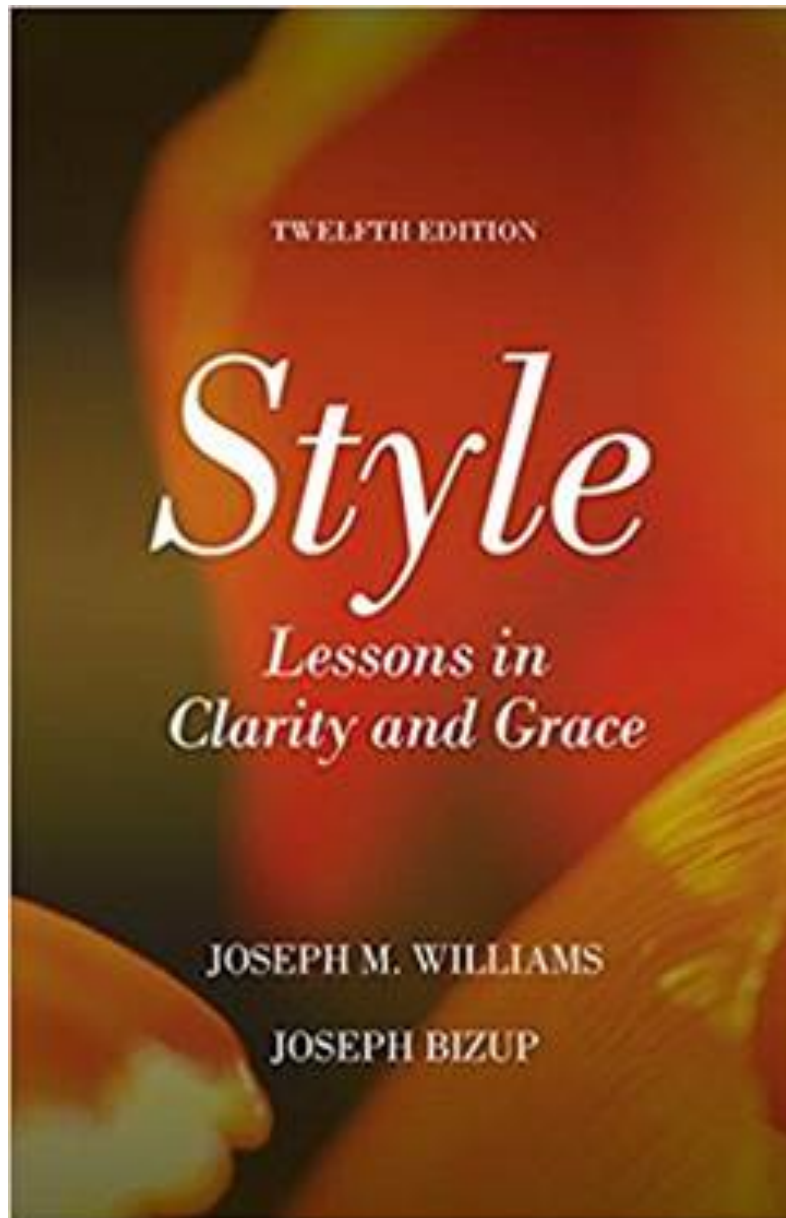# How to Write a Research Paper
or How to Write Your Capstone Paper

Daniel W. Engels, PhD

ISBN-13: 978-0134080413
ISBN-10: 0134080416

Goals of Your Written Word

- Clear writing
- Engaging writing
- Tell a story

Why Writing Goals?

Write clearly to…

    …ensure your readers understand your message

    …clarify your own thinking

Engage your reader to…

    …get your message to the reader

    …get your reader interested in your message

Tell a story to…

    …create a single, easy to follow thread

    …keep your reader reading your entire paper

What to Consider When Writing

- Word Choice

- Sentence Structure

- Paragraph Structure

- Paper Structure

Word Choice

- Choose your words carefully
- Write in the present tense
- Define all acronyms on first use
- Use words appropriate to the subject matter
- "Define or remind" the reader on first use of important words
- No opinion words!

Sentence Structure

- Use short, simple sentences.

- Break long sentences into multiple short simple sentences.

- Break compound sentences into multiple short simple sentences.

Paragraph Structure

- One topic sentence
- 3-4 Supporting sentences

Paper Structure

- Abstract
- Introduction
- \<Tutorial Material\>
- (Data Set)
- \<Methods and Experiments\>
- Results
- Analysis
- Ethics
- Conclusions (and Future Work)

Abstract

- 1 Problem sentence (In this paper, we present…)

- 1 Motivation sentence

- 2-3 sentences what you did to solve the problem

- 1 sentence main result (singular, with a number)

- 1 sentence main conclusion (singular)

Introduction

- 1 Paragraph Motivation (sets the general problem domain)

- 1 Paragraph Problem Statement (specific problem solved by the work)

- 2-3 Paragraphs on solution

- 1 Paragraph on main results (plural)

- 1 Paragraph on main conclusions (plural)

- 1 Paragraph on paper organization

<Tutorial Material>

- You are writing a paper that is **tutorial** in nature

- Your audience is data scientists of varying levels of knowledge (think first term MSDS students to last term MSDS students)

- Include enough information so that all readers can understand your work

(Data Set)

- If you are analyzing data, you must have a section that defines your data

- If you are collecting data, you must have a section that defines your data collection methodology

- Use tables and figures to illustrate your data attributes and examples of the data you use

<Methods and Experiments>

- Define your algorithms, your methods and your experiments

- DO NOT give a play by play of what you did (80-90% of your implementation work will NOT be described in your paper)

Results

- Results of your experiments
- Use tables and graphs
- Use tables and graphs
- Use tables and graphs
- Use tables and graphs
- Don't forget explanations

Analysis

- Analyze your results
- These are NOT conclusions

Ethics

- Discuss the ethics of your problem, solution, or…

Conclusions

- Draw CONCLUSIONS (at least 3)
- This is NOT a summary section

Figures and Tables

- Visualization of your data, your results, your analysis, etc are critical to your story

- Tables instead of bullets

Bullets and Lists

- All bullets and lists should be converted to tables

Summary

- Write a clear, engaging story
- Write a tutorial type paper, particularly for your particular problem domain
- Use figures and tables to add visual clarity and interest to your story