

Formal standards for the preparation of research papers and theses

1 Structure of the work

As a rule, a student research project consists of the following sections:

- 1.1 Title page
- 1.2 Dedication/Thanks*
- 1.3 Table of contents
- 1.4 Summary and keywords
- 1.5 Discussion of the topic
- 1.6 Bibliography
- 1.7 Declaration of authorship (for state examination, diploma, bachelor and master theses)
- 1.8 Appendix

In addition, sections such as a glossary, list of figures, etc. may be added to improve readability. These additions may be useful in individual cases, but have no influence on the evaluation. Items marked with * are optional.

1.1 Title page

The title page should contain the following information and must correspond to the corporate design of the TU Munich.

- a) Research institution (e.g. university, school and department)
- b) Title of the work
- c) Type of paper (e.g. term paper for the first state examination for the teaching profession at vocational schools - wood technology)
- d) Examination subject
- e) Name of the examiner
- f) Name of the supervisor/second supervisor
- g) Name and place of birth of the author
- h) Matriculation number
- i) Date

1.2 Dedication/Thanks

A dedication or acknowledgements may be added, but should be formulated concisely.

1.3 Table of contents

The table of contents reflects the structure of the work and consists of:

- Chapter and section numbers
- Chapter and section headings
- Page numbers

The table of contents must contain the chapters and sections at all levels. In order to make the thesis as clear as possible, the structure of the text should be limited to a maximum of four levels (in the case of student research projects, a maximum of three levels). The outline should show the intellectual structure of the thesis. The bullet points (chapter and section headings) should be formulated as briefly and concisely as possible (preferably using nouns).

In the following example, therefore, **no text** belongs between item 1 and item 1.1.

Example:

1 Results

1.1 Results of the quantitative survey

The quantitative study ...

1.2 Results of the qualitative survey

The qualitative study ...

2 Discussion

The two studies showed ...

3 Conclusions

Hint: It makes sense to create the table of contents together with the other formatting at the beginning of the work.

As a rule, lists of figures and tables take up too much space, are not very helpful for the reader's orientation and are therefore dispensable. However, the origin of the figure or table must be indicated by a source reference (cf. chapter 2.5), as with other citations.

1.4 Summary

The summary should present the central question, the research methods and the main results in a condensed form. It should provide a quick overview of the main points of the work for someone doing a literature search. The summary should be followed by keywords that reflect the content of the work and can thus be used for a literature search. The summary should be approx. 6–8 sentences long; the general rule is, “as long as necessary and as short as possible!”

1.5 Discussion of the topic

1.5.1 Fundamentals

The discussion of the topic constitutes the main part of the paper. The structure of the main part depends on the type of work. A basic distinction is made between:

- Empirical work
- Theoretical work or literature work

The main body of empirical work is structured as follows:

- Introduction
- Research questions/initial hypotheses
- Current state of research (empirical and theoretical)
- Research design
- Research field
- Implementation
- Results
- Discussion, possibly with outlook

The outline of theoretical papers may deviate from this outline depending on the assignment and should be discussed with the supervisor in individual cases.

1.5.2 Introduction

The introduction should prepare the reader for the topic, introduce them to the task and arouse their interest. To this end, the introduction should

- present the general background of the work (Why is it relevant to write a paper on this topic?),
- clearly formulate the overall goals of the work (What gaps in knowledge still exist with respect to the topic addressed and thus make the work necessary? What should be done to close the gaps?).

This permits the research questions or research hypotheses to be clearly derived. Further organization may be useful depending on the scope of the work and can be discussed with the supervisor in individual cases.

1.5.3 Research questions/research hypotheses

In this section, the initial questions are derived in general and clarified in terms of their meaningfulness and relevance. As the work proceeds, they are then refined with the help of the current state of research and then implemented empirically in the methodological section. In the concluding discussion, they are taken up again and must be answered with a view to the theoretical and empirical background, and with respect to the author's own findings.

1.5.4 Current state of research

With the current state of research, relevant studies should be identified and briefly reviewed. In empirical works, it is necessary to consider the current state of theoretical and empirical research. Here too, of course, the following applies: Corresponding references should be indicated in the text and in the bibliography by stating the respective authors, models, etc.

The extent to which further differentiation of the current state of research makes sense should be discussed with the supervisor in each individual case.

1.5.5 Research design

This section describes in detail the general research context in which the work is integrated and which specific aspect it addresses within it. In addition to the overall methodological approach, the research instruments applied are justified and explained. The exact organization depends on the respective work and is discussed with the supervisor. The way in which the basic data is evaluated, e.g. using suitable statistical methods, must also be described and justified here in a comprehensible manner.

1.5.6 Research field

Here, the reference field (precisely: school XY, class 11 x) in which the study was conducted, and with which individuals (pupil X from company Y of occupation Z) it was conducted is described.

1.5.7 Results

The results section contains a clear presentation of all results and findings of the (empirical) studies conducted that contribute to answering the core questions of the topic.

No discussion should take place in the results section! Large tables that do not serve the immediate understanding of the results belong in the appendix (cf. chapter 1.8).

1.5.8 Discussion

In the discussion, the results are interpreted and evaluated. In connection with a classification of one's own results in the current state of knowledge (cf. also literature study), the research questions or hypotheses are discussed here and answered in an appropriate manner. The consequences that can be derived, e.g. for the practical implementation of the findings in future developments, unresolved and possibly further investigations in the subject area being worked on, can be mentioned here as a brief outlook.

1.6 Bibliography

In the bibliography, all sources used in the work are documented. At the latest after completion of the text part, it must be checked whether all source references contained in the text (also in figure and table captions) have been included in the list and whether there is information in the list that (no longer) appears in the text.

All sources are to be listed in the bibliography in alphabetical order (according to the surname of the first author). If there are several sources by the same author(s), they should be listed chronologically (oldest sources first). In the case of sources by the same author from the same year (also in the case of different co-authors), the years are separated by lower case letters (e.g. Meyer 2007a, Meyer 2007b, etc.).

The following information is provided on the sources; examples are given below.

- Name(s) of the author(s).
- First name(s) – abbreviated.
- If there are several authors, all are cited, do not use *et al.*
- If no author can be identified, the source is marked "Anon."
- Year of publication.
- Title of the work (and name of the (book) series, if applicable).
- For books: edition (abbreviated to "Aufl." or "ed."), unless it is the first edition; publisher (not for periodicals); place of publication (or place of publishing).
- For essays/articles: name of the journal; year and, if applicable, issue number (only if the pages of the entire year are not counted continuously). Page numbers (from...to, not total number).
- In the case of works with several volumes, all volumes are considered as a separate book. The number and title of the volume are given after the title of the entire work.
- In the case of dissertations and diploma theses, instead of publisher and place, the term "dissertation" or "diploma thesis", the name of the university, supplemented by the department or faculty and the place of the university, shall be given.
- Contributions in volumes, proceedings or special issues: the author(s) and title of the contribution should be followed by "In: name of the editor(s) (ed./eds.), title of the complete work, publisher, place of publication: page range".
- Standards, guidelines and similar sources should be listed in a separate section of the bibliography (see examples for citation style).
- Online sources should be listed in a separate section of the bibliography. They are to be used only if the document cannot be obtained in paper form. The reference should be as comprehensive as possible, consisting of: surname, first name(s) abbreviated - title of page, year of publication, www: <URL> and "retrieved on: date".
- Personal communications and similar contributions should be treated as traditional sources. The date of the communication should be indicated.

Examples of references:

- Anon. (2000) A Dictionary of Pedagogy, Oxford University Press, ©Market House Books Ltd. <http://www.xrefer.com/>. Retrieved 19.08.2002

- BASF (2007) Ökoeffizienz. Online-Information im Selbstverlag der BASF Coatings AG. http://www.basf-coatings.de/de_DE/sustainability/eco_efficiency.xml. Retrieved on: 19.09.2007
- Becker H.-D. (2001) Oral communication on 12.12.2001
- Engeström, Y. (1996a) Development as breaking away and opening up: a challenge to Vygotsky and Piaget, *Swiss Journal of Psychology*, 55, pp. 126-132.
- Engeström, Y. (1996b) Developmental work research as educational research, *Nordisk Pedagogik*, 16, pp. 131-143.
- Spörer, N./ Brunstein, J. (2005): Diagnostik von selbstgesteuertem Lernen. Ein Vergleich zwischen Fragebogen- und Interviewverfahren. In Artelt, C./ Moschner, B.: *Lernstrategien und Metakognition: Implikationen für Forschung und Praxis*. Münster, Waxmann Verlag, 43-64.
- Flint, W.P.K. (1966) work process knowledge. In: Becker G., Liese W. (Eds.): *Neue Konzepte des Arbeitslernens*, Internationales Symposium Hamburg- Harburg, Heft 1, Lucius & Lucius, Berlin: 199-212.
- Tenberg, R.: *Schüleraussagen und Verlaufsuntersuchung über einen handlungsorientierten Metalltechnikunterricht*. Frankfurt am Main, Berlin, Bern, New York, Paris, Vienna: Lang 1997. Dissertation, 231 p.
- Bruner, J.S. (1967): *A Study of Thinking*. Wiley, New York.
- Schlaffke, W. & Weiss, R. (eds.) (1996). *Das duale System der Berufsausbildung. Leistung, Qualität und Reformbedarf*. Köln: Deutscher Instituts-Verlag.
- Schmidt, H. (1996). Flexibilisierung der Berufsausbildung – Flexibilisierung als Organisationsprinzip? In: *Berufsbildung in Wissenschaft und Praxis*, Vol. 25, No. 4, 1f.
- Griffiths, T. & Guile D. (2001). Learning through work experience. In: *Journal of Education and Work*, Vol. 14, No. 1, 113-131.

1.7 Declaration of authorship

The declaration must be prepared and signed in accordance with the respective examination regulations.

1.8 Appendix

To supplement the text, additional documents (e.g. tables with detailed experimental results, statistical evaluations or calculations) can be included in the appendix of the work. However, argumentation sequences in the main part must not refer to results given in the appendix: The appendix is to be understood as an independent part of the paper and has no influence on the grade.

2 Form and content of the work

2.1 Page layout

The following should be noted:

- It is highly recommended to create a format template that already takes all layout aspects into account before starting work! This saves a lot of time and trouble!
- Paper size: DIN A 4, printed on one side, line spacing 1.5, format text left-justified or as justified text.
- Font type/size: Arial 12 pt., Times New Roman 12 pt. or Calibri 12 pt. (figure and table captions may be smaller and bolded).
- Margins: left 25 mm, right 20 mm, top 25 mm (without header) or 30 mm (with header), bottom 25 mm.
- Header and footer are optional, but their use is recommended for better clarity. The header can contain the corresponding main heading of the respective paragraph (if this is too long, a shortened version can be inserted manually). Page numbering should be right-justified in the footer. Font size should be 1 pt. smaller than in the standard text.
- Page numbering: The pages are counted from the title page. However, the first page number is only on the "thank you page" or the first page of the table of contents.
- For the numbered captions of figures and tables, it is essential to use the corresponding functions of MS Word (or similar programs). The same applies to cross-references to figures, tables, sections or chapters in the text.
- Illustrations (e.g. excel diagrams, photos) should only be inserted into the text document as graphics! Otherwise, the document will quickly become very large and take up an unnecessarily large amount of memory.
- The use of nonbreaking spaces is particularly recommended for the indication of units (e.g. 35 m), as is the use of protected hyphens for compound abbreviations (e.g. T-RFLP and e.g.).

2.2 Text part

The style of expression in a scientific paper differs significantly from the usual prosaic formulations still familiar from school essays. The style of language should be concise, precise and factual throughout. Varied, clever phrasing or figurative language with rhetorical figures or figures of speech seem inappropriate and distract from the content. What is important is the stringency (consistency) of the argumentation, the clarity of the individual statements, the simplicity of the sentences, the avoidance of repetition or redundancy, but also of too much density. Box sentences are just as difficult to read as elaborate passive constructions. Readability can be increased significantly by:

- Structured enumerations (in meaningful places)

- Anticipation for longer arguments (e.g. the following discusses the relationship between the concepts X, Y and Z)
- Visualization of complex contexts or structures (graphics, charts, system diagrams)

Short summaries are useful at the end of larger chapters. These can also be used as transitions to the next chapter. Linguistic repetitions - in contrast to prose - are often useful, as they signal to the reader that there is a parallelism in content. For example, the explanations under a diagram should always be written in the same wording if there are several similar diagrams in succession. This makes it easier to read and understand the differences between the individual diagrams a better contrast. Expressions of opinion should generally be refrained from, as they contradict scientifically sound argumentation.

Italics should only be used for Latin terms and abbreviations, such as *et al.*, *i. e.*, *cf.*, *sic*. Numbers from one to twelve are written out as words. Numbers greater than twelve are written as a number. Units are preceded by a space, with the exception of °. So it says: 20°, but 17 °C or 1000 K.

2.3 Footnotes

Text footnotes serve to supplement the text with notes or further references. In cases of doubt, such footnotes should be dispensed with; really important comments, statements or definitions belong at the appropriate place in the text. Only if the flow of the text is considerably disturbed by the insertion of such information is it advisable to insert a footnote. Under no circumstances do footnotes refer to sources!

2.4 Illustrations and tables

Results can be presented clearly and concisely in figures and tables.

Tables and figures are referred to in the text, they must not appear without prior notice. So → "The use of different materials is shown in Fig. 1." or: "The learners used several learning materials (Fig. 1)." The same is done with tables.

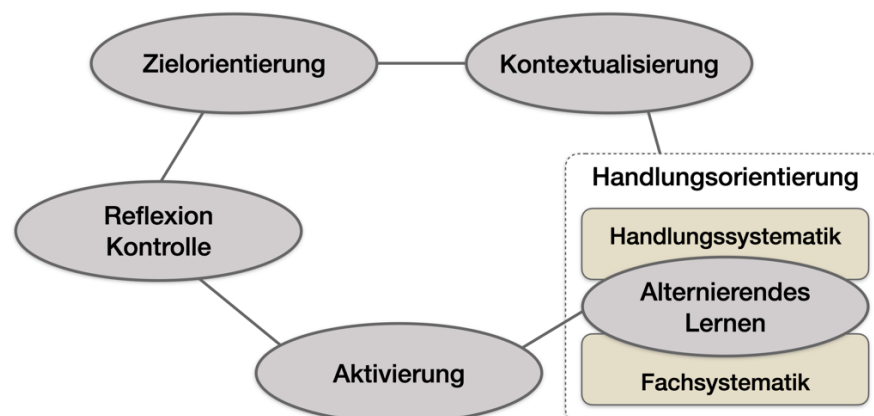


Fig. 1: Orientation concepts or principles for competence- and activity-oriented teaching. Source: TUM Technology Didactics.

Tab. 1 Correlations of learning emotions with their effects, including mean values and standard deviations of the variables. Source: Grieder.

	Konzentration	Anstrengung	Tiefenverarbeitung	<i>M</i>	<i>SD</i>
Freude	.31**	.54**	.49**	2.55	0.76
Ärger	-.50**	-.29**	-.21**	2.47	0.77
Langeweile	-.60**	-.48**	-.36**	2.71	0.82
Angst	-.40**	.06	.03	2.17	0.76
<i>M</i>	3.08	3.10	3.12		
<i>SD</i>	0.86	0.71	0.62		

Anmerkung. Dargestellt sind bivariate Pearson-Korrelationen.
N = 518.
 ***p* < .01 (2-seitig).

The following applies: Each figure or table must be referred to at least once in the text. Otherwise it is dispensable.

- Tables are given a table heading (Table 1)!
- Figures are given a figure caption (Figure 1)!

Furthermore, each figure/table with its (sub-)heading must be self-explanatory without reading the corresponding text. At the same time, the text must be written in such a way that the reader understands its meaning without looking at the corresponding tables/illustrations!

Experimental results or correlations may only be presented once in a table or in a figure. It is not permitted to present them both in tabular and graphical form (repetition)!

The labelling of tables and figures must also explain unusual abbreviations that are already explained in the text at the appropriate place → otherwise self-explanation is not given!

A largely uniform format should be chosen for all tables and figures in the paper. This applies in particular to the scaling and labelling of axes.

2.5 Citation technique

Intensive citation is expected in assessments and in the theory section. A distinction is made between scientific citations (evidence) and personal citations (reference). All sources used directly or indirectly in a paper must be identified and listed in a comprehensible manner so that they can also be found by third parties without difficulty (see also chapter 1.6). This also applies, in particular, to texts taken from the Internet. A single missing reference makes the entire work plagiarized.

Each citation must meet three criteria:

- **Immediacy:** statements should refer directly to the primary source; if this cannot be obtained, a reliable secondary source can also be cited (provided with the reference: "cited from ...").
- **Accuracy:** Accuracy is to be understood literally, i.e. orthographic or punctuation errors, incorrect or outdated statements are to be accepted.
- **Relevance:** The quotation should reflect the statement that the person quoting wishes to substantiate. The scope of the quotation should be sufficient, i.e. it should correspond to the intended purpose.

When citing, a distinction must be made between:

- **Verbatim quotations:** ... "Pupils have been shown to learn most effectively on Tuesdays" (Kollmann 1956).
- **Meaningful quotations:** ... this is also confirmed by work by Meyer (1994) and Müller et al. (2001).

If more than one source is cited for a statement, the sources are cited in chronological order.

- For example, two authors state Meyer and Müller (2007).
- If there are more than two authors, it is e.g. Meyer et al. (2007).

Examples of quotations with the same meaning:

The intrinsic motivation of students with strong leadership skills has been empirically proven several times (cf. Müller 1974, Giebeler 1981, Liebich et al. 2000, Donald 2007).

Müller (1974), Giebeler (1981), Liebich et al. (2000) and Donald (2007) already reported a particularly strong intrinsic motivation among high-achieving pupils.

Forms of documentation

In addition to a printed version of the thesis, the following documents must be submitted to the supervisor as files on a CD-ROM:

- Reading instructions (Read me / Lies mich) as .doc file (by arrangement)
 - The contents of all other files should be described here in short form (file name, keyword-like description of contents).
 - It serves as an orientation guide for finding the desired information.
- Final version of the student research project as a .doc file
- Raw data, e.g. as xls files
 - Especially in experimental work, all raw data must be documented and archived in order to later be able to reproduce the results described in the work.
 - All recorded raw data (incl. associated tables and diagrams) must be saved and made available in .xls files or files from other data processing programs (SPSS, AMOS etc.).
 - Each .xls file must have a legend as the first worksheet describing the following items:
 - Date
 - Project/type and title of work
 - Project manager/supervisor of the work
 - Editor
 - Test designation
 - Overall objective of the experiment
 - Aim of this experiment
 - Specification of all test parameters (materials used, designation of the materials)
 - Experimental methods used
 - Timing of the experiment
 - Special features during implementation
 - Brief description of the test results*
 - All other documents/files that are connected to the work in terms of content and suitable for better understanding the work carried out later, e.g. photos, drawings, presentations (.ppt files), original sources (brochures, product descriptions, etc.).