

This International Student Edition is for use outside of the U.S.

FOURTH EDITION

# TECHNICAL WRITING FOR ENGINEERS & SCIENTISTS



**Mc  
Graw  
Hill**

Leo Finkelstein Jr. • Jeanine Elise Aune • Leslie A. Potter

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# Technical Writing for Engineers & Scientists

**Fourth Edition**

**Leo Finkelstein, Jr.**  
*Wright State University*

**Jeanine Elise Aune**  
*Iowa State University*

**Leslie A. Potter**  
*Iowa State University*





## TECHNICAL WRITING FOR ENGINEERS & SCIENTISTS

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# Dedication

*In memory of Dr. Leo Finkelstein, Jr. We are honored to continue his legacy.*

*This has been one of my favorite projects of all time due, in no small part, to the support of and collaboration with some of my favorite people. It is dedicated to Siggie for unwavering support, to my children for just being, to my pets and pony for the cuddles and chances to recharge my soul, to my mom for being my cheerleader, to my siblings for their wit and humor, and to the legendary Grandma Glenna for showing me the way to teaching and about not letting one's standards slip. And last but not least, to Leslie, for her creativity, enthusiasm, and for keeping my nose to the grindstone.*

—Jenny

*I have always loved language: it was difficult for me to choose between a career in engineering and a career in English. I am grateful for the opportunity to combine both interests in this book and couldn't have asked for a better writing partner—thank you, Jenny! I dedicate it to John, for all that he has done these past 30 years to make it possible for me to tackle this project; as well as to our three boys for their never-ending good humor, generosity of spirit, and willing assistance; to my parents for giving me the best of each of themselves, including my mom's amazing editing skills and my dad's spot-on advice; to my brother who supports me always; and to my in-laws whom I love dearly. Shout-out to my dogs, too, who keep me grounded.*

—Leslie

# Preface

---

## Purpose

The purpose of this book is to succinctly explain the content and structure of concepts and genres common to communication in engineering and science disciplines. Much like Dr. Finkelstein did in the first three editions, we aim to avoid “the sterile, encyclopedic treatment of writing concepts” that exists in many textbooks about writing. While such textbooks can be helpful for writing instructors who want to cover all of the ins and outs of technical writing theory, concepts, strategies, and genres in writing classes, such comprehensive textbooks might not be the most useful for instructors looking to incorporate writing assignments into their already-packed classes, or for students looking for the nitty-gritty details about what they need to do to get the writing project done in their engineering and science classes.

---

## Approach

Our approach to revising this textbook was based on our combined 50+ years of teaching experience. We have endeavored to bring our approach to teaching to *Technical Writing for Engineers and Scientists*, 4th edition.

## Theoretical Foundation

Technical communication is most effective when it considers audience, purpose, and context. Audiences can be categorized in many ways, but one of the most utilitarian methods is to think of them as decision-makers, advisors, and implementors. For example, when you are writing an abstract or summary, you are typically writing for decision-makers and/or advisors. When you are researching and writing a feasibility or recommendation report, you are writing for decision-makers and advisors. When you are writing descriptions or instructions, you are most likely writing for implementors. We have considered these three categories of audience as we have revised the content in this book.

In addition to audience, technical communication is most effective when it considers purpose and context. If we have been hired by the CEO and founder of a major pasta producer to write a report on the feasibility of moving a pasta factory to the upper Midwest, and we write a description of a pasta factory and its components, we will have singularly failed in understanding our purpose. The CEO is already familiar with a pasta factory; they need an evaluation of a solution based on a set of criteria, like proximity to rail lines for shipping raw ingredients. As technical writers, we must anticipate how our communication will be used and in what context. For example, electronic instructions for an executive in their corner office have an entirely different context than those required by a worker standing underneath a molten iron transfer line in a foundry.

## **Restructured for Easier Understanding**

Over the years, we have learned that our students do best when they can see a finished example before we get into the details—much like assembly instructions and recipes, it helps the implementor to look at a picture of the final product before they begin crafting it. Therefore, we restructured the textbook’s genre chapter content to provide a definition first, followed by an overview, a basic general outline, a complete example, that example broken down into the logical moves that the writer needs to make, and if relevant, additional examples illustrating the range of that technical writing genre. The intent is that students see the overall document to “get a feel” for it before they examine the breakdown of the components in that example document.

We have also incorporated references to other chapters along with small excerpts of copied-and-pasted text throughout most of the book. We did this to facilitate the use of individual chapters rather than expecting a student to read and remember the entire book. Bonus: repetition is how we move knowledge into our long-term memory.

## **Analogies**

Over our years of teaching, we have developed the tendency to explain new concepts and ideas to students using analogies (lightbulb moments!). In this revision, we also tried to connect technical writing concepts and genres to a framework with which (we hope!) students are familiar. While not everyone loves dogs, and some may be allergic or even avoid canines for religious



reasons, we anticipate that most everyone will at least be familiar with the concept of the dog, its multiple variations and roles in society, and purposes behind those variations. We hope that our readers find the analogies helpful, if somewhat wacky, in learning about technical writing concepts and genres.

Although we do assume that most everyone is familiar with dogs in [Page v](#) general, we do not assume that everyone knows all of the various dog species by name, and here we took our own advice from [Chapter 4](#) on Technical Definitions:

**In some situations, you might need to sacrifice desired precision in your definition to achieve the required level of communication.**

To ensure that our readers clearly recognize our references to specific dog breeds and their connection to genres, we have treated dog breed names as proper nouns despite generally accepted capitalization guidelines for dog breeds. For example, in most writing situations, “border collie” would not be capitalized, nor would the “pinscher” in “Doberman pinscher.” However, we have capitalized all words in each dog breed name so that readers will know we are talking about Border Collies and Doberman Pinschers as dog genres, analogous to writing genres.

## **Embraced Our Inner Goofy**

Finally, we have tried to incorporate the same Goofy (dog pun intended) sense of humor that we try to share in our courses to make writing as fun and interesting for our students as we can. It was Finkelstein’s light-heartedness and willingness to poke fun at himself that initially attracted us to his textbook, and we are more than happy to continue the tradition.

## **Disclaimers**

As part of our attempts to be light-hearted, we have used numerous fictitious names in examples throughout the book. Any similarity to actual humans, towns, or organizations is completely coincidental.

Also, just as many sources for students writing technical reports have moved online in the past decade, so have they migrated online for authors writing textbooks. We have cited numerous websites throughout the text, including access dates, but understand that these addresses might change over time. Our intent was to provide enough information for readers to be able to

search the topics successfully even if the websites change.

---

## Organization

We organized the fourth edition around three major sections: the first one discusses fundamental material, the second describes how to write the most common technical documents, and the third provides useful information that, frankly, does not fit neatly in the first two sections.

### Section I: Fundamentals

[Chapters 1](#) through [6](#) deal with basic considerations, including the component skills you will need to produce effective technical writing. Expanding on the successful approach used in the first three editions, this section includes

- [Chapter 1: Introduction](#) explains what technical writing is and the basic concepts needed in technical writing.
- [Chapter 2: Ethical Considerations](#) focuses on ethics in technical writing and includes a general discussion of ethical considerations for technical writers.
- [Chapter 3: Note-taking](#) provides both the “why” and the “how” of taking notes, including techniques and legal/ethical considerations.
- [Chapter 4: Technical Definitions](#) explains the “nuts and bolts” of writing effective technical definitions because the ability to define is one of the primary skills needed for most technical writing.
- [Chapter 5: Description of a Mechanism](#) explains another primary skill needed for technical writing, which is being able to describe mechanisms precisely, accurately, and at a level the audience can understand.
- [Chapter 6: Description of a Process](#) explains how to describe processes, that is, third-person descriptions of events that do not directly involve the reader.

### Section II: Technical Documents

- [Chapter 7: Instructions and Manuals](#) explains how to write

instructions, or second-person descriptions for human involvement that provide specific directions so that the reader can perform a task or series of tasks.

- **[Chapter 8: Proposals](#)** explains the three necessary things that all proposals must include, provides multiple examples of informal proposals, and parses the “why” and “how” for each section.
- **[Chapter 9: Progress Reports](#)** builds on the proposals in [Chapter 8](#), explaining the necessary elements of a progress report and showing how to construct an effective progress report.
- **[Chapter 10: Feasibility and Recommendation Reports](#)** explains how to develop objective documents that identify and evaluate solutions to problems and explains the difference between a feasibility and a recommendation report.
- **[Chapter 11: Laboratory and Project Reports](#)** explains the difference between and the purpose of laboratory and project reports, as well as their various elements.
- **[Chapter 12: Research Reports](#)** explains the focused, objective nature of research reports, the general structure, and the wide variety of content based on audience need.
- **[Chapter 13: A3 Reports](#)** shares the history of the document, templates and examples, and an understanding of the usefulness in business.
- **[Chapter 14: Abstracts and Summaries](#)** explains the purpose of abstracts and summaries and provides examples of four different kinds of summations with a focus on both academic and business situations.

### Section III: Other Useful Stuff

- **[Chapter 15: Style and Mechanics](#)** highlights common issues with basic building blocks, including how style is related to mechanics (spelling, punctuation, and grammar).
- **[Chapter 16: Documentation](#)** shows examples of how to cite many different kinds of online, print, and in-person sources.
- **[Chapter 17: Visuals](#)** includes basic guidelines for when to use what kinds of visuals, as well as tips for constructing them as accurately and effectively as possible.

- **[Chapter 18: Presentations](#)** provides in-person and online presentation tips, including an example set of slides for an update presentation.
- **[Chapter 19: Business Communication](#)** provides some general guidelines, outlines, and examples for business communication.
- **[Chapter 20: Communication with Future Employers](#)** details six specific kinds of job-seeking communication, including both written (e.g., resumes) and oral (e.g., interviews).
- **[Chapter 21: Team Writing](#)** addresses important considerations for accomplishing a collectively written document, both as a student and as a professional.

We believe that our revisions will be useful to students and instructors who choose to use this book. However, we acknowledge (and appreciate!) that language and communication are always evolving and what is considered acceptable today might be adapted by tomorrow. We have done our best to capture generally accepted formulations and long-lived rules.

Being an effective technical writer continues to increase in importance. In fact, we have heard from some employers that they would rather hire good writers with average technical skills (because they can teach the technical skills themselves), than hire someone with high technical skills who communicates poorly. We would be delighted if our textbook could help students gain the communication skills that employers want.

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Department of English  
Iowa State University

Leslie A. Potter, Teaching Professor  
Department of Industrial and Manufacturing Systems Engineering  
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# Contents

**Preface iv**

**About the Authors xiii**

**Email to a Technical Writer xiv**

**IM to a Technical Writer xv**

**Acknowledgements xvi**

## **1 Introduction 1**

What Is Technical Writing? 1

Reducing Abstraction 2

Audience, Purpose, and Context 4

Audience 5

Purpose 5

Context 6

Genre Decisions 7

Characteristics of Technical Communication 8

## **2 Ethical Considerations 9**

What Is *Ethics* in Technical Writing? 9

Academic and Professional Dishonesty and Copyright Infringement 12

Image Alteration and Ethics 15

Social Media Presence 15

Plagiarism Exercise 16

Image Alteration Exercise 17

## **3 Note-taking 19**

What Is Note-taking? 19

Utility 22

Ethical Implications 22

Legal Implications 23

Digital Footprints 24  
Note-taking Checklist 24  
Exercise 24

## **4 Technical Definition 27**

What Is a Technical Definition? 28  
Classifications and Classes 29  
Differentiation 30  
Avoiding Imprecision 31  
Extensions 31  
    Further Definition 31 / Comparison and Contrast 32 / Classification 32  
    Cause and Effect 32 / Process 32 / Exemplification 32 / Etymology 32  
Required Imprecision 32  
A Word about Defining Specifications and Standards 33  
Definition Checklist 33  
Exercise 34

---

Page viii

## **5 Description of a Mechanism 35**

What Is a Description of a Mechanism? 36  
*Outline 5.1—Description of a Mechanism* 36  
Moving from an Outline to a Complete Description 37  
*Example 5.1—General Mechanism Description* 37  
Dissecting Example 5.1 39  
Visuals and Mechanism Descriptions 43  
Mechanism Description with Expanded Functional Theory 43  
*Example 5.2—Description of a Mechanism* 44  
Specifications Using a Functional Mechanism Description 47  
*Example 5.3—Codified Form of a Functional Mechanism Description* 47  
Mechanism Description Checklist 48  
Exercise 49

## **6 Description of a Process 53**

What Is a Process Description? 54

Outline of a Process Description	54
<i>Outline 6.1—Process Description of a Mechanism in Operation</i>	54
<i>Outline 6.2—Description of a Conceptual Process</i>	55
<i>Example 6.1—Description of a Mechanism in Operation</i>	56
Dissecting Example 6.1	57
Visuals and Process Descriptions	59
<i>Example 6.2—Description of a Conceptual Process</i>	60
<i>Example 6.3—Description of a Physical Process</i>	62
Process Description Checklist	63
Exercise	64

## **7 Instructions and Manuals 67**

What Are Instructions?	68
<i>Outline 7.1—Instructions</i>	69
<i>Example 7.1—Instructions for a Non-Expert</i>	70
Dissecting Example 7.1	74
<i>Example 7.2—Instructions for an Audience with Some Experience</i>	77
More on Manuals	82
Visuals and Instructions	82
Conclusion	83
Instructions Checklist	83
Exercise	84

## **8 Proposals 87**

What Is a Proposal?	87
Formal and Informal Proposals	88
Formal Proposals	89
Government Proposals	89
Informal Proposals	90
<i>Outline 8.1—Informal Proposals</i>	91
Informal Proposal	91
<i>Example 8.1—Informal Proposal</i>	92

Dissecting Example 8.1 95  
Layout and Presentation 99  
Title Page 100  
*Example 8.2—Title Page* 100  
Attachments and Appendices 100  
    Transmittal Document 101  
*Example 8.3—Transmittal Email* 101  
*Additional Example 8.4—Topic Proposal* 102  
Proposal Checklist 104  
Exercise 105

## **9 Progress Reports 109**

What Is a Progress Report? 110  
Progress Report Formats 111  
*Outline 9.1—Progress Reports* 111  
*Example 9.1—Progress Reports* 112  
Dissecting Example 9.1 113  
Communicating the Progress Report 115  
*Example 9.2—Progress Report for a Student Project* 116  
Progress Report Checklist 117  
Exercise 117

## **10 Feasibility and Recommendation Reports 121**

How Do Feasibility and Recommendation Reports Differ? 122  
Establishing and Assessing Measurable Criteria 122  
*Outline 10.1—Feasibility Report* 124  
*Outline 10.2—Recommendation Report* 125  
Writing Feasibility and Recommendation Reports 125  
Recommendation Report 126  
*Example 10.1—Recommendation Report* 127  
*Dissecting Example 10.1* 130  
*Example 10.2—Feasibility Report* 133



Feasibility and Recommendation Report Checklist 136  
Exercise 136

## **11 Laboratory and Project Reports 143**

What Are Laboratory and Project Reports? 144

*Outline 11.1—Laboratory Report 144*

*Outline 11.2—Project Report 145*

*Example 11.1—Laboratory Report 145*

Dissecting Example 11.1 150

*Example 11.2—Project Report 154*

Visuals in Laboratory and Project Reports 156

Laboratory and Project Report Checklist 157

Exercise 157

## **12 Research Reports 161**

What Are Research Reports? 162

*Outline 12.1—Research Report 162*

*Example 12.1—State-of-the-Art Research Report 163*

Dissecting Example 12.1 165

Obtaining the Necessary Details 168

Secondary Research 169 / Primary Research 169

Evaluating Sources 170

Incorporating Source Material 170

*Example 12.2—Historical Research Report 172*

Documenting Sources 175

Visuals in Research Reports 176

Formatting a Research Report 176 / Transmitting a Research Report 177

*Example 12.3—Transmittal Email 178*

Conclusion 178

Research Report Checklist 178

Exercise 179

## **13 A3 Reports 181**

What Is an A3 181  
Outline of an A3 with Variations 182  
Example 184  
Disclaimer 186  
Problems to Avoid When Creating an A3 186  
Summary 187  
A3 Checklist 187  
Exercise 188

## **14 Abstracts and Summaries 191**

Abstracts 192  
    What Are Descriptive Abstracts? 193 / What Are Informative Abstracts? 193  
    Writing Informative Abstracts 194  
Summaries 194  
    What Are Academic Summaries? 194 / Writing Academic Summaries 195  
    What Are Executive Summaries? 196 / Writing Executive Summaries 196  
Conclusion 198  
Checklist for Abstracts and Summaries 198

## **15 Style and Mechanics 201**

Stylistic Considerations 202  
Economy 202  
Precision 203  
Style Guides 204  
Grammar: What Is It and Why Is It a Big Deal? 204  
Spelling Errors 205  
A Word about Homonyms 205  
Spelling Numbers 207  
    Capitalization 207  
Punctuation Errors 208  
    Comma Splice 208 / Fused Sentence 209 / Punctuation 210  
Sentence Fragments 211  
Misplaced-Modifier Errors 212  
Passive Voice Problems 212

When to Use the Passive 213  
Verb Agreement Errors 213  
Pronoun Agreement Errors 214  
Pronoun Reference Errors 215  
Case Errors 215  
Noun Clauses 216  
Compound Adjectives 216  
Phrasal Verbs 216  
Parallel Construction 217  
Bullets vs. Paragraphs 217  
English as a World Language 218  
Proofreading 218  
Exercise 1 219  
Exercise 2 219

## **16 Documentation 221**

What Is Documentation? 222  
Documentation Styles 223  
When to Document Sources 223  
    To Meet Legal Requirements 223 / To Meet Academic Standards 223 / To Establish Credibility 223  
What Happens When You Do Not Sufficiently Document Sources 224  
How to Document Sources 224  
Online Media 225  
Example Documentation 226  
    Large, Complex Website 226 / University Website 226 / Online Forum 226  
    Source Code Repository 226 / Journals 227 / Conference Papers 227  
    Computer Local Storage Media (Computer Flash Drive, External Hard Drive, or other local storage device) 227  
Print Media Examples 227  
    Books (Print or Audio) 227 / Encyclopedias 227 / Newspapers 227  
    Nonjournal Entries 228 / Technical Reports 228 / Dissertations and Theses 228  
Other Examples 228  
    Interview 228 / Lecture 228  
Checklist for Documentation 228

## **17 Visuals 231**

What Are Visuals? 231

General Guidelines for Using Visuals 231

Guidelines for Design of Visuals 232

Reproducibility 232 / Simplicity 233 / Accuracy 233 / Types of Visuals 236 / Equations and Formulas 236

*Example 17.1—Mathematical Equations and Formulas 236*

*Example 17.2—In-Text Mathematical Equations and Formulas 237*

*Example 17.3—Format of Terms 237*

*Example 17.4—Formulas in Chemistry 237*

*Example 17.5—In-Text Chemistry Formulas 237*

Diagrams 238 / Graphs 239 / Schematics 243 / Tables 244 / Images 244 / Fonts 247

Conclusion 249

Checklist for Visuals 249

Exercise 250

## **18 Presentations 251**

What Are Presentations? 252

Substantive Ideas 253 / Clear, Coherent Organization 254

Terminology and Concepts 254 / Professional Performance 254

Speaking Situations 256

Impromptu 256 / Extemporaneous 257 / Manuscript 257

Speaking Purposes 257

Informative 257 / Demonstrative 257 / Persuasive 258 / Technical Updates—Combining Purposes 258

General Guidelines for Effective Supporting Media 258

Title Slide 259 / Overview Slide 259 / Discussion Slide 261

Summary Slide 265 / Reflections Slide 265 / Controlling Complexity 267

Visuals and Complexity 267 / Special Effects 269

Checklist for Presentations 269

## **19 Business Communication 271**

Email 272

*Example 19.1—Email Actually Received by One of the Authors 273*

*Example 19.2—Fictitious Email That Would Have Made Its Recipient Happy*

*to Help* 274

*Outline 19.1—Email* 274

Memoranda 275

*Outline 19.2—Memoranda* 275

Example 19.3 Memo of Agreement 275

*Example 19.3—Memo* 276

Letters 277

*Outline 19.3—General Business Letter* 277

*Example 19.4—Block Letter Format* 278

*Example 19.5—Modified Block Letter Format* 279

*Example 19.6—Block Letter Format Without Official Letterhead* 280

Transmittal Letters 281

*Example 19.7—Transmittal Letters for a Student Project* 281

Job Application Letter 282 / Invitation Letters 282 / Letters for the Record 282

*Example 19.8—Letters for the Record* 283

Letters of Inquiry 284 / Response Letters 284

Instant Messaging 284

Some Communications Require a Personal Touch 284

Face-to-Face Meetings 285 / Phone Calls 285 / Thank You Notes 285

Conclusion 286

Checklists for Business Communications 286

## **20 Communications with Future Employers (aka, Getting a Job) 289**

Written Communication 291

What Is a Resume? 291 / Writing a Resume 292

*Outline 20.1—Resume* 293

Name 293 / Objective 293 / Education 294 / Experience 295

Computer Skills, Activities and Leadership, Awards, Volunteering, Skills, Etc. 296

Ten Tips for Creating a Good Resume 297

Cover Letters 298

Thank You Note 300 / Finding Jobs (and Jobs That Find You) 300

Oral Communication 301

Job Fair Conversation 301 / Networking 301 / Interviewing 303

*Putting It All Together* 305  
*Example 20.1—Cover Letter* 306  
*Example 20.2—Resume* 307  
*Example 20.3—Thank You Note After an Interview* 308  
Resume/Job Application Checklists 308  
Exercise 309

## **21 Team Writing 311**

Student versus Professional Team Writing 312  
The Process of Team Writing 313  
*Outline 21.1—Team Writing Process* 314  
    Requirements 314 / A Word about Themes (Tell the Story) 315  
    Preliminary Actions 315 / Document Production 316  
Professional Team Writing 317  
    Requirements 318 / Preliminary Actions 319 / Document Production 319  
Student Team Writing 320  
    Requirements 321 / Preliminary Actions 321 / Document Production 321  
Conclusion 322  
Team Writing Checklist 322

## **Index 325**



# About the Authors

Leo Finkelstein, Jr., received a bachelor's degree from the University of North Carolina at Chapel Hill in 1968; a master's from the University of Tennessee at Knoxville in 1969; and a Ph.D. from Rensselaer Polytechnic Institute at Troy, New York, in 1978. He was Lecturer and Director of Technical Communication for the College of Engineering and Computer Science, Wright State University, Dayton, Ohio. He directed the technical writing program at the U.S. Air Force Academy while also serving as adjunct faculty for the University of Colorado at Colorado Springs. He wrote, produced, and directed technical films in Southern California and commanded a combat-documentation, photographic unit in Southeast Asia during the Vietnam War, flying combat missions as an aerial photographer. In addition, his military service included experience in both space and logistics systems. He held FCC commercial and amateur radio licenses, had a black belt in tae kwon do, and was an avid user of all types of gadgets.



*Jeanine Elise Aune*

Jeanine (Jenny) Elise Aune is a Teaching Professor and the Director of ISUComm Advanced Communication (AdvComm) program at Iowa State University (ISU). She has an M.A. and Ph.D. from the University of Wisconsin-Madison and has been teaching writing in the Department of English at Iowa State University since 1999. She was the Coordinator of ISU's Learning Community (LC) English links for 11 years. Her responsibilities included helping linked discipline faculty communicate their expectations for students' communication skills to English instructors, and helping English instructors re-design writing classes to help students develop

those skills. The number of LC-linked English sections more than doubled during her tenure. She has been directing or co-directing the Advanced Communication program since 2011. She has worked with stakeholders across campus to build standardized curricula for the program's four courses—business communication, proposal and report writing, biological communication, and technical communication—in both face-to-face and online mediums. These four courses are taught by ~40 instructors in ~200 sections and enroll ~4,800 students every academic year. Most recently, the online business communication course earned QM certification<sup>1</sup> at 97%, and the online technical communication course earned QM certification at 98%.



*Leslie A. Potter*

Leslie A. Potter is a Teaching Professor in the Industrial and Manufacturing Systems Engineering (IMSE) department at Iowa State University (ISU). She has a B.S. in industrial engineering from ISU and an M.S. in industrial engineering with an emphasis in manufacturing from The Pennsylvania State University. She worked as an engineer and supervisor for John Deere for seven years before joining IMSE at ISU, where she has taught undergraduate courses across the curriculum for the past 20+ years, ranging from freshman problem-solving and programming to capstone design. As part of her research at ISU, she co-developed a professional communications course within the industrial engineering curriculum. From those efforts, she has developed and incorporated substantial writing and speaking curricula that are used by many of her peers. She was the co-founder in 2013 as well as the co-chair for the IMSE Undergraduate Research program for seven years, supporting hundreds of students with writing and presenting their research. She regularly requires writing and presentation assignments in her engineering courses, and has collaborated with faculty in the Iowa State University Department of English since 2007.



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<sup>1</sup><https://www.qualitymatters.org/reviews-certifications>

# Email to a Technical Writer

Technical writers must consider their audience, purpose, and situational context. The following is an example of an email that the authors of this textbook could send to potential users of this textbook.

**From:** JennyandLeslie@Finkelstein

**Sent:** Monday, June 14, 2021 1:32 PM

**To:** Student

**Subject:** Email to a Technical Writer

Dear Student,

Your decision to study a technical field is most admirable, and we applaud your fortitude and motivation in dedicating your time and effort to learning a subject that has the power to change the world. However, your knowledge and expertise can only be understood by others if you can communicate your ideas, thoughts, findings, recommendations, and preferences with both technical and non-technical audiences. It is there, at the point of communicating ideas as non-abstractly as possible, that we can support you. We hope that after reading a few pages of our not-typically-super-serious textbook, having a conversation or two with others about it, and allowing yourself to enjoy the relatively formulaic processes of technical writing, you will come to appreciate the power of audience, purpose, and context. With this note, we offer two thoughts.

First: Writing in the real world is very different from the writing you have likely done to date.

You will need to change your mindset. No longer will you write for an audience of one. No longer will you write to a teacher to show them how much you know or have learned. We must now ask you to put aside the unintended mindset you might have of, “I will write what my instructor wants.” To become an effective technical writer, you must anticipate who your audience will be, recognizing that you might have multiple audience types, and why you will write for each of them. Do you wish to inform, persuade, or simply create goodwill? Ask yourself: what outcome do I need? And how can I make it happen? Then write with this at the front of your mind.

Second: While technical writing is a serious endeavor, one (and by that we include you) should not take oneself too seriously.

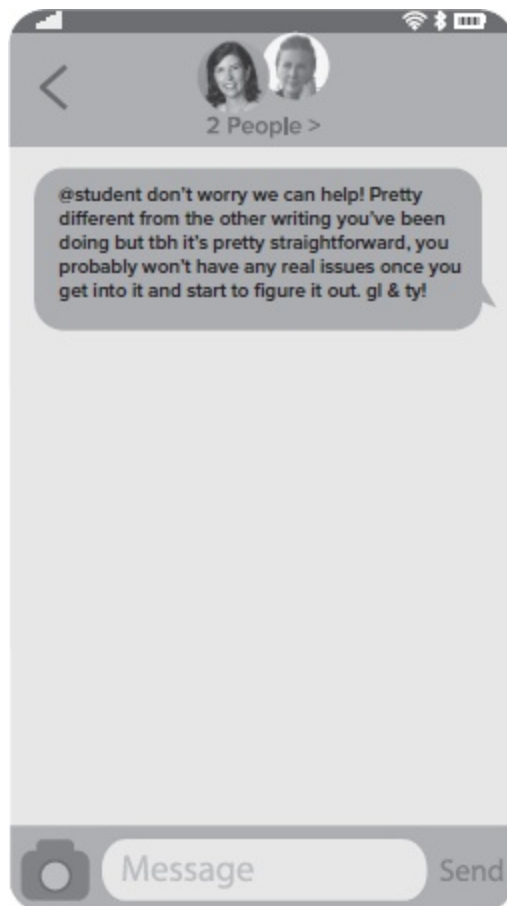
Accomplishment is one of life’s greatest rewards. Perhaps you have already been successful in calculus, soccer, robotics, speech, origami, research, baking, dance, or gaming. You sit in our classroom—we know how amazing you are! And we know that you can be an accomplished technical writer, too. As with your other successes, it requires only a willingness to improve through practice and reflection, but this is ever-so-much-more enjoyable with a quick laugh and permission to enjoy the sometimes painfully iterative improvement process. Somewhat related, we thank you for indulging our, shall we say “quirky,” sense of humor (some will say “bad”—we happily accept that). In short, we say lighten up! Enjoy the ride. And the write!

We thank you for the confidence you will place in our ability to communicate about communication, knowing full well that the initial decision was not your own, but your instructor's.

Yours very truly,  
Jenny and Leslie

# IM to a Technical Writer

The same information can be presented in different ways. For example, the authors of this textbook could also choose to send an IM to potential users of this textbook. The basic idea is the same, but much detail has been removed and the language is much more informal.



# Acknowledgements

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