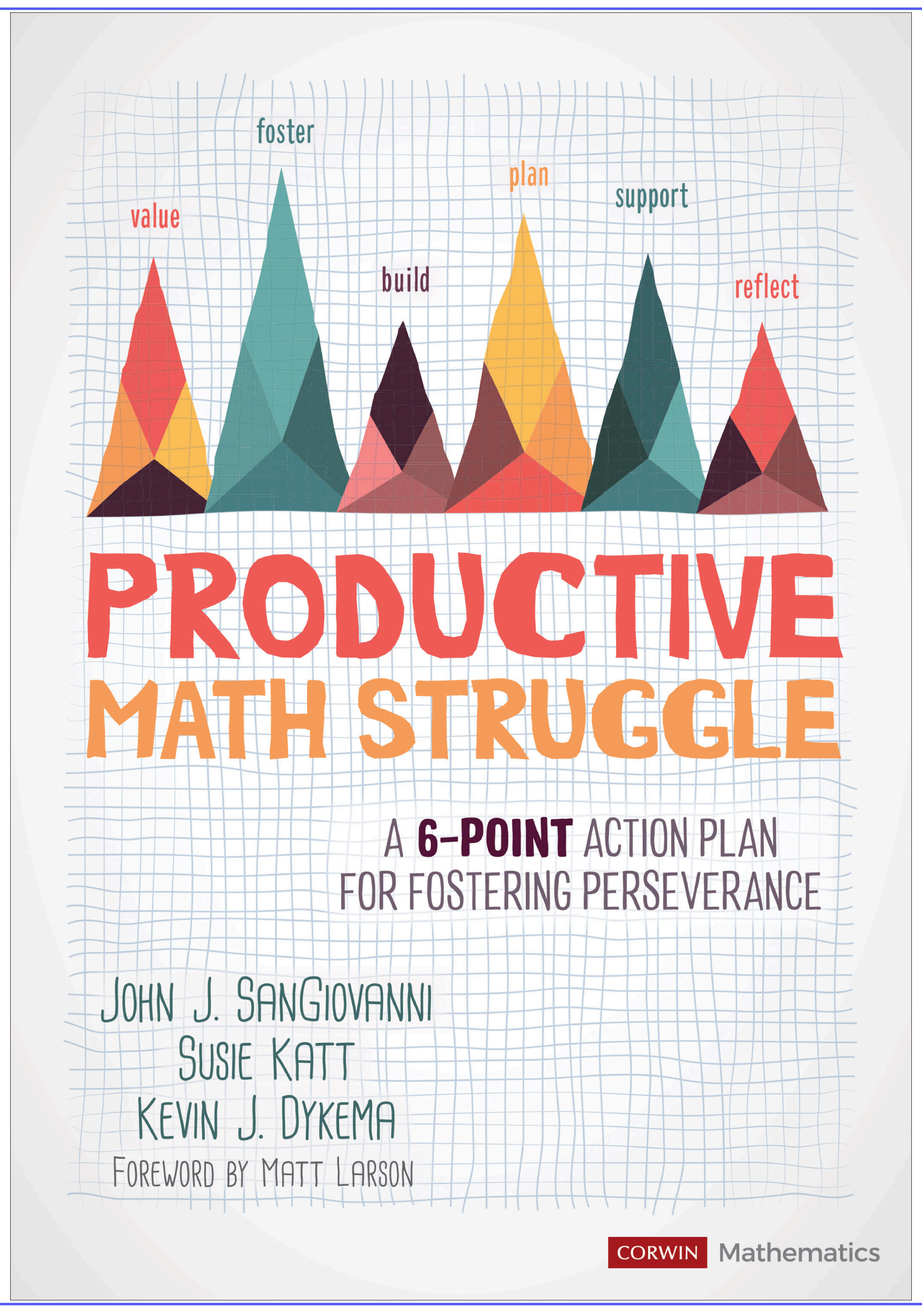

ebookbig.com

or scan the QR code to access the digital study portal.

"Before today I couldn't put my finger on what productive struggle is and how I can help foster it in my classroom. After reading *Productive Math Struggle*, I have a firm grasp on how teachers can use struggle to change how students approach their tasks and the subject as a whole. The book combines a clear case for why we should embrace the struggle, with dozens of practical tools that show teachers, coaches, and administrators can start this work immediately. The authors explain why our students need a culture that can support productive struggle and suggest a way to challenge the prevalent negative beliefs about math that students bring into our classrooms."

Carl Oliver
Assistant Principal
City-As-School High School
New York, NY

"First ask yourself, as SanGiovanni, Katt, and Dykema probe: "Have your students fallen out of love with math?" Or, perhaps, your students were never in love with math because they saw it as inaccessible or confusing. Simply telling students to try harder doesn't work and leaves students and teachers rolling about in a cycle of destructive struggle. Fret no more—the answer is here! When teachers use these fantastic, thoughtful strategic action steps, this heartbreaking phenomenon does not have to be a reality in anyone's classroom! Get this book and begin your journey for cultivating a positive classroom environment that promotes productive struggle that will have your students joyfully falling head over heels in love with mathematics."

Beth Kobett
Associate Professor, School of Education
Stevenson University
NCTM Board of Directors

""Invite productive struggle—don't scaffold it away." This might be my new motto for teaching and learning. This book is an essential read for everyone interested in helping students understand mathematics, not just learn procedures to pass a test. By sharing practical strategies and structures, including focus on mathematical identity and families, the authors help us invite productive struggle into our classrooms. They ask us to think critically about common practices like modifying tasks or revoicing to ensure our use of these strategies supports students for deep learning. Every educator should read and use this book to welcome productive struggle into the classroom."

Sara Delano Moore
Author of *Visible Learning for Mathematics* and *Mathematize It!*
Director of Professional Learning, ORIGO Education

This page is intentionally left blank

PRODUCTIVE MATH STRUGGLE

This page is intentionally left blank

PRODUCTIVE MATH STRUGGLE

A 6-Point Action Plan for Fostering Perseverance

John J. SanGiovanni, Susie Katt, and Kevin J. Dykema

Foreword by Matt Larson

CORWIN Mathematics

CORWIN
A SAGE Publishing Company

For information:

Corwin
A SAGE Company
2455 Teller Road
Thousand Oaks, California 91320
(800) 233–9936
www.corwin.com

SAGE Publications Ltd.
1 Oliver's Yard
55 City Road
London, EC1Y 1SP
United Kingdom

SAGE Publications India Pvt. Ltd.
B 1/I 1 Mohan Cooperative Industrial Area
Mathura Road, New Delhi 110 044
India

SAGE Publications Asia-Pacific Pte. Ltd.
18 Cross Street #10–10/11/12
China Square Central
Singapore 048423

Copyright © 2020 by Corwin Press, Inc.

All rights reserved. Except as permitted by U.S. copyright law, no part of this work may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without permission in writing from the publisher.

When forms and sample documents appearing in this work are intended for reproduction, they will be marked as such. Reproduction of their use is authorized for educational use by educators, local school sites, and/or noncommercial or nonprofit entities that have purchased the book.

All third-party trademarks referenced or depicted herein are included solely for the purpose of illustration and are the property of their respective owners. Reference to these trademarks in no way indicates any relationship with, or endorsement by, the trademark owner.

Printed in the United States of America.

ISBN 978-1-5443-6946-4

Executive Editor, Mathematics: Erin Null
Associate Content
Development Editor: Jessica Vidal
Editorial Intern: Nyle DeLeon
Production Editor: Tori Mirsadjadi
Copy Editor: Terri Lee Paulsen
Typesetter: Integra
Proofreader: Scott Oney
Indexer: Integra
Cover Designer: Gail Buschman
Marketing Manager: Margaret O'Connor

This book is printed on acid-free paper.

20 21 22 23 24 10 9 8 7 6 5 4 3 2 1

DISCLAIMER: This book may direct you to access third-party content via web links, QR codes, or other scannable technologies, which are provided for your reference by the author(s). Corwin makes no guarantee that such third-party content will be available for your use and encourages you to review the terms and conditions of such third-party content. Corwin takes no responsibility and assumes no liability for your use of any third-party content, nor does Corwin approve, sponsor, endorse, verify, or certify such third-party content.

CONTENTS

Foreword by Matt Larson xvii

Acknowledgments xxi

About the Authors xxiii

Introduction: Why Struggle? Why Now? 1

Chapter 1. ACTION 1: **VALUE** PRODUCTIVE STRUGGLE 8

Why Struggle Matters 10

- Math Is More Than the Pursuit of Answers 12
- Math Isn't a Procedure 12
- Math Is About Equity, Access, and Opportunity 15
- Productive Struggle Is Essential for Living and Learning 16

What Productive Struggle Is and Isn't 16

- What Struggle Looks Like 17
- When Schools Value Struggle 19
- Teacher Behaviors for Productive Struggle 20
- Student Behaviors for Productive Struggle 21
- Educating Families 22
- Productive Struggle Look-Fors 22
- Whole School Agreement About Productive Struggle 24
- Struggle and a Growth Mindset 25
- Moving From Unproductive to Productive Beliefs About Struggle 26

Key Takeaways About Action 1: Value Productive Struggle 28

Chapter 2. ACTION 2: **FOSTER** AN IDENTITY FOR PRODUCTIVE STRUGGLE 29

What Is a Math Identity? 31

- Your Mathematical Identity and Its Effects on Instructional Choices 32
- Thinking About Your Experiences as a Math Student 35

Knowing Your Students' Mathematical Identities 36

Activities for Uncovering Students' Mathematical Identities 37

- Student Identity Activity 1: My Math Autobiography 38
- Student Identity Activity 2: My Math Timeline 40
- Student Identity Activity 3: Journal Prompts 40
- Student Identity Activity 4: Math Beliefs Inventory 41
- Student Identity Activity 5: Math Role Models and Their Stories—Who Are Mathematicians? 42
- Student Identity Activity 6: Bumper Stickers 44

Chapter icons: Chapter 1: shutterstock/topform; Chapter 2: iStock.com/Paket

Student Identity Activity 7: My Math Superpower 45
Student Identity Activity 8: Struggle Emojis 46
Key Takeaways About Action 2: Foster Identity for Productive Struggle 47

Chapter 3. ACTION 3: **BUILD** COMMUNITY FOR PRODUCTIVE STRUGGLE 48
Building Classroom Community for Productive Struggle 50
Addressing Challenges to Creating Community 51
Establishing Norms for a Productive Community 52
Maintaining Community Throughout the Year 55
Activities for Building and Maintaining a Productive Math Community 56
Community Activity 1: Math Pledge 57
Community Activity 2: Group Behaviors Comic Strip 59
Community Activity 3: Good Groups vs. Bad Groups 60
Community Activity 4: The Number Quilt 60
Community Activity 5: A Picture Is Worth 1,000 Numbers 62
Community Activity 6: Name and Number Tents 64
Community Activity 7: Dimensions of Me (or Many Faces) 65
Activities to Promote a Community Understanding of Productive Struggle 66
Community of Struggle Activity 1: The Picture of Struggle 67
Community of Struggle Activity 2: A Time I Struggled—The Ski Jump 70
Community of Struggle Activity 3: Create a Class Definition of Struggle 71
Key Takeaways About Action 3: Build Community for Productive Struggle 72

Chapter 4. ACTION 4: **PLAN** FOR A LESSON WITH PRODUCTIVE STRUGGLE 73
Planning for Struggle 75
Establish the Mathematics Goal 78
Select Tasks That Create the Right Amount of Struggle 78
Selecting High-Quality Tasks for Rigor 81
Tasks for Conceptual Understanding 83
Tasks for Procedural Fluency 83
Tasks for Application 84
Modify Tasks to Provoke Productive Struggle 85
Modification Strategy 1: Ask Students to Create Multiple Representations (Create) 86

Chapter icons: Chapter 3: shutterstock/Ksuxa-muxa; Chapter 4: iStock.com/elapela

Modification Strategy 2: Ask Students to Create or Connect Different Representations (Connect) 88
Modification Strategy 3: Ask Students "Does This Always Work?" (Generalize) 91
Modification Strategy 4: Ask Students the Reverse (Reverse the Problem) 92
Modification Strategy 5: Ask Students to Agree or Disagree (Justify) 93
Modification Strategy 6: Ask Students Open Questions (Open it) 94
Modification Strategy 7: Ask Students to Compare and Contrast (Similarities and Differences) 96
Modification Strategy 8: Ask Students to Find and Use a Pattern (Find a Pattern) 97
Modification Strategy 9: Ask Students to Put Their Understanding in Writing (Write About It) 98
Modification Strategy 10: Ask a Different Question (Change the Focus) 99
Modification Strategy 11: Ask Before They Are Taught (Change the Sequence) 99

Doing the Task and Anticipating 100
Anticipate Representations 102
Anticipate Language and Terms 102
Anticipate Misconceptions and Flawed Strategies 102
Planning Response and Reaction 103

Instructional Models, Routines, and Other Considerations When Planning for Struggle 104
Direct Instruction 104
Gradual Release of Responsibility 105
Other Instructional Choices 106

Key Takeaways About Action 4: Plan for Productive Struggle 109

Chapter 5. ACTION 5: **SUPPORT** THE PRODUCTIVE STRUGGLE DURING THE LESSON 111

Classifying Various Types of Struggle 114
Responding to Different Kinds of Struggle 115
The Problem With Rescuing Student Answers 116

Struggle Moves That Rescue Thinking 118
Struggle Move 1: Prepping the Task 119
Struggle Move 2: Catch and Release 121
Struggle Move 3: Referrals 123
Struggle Move 4: Metacognitive Questions 133
Struggle Move 5: Remove the Numbers 135

Tips for Navigating Struggle 137
Teacher Tip 1: Don't Restate More Than They Say (Revoicing) 137

Chapter icon: iStock.com/tom-iurchenko