
Graduate Student Writing for Engineers

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Writing in Graduate School

You're not an undergraduate anymore!

Undergraduate Expectations

- Proper grammar
- Answer specified questions related to data
- Clearly report what has been observed
- Report current literature regarding a specific topic

Graduate Expectations

- Meet all UG Expectations
- Increased clarity and succinctness
- Show knowledge of broader range of literature
- Synthesize arguments
- Address both sides of an argument
- Draw your own conclusions based on literature

Types of Writing You'll Need to Know

Documenting Research

- Documenting Software
- Lab Notebook
- Instruction Manuals
- Lab Reports

Proposing Research

- IRB Forms
- Proposals
- Dissertation / Thesis
Outline

Reporting Research

- Thesis /
Dissertation
- Journal Articles
- Abstracts
- Presentations



Documenting Research

Lab Notebook

Purpose: Document experimental planning, procedures and results (includes any conversations)

Audience: Yourself, Your advisor/other professors, Other graduate students

Format:

- Experimental procedure: detailed description of what experiments were conducted
- Results: any measurements taken
- Documentation: any “pictures” from experiments or printouts from results
- Notes: questions to yourself, other ideas to pursue
- Date all entries

Guidelines: Thorough, concise, clear enough for you or someone in your lab to repeat same methods to obtain results



Instructional Manuals

Purpose: Document experimental procedures

Audience: Yourself, Your advisor/other professors, Other graduate students, Others in your field

Format:

- Step-by-step description of experimental procedure: what experiments were completed
- Similar to procedure component of lab notebook

Guidelines: Thorough, Concise, Clear, Needs to be repeatable by you or another in your field



Lab Reports

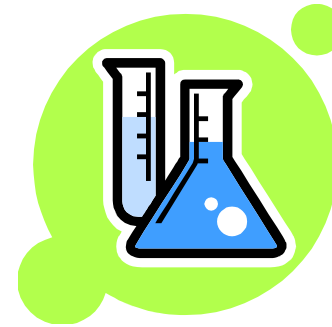
Purpose: Document experimental procedures

Audience: The professor of the course

Format:

- **Abstract:** brief overview of report
- **Introduction:** overview of topic/experiment covered in lab
- **Methods/Materials:** explanation of what was completed
- **Results/Discussion:** summary of findings and discussion on significance
- **Conclusions:** final conclusions based on findings
- **References:** any documents used in lab report

Guidelines: Thorough, Concise, Clear, Good organization, Use of technical language, Proper grammar and syntax



Software Documentation

Purpose: Provide information about software code

Audience: Yourself, Others in your field

Format:

- Depends on requirements
- Plain Old Documentation (POD): detailed information within code
 - Name of software
 - Function of software
 - Author
 - Bugs
- **Guidelines:** Thorough, Concise, Clear, Understandable (others in field need to be able to understand the code in order to use/modify it properly)



Proposing Research

IRB/IUCUC Documentation

Purpose: Receive permission to safely conduct human (IRB) or animal research (IUCUC).

Audience: Institutional Review Board / Consent form for Subjects

Format:

- Obtain appropriate forms from IRB website

Marquette: <http://www.marquette.edu/researchcompliance/research/irbforms.shtml>

AND if you will be conducting research at either MCW, VA, or both:

MCW: <http://www.mcw.edu/hrpp.htm>

VA: Available through VPN or a proxy. You will need an MCW account and/or an investigator at the VA.

Link to proxy: <http://proxy.lib.mcw.edu/login>

Select “InfoScope” under “MCW Links”

Then select “Research Resources” from left panel under “Working”

At the bottom of the page, select “VA Medical Research Service” under “Website Links”

To get access to proxy:

Click on “authorized users” at the top of MCW login page

Then select “apply online using the appropriate CAR form” link at the bottom of the page.

IRB/IUCUC Documentation

Format (continued):

- All experimenters need to complete online IRB training course "Protecting Human Research Participants"
- You will need to include
 - Justification for your experiment
 - Who will participate?
 - Participant consent forms (human subjects)
 - Benefits to the participants
 - Disclosure of risks
 - Detailed description of your methodology including equipment and procedures

Guidelines: Include detail. View prior IRB documentation and consent forms from your lab. Use the IRB website as a resource.

Outline for Thesis or Dissertation

Purpose: Agreement between you, your committee members and the Graduate School for your planned research.

Audience: Committee members

Format (specific to Marquette's Graduate School):

- ❑ Title
- ❑ Statement of the Problem
- ❑ Present Status of the Problem
- ❑ Statement of Materials (if appropriate)
- ❑ Statement of Procedure or Methodology
- ❑ Outline of Dissertation or Thesis
- ❑ Bibliography
- ❑ Tentative Timetable

Helpful Hints: Meet with your research advisor to discuss your project before beginning your outline. Visit <http://www.grad.mu.edu/forms/index.shtml> and download the required form for your outline.

Graduate Research Proposal

Purpose: To demonstrate to your committee that your research is original, pertinent to your field, clearly grounded in existing literature, and can be feasibly completed by you within a reasonable timeframe.

Audience: Committee members

Format (follows NIH grant proposal format):

- A. Specific Aims – *What are the objectives of the study?*
- B. Background and Significance – *Why is this an important issue?*
- C. Preliminary Studies/Pilot Data – *What evidence led you to pursue this issue?*
- D. Research Design and Methods – *How will you achieve your study objectives?*
- E. Literature Cited

Guidelines: Speak with your advisor to determine how your proposal should be written. If possible, get a copy of previous student's proposal.

Proposal Format[†]

- Specific Aims
 - Broad, long-term objectives and goal of the specific research proposed.
- Background and Significance
 - State background leading up to present application, critically evaluate current knowledge of problem, specifically identify gaps that the project is intended to fill.
- Preliminary Studies/Pilot Data
 - Provide an account of the principal investigator's preliminary studies pertinent to the current application.
- Research Design and Methods
 - Describe the design framework, procedures, analyses that will be used to accomplish specific aims; explain how data will be collected, tools, potential difficulties or limitations to the proposed procedure; include a timetable of the proposed study.
- Literature Cited
 - Provides a complete reference of all previously published work.

[†]Adopted from the National Institute of Health (NIH) requirements for grant applications (www.nih.gov)

Reporting Research

Thesis / Dissertation

Purpose: Report Original, Independent Graduate Research

Audience: Primary Advisor / Committee, Other Graduate Students

Typical Format

- Acknowledgements
- Table of Contents
- List of Figures
- List of Tables
- Executive Summary / Abstract
 - Always written last
 - Brief explanation of your hypothesis
 - Summary of your experiment and findings
- Ch 1: Literature Review
 - Detailed explanation of the current status of your hypothesis
 - Thorough evaluation of the literature regarding this topic
 - Include prior research leading to your dissertation
 - Describe the research void you are filling
 - Make an argument for the value of your specific research

Thesis / Dissertation

- Ch 2: Methods

- Subjects – animal or human (if necessary):
 - How many?
 - Inclusion / Exclusion Criteria
 - Ages
 - State this is an IRB approved study
- Equipment:
 - Hardware
 - Software
 - Instrumentation
- Experimental Procedure:
 - What you tested
 - How you tested it
 - What was measured
- Data Analysis:
 - Post-processing of data (filters, etc)
 - What equations were used?
 - What statistics did you run (ANOVA, correlations, etc)?

Thesis / Dissertation

- Ch 3: Results

- Direct statement of your findings
- Report statistical significance
- Use Figures / Tables to illustrate data
 - Label Axes
 - Clear legends
 - Appropriate line widths
 - Caption should concisely summarize figure

- Ch 4: Discussion

- Explain your results
- Develop Theories
- Support / Compare / Contrast data with available literature

- Ch 5: Conclusions

- Summarize main ideas
- Do not introduce new ideas here

- Works Cited

- Work with your advisor to choose appropriate format for citations and references

Thesis / Dissertation

Alternate Format:

Thesis

- Acknowledgements
- Executive Summary / Abstract
- Table of Contents
- List of Figures
- List of Tables
- Ch 1: Literature Review
- Ch 2: Journal Format
- Ch 3: Conclusions / Integration of Results / Future Directions
- Works Cited
- Appendices

Alternate Format:

Dissertation

- Acknowledgements
- Executive Summary / Abstract
- Table of Contents
- List of Figures
- List of Tables
- Ch 1: Literature Review
- Ch 2: Aim 1 (Journal Format)
- Ch 3: Aim 2 (Journal Format)
- Ch 4: Aim 3 (Journal Format)
- Ch 5: Conclusions / Integration of Results / Future Directions
- Works Cited
- Appendices

Guidelines: Ask your advisor for the format they prefer. Look at previous dissertations from your lab or the department. *Consult the Graduate School website for specific formatting requirements* <http://www.grad.mu.edu/>.

Journal Article

Purpose: Report novel scientific results

Audience: Journal Editor/Reviewers, Experts in your field

Format (See Thesis / Dissertation for details)

- Abstract
- Introduction
- Methods
- Results
- Discussion
- Conclusions
- Works Cited

Guidelines: Format per specific journal requirements (word count, # of figures, figure sizes, specific categories, citation style). Be thorough, Concise, Clear. Included detailed captions on Figures/Tables. Avoid technical jargon. Write the abstract last.

Conference Abstract

Purpose: Summary of your work to be presented at a conference. Often published in conference proceedings.

Audience: Conference Committee / Conference Attendees

Format

- Typically 200-400 words
- Succinctly explain all aspects of experiment
- 1 sentence to 1 paragraph for each topic: Intro, Methods, Results, etc.

Guidelines: Follow format provided in the “Call for Presentations” documentation. Be brief, but clear. Reader must understand your experiment, but can come to your presentation to hear details.

Conference Presentation

Purpose: Present your work to others in your field (often before work is published). Gain feedback from a wide range of perspectives.

Audience: Conference Attendees

Format

- Poster Session -or- PowerPoint Presentation (10 – 15 slides, or 1 min / slide)
- Cover all topics related to experiment (Intro, Methods, etc.)
- Incorporate pictures, graphs, movies (in .ppt) when possible

Guidelines: Focus on your methods and data. Use large enough fonts and line widths. Use appropriate color schemes. Ensure presentation is readable to the audience members. Keep number of words on a slide to a minimum. For poster sessions follow guidelines for poster size. Graphs should be clearly labeled. ***Be prepared for questions, suggestions and criticism!***



Citing Literature

Give Credit Where Credit is Due

- Academic Honesty Policy and Procedures

- <http://www.marquette.edu/rc/academichonesty.shtml>

Plagiarism[†]

- Plagiarism is intellectual theft. It means use of the intellectual creations of another without proper attribution. Plagiarism may take two main forms, which are clearly related: 1. To steal or pass off as one's own the ideas or words, images, or other creative works of another and 2. To use a creative production without crediting the source, even if only minimal information is available to identify it for citation.
- Credit must be given for every direct quotation, for paraphrasing or summarizing a work (in whole, or in part, in one's own words), and for information that is not common knowledge.
- **Examples: Figures / Illustrations, Concepts, Methodologies, Theories, Data**

[†] Taken from: <http://www.marquette.edu/rc/academichonesty.shtml>

Helpful Resources for Writing

Format and Style Guides

- Follow MLA, APA, ALA, Chicago, etc.
- For more information visit:
 - <http://owl.english.purdue.edu/owl>

Citation

- <http://citationmachine.net/>
- <http://www.marquette.edu/library/refworks/>

Writing Centers

- <http://www.marquette.edu/writingcenter/>
- <http://owl.english.purdue.edu/handouts/index2.html>
- <http://www.wisc.edu/writing/>