

IEEE PCS Professional Engineering Communication Series
Ryan K. Boettger, Series Editor

SO, YOU HAVE TO

A GUIDED WORKBOOK

— WRITE —

FOR ENGINEERS

A LITERATURE REVIEW

CATHERINE BERDANIER | JOSHUA LENART


IEEE PRESS

 **IEEE PRO COMM**
Professional Communication Society

WILEY

So, You Have to Write a Literature Review

IEEE Press

445 Hoes Lane
Piscataway, NJ 08854

IEEE Press Editorial Board

Ekram Hossain, *Editor in Chief*

Jón Atli Benediktsson

David Alan Grier

Elya B. Joffe

Xiaoou Li

Peter Lian

Andreas Molisch

Saeid Nahavandi

Jeffrey Reed

Diomidis Spinellis

Sarah Spurgeon

Ahmet Murat Tekalp

So, You Have to Write a Literature Review

A Guided Workbook for Engineers

Dr. Catherine G.P. Berdanier

Dr. Joshua B. Lenart

IEEE PCS Professional Engineering Communication Series




IEEE PRESS

WILEY

Copyright © 2021 by The Institute of Electrical and Electronics Engineers, Inc.
All rights reserved.

Published by John Wiley & Sons, Inc., Hoboken, New Jersey.

Published simultaneously in Canada.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning, or otherwise, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 750-4470, or on the web at www.copyright.com. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at <http://www.wiley.com/go/permission>.

Limit of Liability/Disclaimer of Warranty:

While the publisher and author have used their best efforts in preparing this book, they make no representations or warranties with respect to the accuracy or completeness of the contents of this book and specifically disclaim any implied warranties of merchantability or fitness for a particular purpose. No warranty may be created or extended by sales representatives or written sales materials. The advice and strategies contained herein may not be suitable for your situation. You should consult with a professional where appropriate. Neither the publisher nor author shall be liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or other damages.

For general information on our other products and services or for technical support, please contact our Customer Care Department within the United States at (800) 762-2974, outside the United States at (317) 572-3993 or fax (317) 572-4002.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic formats. For more information about Wiley products, visit our web site at www.wiley.com.

Library of Congress Cataloging-in-Publication Data:

Names: Berdanier, Catherine Grace Patrick, 1988- author. | Lenart, Joshua Bela, 1978- author.

Title: So, you have to write a literature review : a guided workbook for engineers / Catherine Grace Patrick Berdanier, Joshua Bela Lenart.

Description: First edition. | Hoboken, New Jersey : John Wiley & Sons, Inc., [2021] | Series: Wiley-IEEE series | Includes bibliographical references and index.

Identifiers: LCCN 2020018706 (print) | LCCN 2020018707 (ebook) | ISBN 9781119555025 (paperback) | ISBN 9781119555032 (adobe pdf) | ISBN 9781119555056 (epub)

Subjects: LCSH: Technical writing. | Book reviewing

Classification: LCC T11 .B443 2020 (print) | LCC T11 (ebook) | DDC 808.06/662-dc23

LC record available at <https://lcn.loc.gov/2020018706>

LC ebook record available at <https://lcn.loc.gov/2020018707>

Cover design by Wiley

Set in 9.5/12.5pt STIXTwoText by SPi Global, Chennai, India

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

Contents

A Note from the Series Editor *ix*

About the Authors *xiii*

Acknowledgments *xv*

About the Book *xvii*

How to Use This Book *xix*

1 Why Is Writing So Hard? *1*

Overcoming Barriers to Writing and Making Time to Write *1*

- 1.1 Writing as a Cognitive, Social, and Affective Activity *2*
- 1.2 Time Management, Self-Discipline, and the Writing/Research Timeline *4*
- 1.3 Accountability Is an Essential Part of Writing *5*
 - 1.3.1 Shut Up & Write Groups *5*
 - 1.3.2 Accountability Partners *6*
 - 1.3.3 Schedule Your Writing in a Scientific Way *7*
 - 1.3.4 Deliberate and Distributed Practice *7*
 - 1.3.5 Bribery *8*
- References *9*

2 What Is the Point of a Literature Review, Anyway?! *11*

- 2.1 The Literature Review Serves as an Argument to Establish a Gap in Prior Research *12*
- 2.2 The Literature Review Establishes the Author's Credibility *13*
- 2.3 The Literature Review Prepares Readers to Interpret and Appreciate Your Findings *15*
- 2.4 Envisioning Your Audience *15*
- 2.5 Deliberate Language Choices Support the Functions of the Literature Review *16*
- Reference *17*

3	Gathering and Storing Literature	19
3.1	What to Cite? The Difference Between Types of Academic Publications	19
3.2	What NOT to Cite: Types of Documents to Avoid Citing	21
3.3	Searching for Literature	23
3.4	Saving and Storing Your Literature	23
3.5	Reference Managers	27
3.6	Your Turn: Collecting Literature	27
3.7	But How Many References Do I Need in My Literature Review?!	30
4	Reading Strategies and Remembering What You Read	33
4.1	Deciding Whether to Skim or Read	33
4.2	What Are You Focusing On?	34
4.3	Effective Methods for Skimming Literature	36
4.4	Reading Scholarly Literature	38
4.5	Taking Notes and Starting an Annotated Bibliography (or: Helping Your “Future Self”)	39
	References	42
5	Finding Connections Between Literature	43
5.1	Identifying Overarching Themes and Topics in Literature	44
5.2	Identifying “Synthesis” of Literature in Action	46
5.3	Drawing Connections Between Literature	48
5.4	Justifying “Gaps in the Literature”	49
6	Organizing Your Literature Review	53
6.1	Envisioning the Macrostructure of Your Literature Review	54
6.2	A Discussion on Topic Sentences: The First Sentence of the Paragraph	61
6.3	Creating a Macrostructure for Your Own Literature Review	61
7	Writing the “Ugly Draft”	65
7.1	Twelve Steps to Building Your Literature Review	65
7.2	Strategies to Help You Build and Sculpt Paragraphs: Introducing Rhetorical Moves and Steps in Genre Maps	69
7.3	If You Are Not into Outlines ... Leverage Who You Are as a Writer to Get that Ugly Draft on Paper!	73
	References	73
8	Using Citations to Connect Ideas	75
8.1	The Proximity of the Citation to the Reference Carries Meaning	75
8.1.1	String Citations	76

8.1.2	Topic Citations	77
8.1.3	End-of-Sentence Citations	78
8.1.4	Direct Citation	79
8.2	Literature Occurs in the Past, but a Literature Synthesis Points to YOUR Future	81
8.3	The “Accordion Stage” of Writing a Literature Review Will Hone the Density of Citations and Conciseness	83
8.4	The Literature Review Is a Political Document	84
9	Revising the “BIG Four” Literature Review Faux Pas	87
9.1	Ineffective or Missing Topic Sentences	87
9.1.1	All Sentences That Follow the Topic or Umbrella Sentence Should Directly Support That First Sentence	88
9.1.2	There Is Rarely a Need To Directly Cite One Article or Author in the Topic Sentence	89
9.2	Fluffy Writing	91
9.3	Globalisms	91
9.4	Lack of Connection or Synthesis Between Topics or Articles	93
	Reference	96
10	Am I Done Yet?	97
10.1	Self-Check Yourself Before You Wreck Yourself	97
11	Interpreting Advisor Feedback	101
11.1	Conclusion: Our Wishes for You	103
12	Theory Behind the Practice	105
	For Instructors and Advisors	105
12.1	On Genre Studies and Moves-Steps Analysis	106
12.2	On Technical Writing for Engineers	109
12.3	On Writing Literature Reviews	111
12.4	On Grammar Editing and Revision Strategies	113
12.5	Last Thoughts	116
	References	116
	Index	119

A Note from the Series Editor

Stop me if you have read this before: the skills acquired by students in STEM majors often conflicts with industry's expectations of skills.

Industry wants employees who not only have technical expertise but also the ability to clearly communicate that expertise. Meanwhile, academics are adjusting their programs to reflect their institution's initiatives to recruit and retain students and simultaneously expand their degree plans with math and science courses that meet external accreditation requirements. Though STEM program directors and professionals share a mutual goal – to produce and to hire the best technical talent – their paths toward achieving that goal often appear disparate.

Within this broader issue are conversations on the need for and placement of soft skills in STEM curricula. A 2018 survey found that STEM industry leaders identified communication skills as the most important in their fields. In fact, half of the highest ranked skills were considered soft skills: communication, work ethic, problem solving, team work, and analytical skills [1]. This does not mean that technical skills are not important to industry practitioners, but there seems to be a perception that soft skills (as well as managerial skills) play an increasingly important role in industry. This perception is further complicated by the findings that STEM majors do not always find value in improving their soft skills [2].

In engineering fields, writing is typically taught as a general elective requirement for undergrads, while relatively little (if any) required curricular time is focused on discipline-specific writing at the graduate level [3]. In addition to a lack of writing instruction in STEM degree plans, we need to acknowledge the writing exposure our students received before they even entered a college classroom. Students in North American and European elementary and secondary schools are typically exposed to writing that only reflects the “‘approved cannon’ of literature common to most English classrooms” [4, p. 97]. This writing is characterized as expository and encourages developing writers to describe, reflect, and explain ideas in the forms of essays, reflective pieces, and short stories. These are not necessarily incorrect ways to teach writing, but they do condition developing

writers to communicate in ways that may not reflect the situations they will encounter in the workplace.

It is not surprising then that the literature review, which requires writers to establish credibility not through their own personal insights and opinions but with a persuasive presentation of scholarly research, remains an unfamiliar and elusive text type to many STEM students. Before the actual writing can even begin, writers have to identify and sift through a seemingly unmanageable amount of information. Then they synthesize, paraphrase, and generalize that information to build credibility and establish ownership of their own ideas. Anyone tasked with writing a literature review has undoubtedly found it an arduous process, but I assume you already know this. It is why you chose this book. Maybe you are a Masters student about to start your thesis, or perhaps you are an advisor who needs a comprehensive guide for your students. Whatever your reason, you have no better coaches than Catherine G.P. Berdanier and Joshua B. Lenart.

I met Catherine and Joshua at their presentation at the 2017 IEEE International Professional Communication Conference [3]. I typically attend conference panels on curriculum development and assessment, but I rarely leave those panels feeling particularly informed or inspired. Just as there is a stigma attached to the value in acquiring soft skills, there is a perception that pedagogical research is lightweight and inconsequential. Unfortunately, the related research in technical and scientific communication does little to combat this perception: the recommendations from these studies are often informed by self-report, lacking generalizability outside a single instructional setting. My own advisor equated these scholarly endeavors with having a cup of coffee with a colleague – the experience is often enjoyable and instantly gratifying, but the resulting recommendations are not sustainable and only as useful as chatting about an experience over a cup of coffee [5].

But rather than just describing their own experiences, Catherine and Joshua presented an instrument that engineering students could use to self-evaluate the structure and style of their own literature reviews. Their framework was inspired by moves-steps analysis, and their discipline-specific, non-reductionist, easy-to-follow coding scheme was refined from testing across multiple instructional sites and student populations. The scholarship that Catherine and Joshua conduct acknowledges engineering students' limited instruction in academic and technical writing and then builds from those realities to improve their communication competences.

This book offers a sampling of the rich data that Catherine and Joshua have collected throughout their careers. They scaffold learning appropriately with authentic examples and student-tested activities. They deliver content that is easy for students to digest but substantial enough for advisors who require a comprehensive text on the subject.

I remain committed to bringing you quality, accessible content with this series. In particular, the support from both the Wiley Press and IEEE teams make this commitment a privilege. I would also like to acknowledge the contributions of Austin Goodwin whose work has helped me rebrand this series and freshen the perceptions of professional communication. As always, I have amazing support from the Department of Technical Communication at the University of North Texas and my chair Kim Sydow Campbell. Finally, to my son Liam West – we have not met yet, but I am already in love.

Ryan K. Boettger, PhD

References

- 1 John, D.D., Chen, Y., Navaee, S., and Gao, W. (2018). STEM education from the industry practitioners' perspective. *2018 ASEE Annual Conference & Exposition*, Salt Lake City, UT (24–27 June 2018).
- 2 Pulko, S.H. and Parikh, S. (2003). Teaching 'soft' skills to engineers. *International Journal of Electrical Engineering Education* 40 (4): 243–254.
- 3 Lenart, J.B. and Berdanier, C.G.P. (2017). Optimizing a genre analysis framework to investigate engineering literature reviews. *2017 IEEE International Professional Communication Conference (ProComm)*, Madison, WI (23–25 July 2017), pp. 1–6. IEEE.
- 4 Jones, S. (2007). Composing in the style of Mozart: an exploration of the “struggling boy writer” comparing the composing processes and strategies of boys and girls. *English Teaching* 6 (1): 96.
- 5 Eaton, A. (2010). Conducting research in technical editing. In: *New Perspectives on Technical Editing* (ed. A.J. Murphy), 7–28. Amityville, NY: Baywood.

About the Authors

Dr. Catherine Berdanier is an Assistant Professor of Mechanical Engineering in the Department of Mechanical Engineering at Pennsylvania State University at University Park. She holds an MS in Aeronautical Engineering and a PhD in Engineering Education from Purdue University. Her research focuses mainly on graduate-level engineering education with emphasis on engineering writing and communication, attrition, and persistence. Her research has been funded through multiple NSF awards. She is the Director of the Engineering Cognitive Research Laboratory (E-CRL), where she and her graduate students investigate questions concerning the human side of engineering through a variety of quantitative, qualitative, experimental, and analytical methods.

Dr. Joshua Lenart is an Associate Instructor with the Communication, Leadership, Ethics, and Research (CLEAR) Program at the University of Utah where he also received his PhD in Writing and Rhetoric Studies and now teaches technical communication for the College of Engineering. His teaching expertise includes administrative and organizational writing, grant writing, teambuilding, and strategic communications. His research expertise focuses on natural resource management policy as it relates to landscape-scale impacts on wildlife habitat, hydrologic systems, community resilience, adaptation planning, and long-term land-use conservation. For the past five years, he has led various transdisciplinary research projects examining land, water, and wildlife resource management conflicts vis-à-vis policy, stakeholder input, feasibility and environmental impact assessment, and collective impact engagement.

