, requirements can be defined...”)
- Check yourself the “red line” principle: do you have a clearly visible line of thinking, without any interruptions?
Argumentation

- Use literature to prove your statements (preferably, in the introduction and state-of-the-art)
- Refer to the results which you elaborated in the state-of-the-art (always allowed)
- Use facts that have been specified before to argue. Be careful that you argumentation can be followed!
- Apply an accepted scientific method. Introduce this method in the state-of-the-art, and then apply it in your “own part”. Again, be careful that the reader would be able to repeat and prove your judgements!
Quoting

- Quoting literally:
  - Identification by "quotation marks" or (for full sentences only) by an indented notation
  - Reference without any changes. Indicate text omissions “(...)"
  - Always give the page number where the quote can be found

- Quoting analogously:
  - No quotation marks
  - Reference to source “(cp. [17])”, “[17, pp. 78-80]”
  - Be sure to keep the context of the original meaning
  - Possible to state the origin (“as Rabe states [18] ...”)
  - Where necessary, give also page number (e.g. for books)
REFERENCES
References: Books (1/2)

- One author:
  - surname, first name: title, Xth edition. city: publisher, year

- Several authors:
  - surname, first name; surname, first name: title ... {always name all authors}

- Editors:
  - surname, first name (ed.): title (edition). city: publisher, year {“eds.” if > 1 editor}
References: Books (2/2)

- Without authors:
  - institution: title. city: publisher, year

- Specific publishers might request different style
- Edition can be omitted if first edition
- First names may be (systematically!!) abbreviated to initials
References: Journals, Papers

- Papers in Journals:
  - surname, first name: title. name of the magazine, volume (year) issue, pages.

- Papers in Books:
  - surname, first name: title. In: surname, first name (ed.): title. city: publisher, year, pages
Three Possibilities for setting up the References

- By numbers:
  - Numbering according to occurrence in text (but only the first occurrence gets a number)
  - In references, use “[17] surname, …” or “/17/ surname, …” or “17. surname” (hint: use a tab stop for unique formatting)

- By codes:
  - Instead of a number, you can use a combination of first letters of author name and year ( “[Rab05]”). For multiple authors, you may choose to take first letter of each author (“/RMJ04/ Rabe, M.; Mertins, K. and Jäkel, F.: …”).
  - Advantage: No need to set up a sequence in the text.
Three Possibilities for setting up the References

- By author names:
  - No Number or codes, No Indentation
  - Give year in brackets immediately after authors “surname, first name (year) title...”
  - If same author occurs twice in the same year, add a letter to the year (2005a), (2005b)
Specific Sorting Rules (Author Names)

- Sorting of references that start with the same author name (e.g. Springer):
  1. Publications with only this author, sorted by year
  2. Publications with two authors, sorted by the name of the 2nd author, then sorted by year
  3. Publications with more than 2 authors, sorted only by year (name of the second and further authors have no influence on the sequence, in this case)

- Rules might depend upon the journal or publisher
Reference to numbers / codes

- In the text, mark analogue to the reference list:
  - Rabe states that students should take care of their work [17].
  - ... their work /17/.
  - ... their work /17, p. 587/
  - ... their work /Rab05/.
  - Rabe and Mertins state that .... their work [RM05]

- Recommended brackets are [] and //.

- For literal citations, always provide the page number
  - It has been shown that "Simulation is a really relevant method for production planning" [Rab05, p. 87].
References with Author Names

- Use the author immediately and add the year in brackets
  - Rabe and Mertins (2002a) explain that ...

- Mention the reference only in brackets
  - In general, students should take care for their work (Rabe 2005).

- Two authors: name both
  - ... their work (Rabe and Mertins 2005)

- More than 2 authors: use “et al.” (et alias = lat. and others)
  - ... their work (Rabe et al. 2005)
Internet Sources

- Sources should always:
  - Ensure the identification
  - Allow reproduction

- This is typically not given for Internet sources.

- Difficulties of reproducing Internet sources are:
  - Source can disappear from the Internet
  - Location of a source can change
  - Contents are changeable (author permanently can change content, changes of the content frequently cannot be comprehended)
  - Sources are frequently not archived
  - Locators can be dynamic (i.e. lead only to a huge site, but not to a specific information)
Quoting of Internet Sources

- Still, there is no “standard way” of quoting Internet sources
- Always, the day of the visit should be given
- If necessary, more information should be specified (e.g. www.tu-dortmund.de is not a suitable source reference)
- Information from Internet sources should be duly archived (professors or scientific colleagues might require proof later, if the internet source has disappeared or moved!)
- Still try to follow the “classical” principles (give author or editor, title, ...)  
References / Bibliography

- Add “References” at end of the document (after summary)
- Avoid footnotes
- The reference list contains ONLY references that are used in the text
- A “further reading list” (bibliography) is allowed, but should be declared as such and given as a separate list (typically used for lecture books)
At the End ...

- These are hints, no rules “graved in stone”
- You can change, but do it **systematically**
- Take “good samples” as a guideline (e.g. books from famous publishers)