

NINTH EDITION

# Teaching Children Science

A Discovery Approach

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# Preface

## About the Authors

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Don DeRosa, Ed.D., is a clinical associate professor at Boston University School of Education, where he teaches science teaching methods to elementary and secondary education pre-service teachers.

Joseph Abruscato was a nationally prominent educator and author of professional books in the field of science teaching. He retired from The University of Vermont in 2006 with the rank of Professor Emeritus after a distinguished career that began there in 1969. Joe received his B.A. and M.A. degrees from Trenton State College in science education, physics and chemistry and his Ph.D. in science education and curriculum development from The Ohio State University. At The University of Vermont, Joe was the chief architect of enhancing the Elementary Teacher Preparation Program with articulated campus-based pedagogy and public school practica.

## About this Book

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*Teaching Children Science* was written with the K—5 pre-service elementary teacher in mind. The authors understand that teaching science may be out of the comfort zone for many readers. A primary goal of the text is to help aspiring elementary teachers understand their roles not as science experts, but as lead learners of science who can inspire and guide their young students to experience science through the joys and challenges of inquiry and discovery. It emphasizes methods and strategies for teaching the subject that invite students to learn science through doing science. Practices are grounded in theory that reflects research about how students learn science and scientific ways of thinking. Effective science teaching requires a familiarity with science practices and content as well as strategies and methods. Chapter 1, *Inquiry: The Path; Discovery: The Destination*, begins with some insights about what it means to do science and the nature of science. Chapters 7–12 are devoted specifically to providing fundamental content knowledge in the Earth/space, life, and physical sciences for the elementary school teacher.

## New to This Edition

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### ● Expanded coverage of (and alignment to) NGSS Standards

As the Next Generation Science Standards become more embedded in the national curricula, evidence and resources that inform effective three-dimensional teaching and learning continue to emerge. This text addresses each science practice and incorporates resources to support three-dimensional instructional strategies.

- NGSS curriculum bundles are addressed in Chapter 3, and evidence statements are used to support three-dimensional assessment in Chapter 5.
- Strategies for culturally responsive teaching based on NGSS Appendix D, “All Standards, All Students,” are included in Chapter 3. You will also find references of NGSS to Common Core State Standards in Chapter 2.

- Sample lessons and activities throughout the text model the integration of science practices, disciplinary core ideas, and crosscutting concepts.
- The content in Chapters 7–12 and the ideas for putting content into action in Appendices A, B, and C are organized around NGSS Disciplinary Core Ideas.

### ● Updated videos that reinforce key ideas

Chapters 1–6 have been updated to include short video excerpts of experienced teachers in science classrooms as well as their personal reflections on their practices. Each video includes prompts that invite pre-service teachers to critique the videos that highlight key concepts addressed in the text.

### ● Revised chapter on planning now focuses on the 5E learning cycle

The 5E learning cycle, developed by the Biological Science Curriculum Studies in the late 1980s, continues to be the basis for concept development in lesson planning strategies reflected throughout the text. More examples of hook questions for engagement are provided as well as a lesson plan template with explicit guidelines for developing lessons that incorporate criteria for the “Engage, Explore, and Explain” phases of the 5E instructional strategy in Chapter 3.

### ● Reorganized and condensed chapters provide a more streamlined learning experience

- The text has been reduced from 18 to 12 chapters and organized into two parts rather than four. Part 1 addresses science teaching theory and practice, while Part 2 provides a refresher of science content knowledge in the areas of Earth/space sciences, life sciences, and physical sciences.
- Previous edition chapters on using technology and adapting the curricula have been eliminated, and the information presented in these chapters has been integrated throughout the book. For example, in Chapter 3, Sheltered Instruction Observation Protocol (SIOP) has been coupled with elements of the 5E instructional strategy to illustrate accommodations for English language learners. In Appendix A, students are directed to access and analyze data on the latest earthquake activity across the globe provided by the United States Geological Survey to explore the dynamics of plate tectonics.
- Previous edition Chapters 12, 15, and 18 have moved to Appendices A, B, and C. These sections include suggested ideas and activities for implementing content in Chapters 7–12. Ideas for each content area—Earth/space sciences, life sciences, and physical sciences—are organized as follows:
  - **Unit Plan Ideas and Questions:** These are organized by the Disciplinary Core Idea Arrangements of the NGSS and include a unit title, question, and brief unit overview.
  - **Make the Case—An Individual or Group Challenge:** This section challenges the reader to reflect on the use of phenomena in three-dimensional teaching and identify potential phenomena for disciplinary core ideas.
  - **Classroom Enrichment Ideas:** This section makes suggestions for discovery centers, bulletin boards, and field trips that could enrich each content area. Suggestions for articulation with disciplinary core ideas are listed in parenthesis for each enrichment idea.
  - **Examples of Topics and Phenomena:** Suggested phenomena are given for selected topics in each discipline along with motivating questions, activities, and science content that support the topic for teachers.

- **Discovery Activities:** These are activities that you may find helpful to support teaching the content area. Each activity includes objectives, science processes, materials, a motivation (engagement), directions, discussion questions, and science content for the teacher.
- **Real Teaching vignettes provide insight and reflection on practices**

Included in each content chapter (7, 9, 11 and 12), these vignettes describe real lessons taught or observed by the author. The narratives include brief reflections about the teaching moves and decisions made by the teacher during the class. Bracketed references to instructional strategies addressed in the text are also included. The examples are meant to illustrate actual teaching “episodes,” with the hope that readers will learn from these small victories and failures! See *Real Teaching: Air Pressure* in Chapter 11.

## Key Content Updates by Chapter

- Chapter 1, previously Chapters 1–2, provides updates with more depth on key topics such as how children learn science, the nature of science, and an introduction to the NGSS as essential resources for science educators.
- Chapter 2 addresses each of the science practices in much more depth than the prior edition as well as the role of inquiry and discovery in science learning with sample activities that illustrate inquiry skills.
- Chapter 3 addresses planning learning experiences for children based on relevance, rigor, and coherence utilizing resources such as the NGSS bundles and Understanding by Design to guide unit planning. Elements of the 5E instructional strategy are used as frameworks for organizing science lessons that emphasize scientific ways of knowing. A sample lesson is included that illustrates lesson design using NGSS resources. Universal Design for Learning and Response to Intervention are included for consideration in lesson planning. Lesson plan templates, new to this edition, provide scaffolds for pre-service teachers to develop lesson plans that inspire scientific explanations and solutions to problems.
- Chapter 4, *Creating Environments for Discovery*, addresses more nuanced strategies for creating dynamic science learning experiences, ranging from the physical work space and discovery stations to an in-depth discussion about fostering accountable science talk through effective questioning, talk-tools, and science circles.
- Chapter 5 focuses on assessing across three dimensions with examples based on NGSS assessment tasks and evidence statements. Both formative and summative assessment strategies are addressed, including traditional and reform-based assessments such as science notebooks, student interviews, and portfolios. As in the previous edition, examples of analytical and holistic rubrics are provided.
- Chapter 6 addresses integration of science and engineering with other disciplines. New to this edition are discussions about STEAM in the context of integration.
- Chapters 7, 9, 11 and 12 provide a refresher of science content knowledge and have been updated and aligned with disciplinary core ideas. Sections referred to as *Real Teaching* have also been included in content chapters. *Real Teaching* consists of selected reflections by the author on his

experiences teaching concepts in the discipline to elementary children. References to teaching strategies introduced in Chapters 1–6 are bracketed to illustrate how the strategy may be implemented in practice.

## Instructor Resources

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The following supplements to the textbook are available for download under the “Educator” tab at [www.pearsonhighered.com](http://www.pearsonhighered.com). Enter the author, title, or ISBN, then select this textbook. Click on the “Resources” tab to view and download the supplements detailed below.

- **Instructor’s Resource Manual with Test Bank**  
The Instructor’s Manual/Test Bank (0-13-357414-8) provides activity ideas for class sessions as well as multiple-choice quizzes.
- **PowerPoint™ Presentations**  
Ideal for lecture presentations or student handouts, PowerPoint™ Presentations (0-13-357424-5) for each chapter include key concept summaries.

## Enhanced Pearson eText

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The Enhanced Pearson eText provides a rich, interactive learning environment designed to improve student mastery of content with the following multimedia features:

- **Video Examples:** Embedded throughout the eText, these video clips illustrate key concepts and strategies. The videos in Chapters 1–6 have been updated to illustrate instructional strategies in practice by experienced teachers as well as their personal reflections on the use and effectiveness of those strategies.
- **Chapter Quizzes:** Located at the end of each chapter, these multiple-choice questions give students the opportunity to check their understanding of the learning outcomes introduced at the beginning of the chapter.
- **Internet Resources:** Included in the *Resources for Discovery Learning* section at the end of Chapters 1–6, these links provide students with an opportunity to extend their learning beyond the text.

## Acknowledgments

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Many people have shaped this book’s content, directly and indirectly. Most of all, I would like to acknowledge Joseph Abruscato, who passed away in 2009. Joseph was a gifted educator whose contributions to the field of science education have undoubtedly informed and inspired generations of teachers and students. He is responsible for the quality and success of this text and several other publications of which he is the author. It is with humility that I assume responsibility for carrying on the legacy of his wonderful work.

I would like to thank those who have reviewed this edition of *Teaching Children Science* for sharing their expertise and valuable insights: Audrey Cohan, Ed.D., Molloy College; Sarah J. Carrier, NC State University; Todd F. Hoover, Bloomsburg University of Pennsylvania; Joe Sciulli, University of North Carolina at Pembroke; John D. Tiller, Tennessee State University.

Finally, I would like to thank Drew Bennett, Jill Ross, Heather Winter, and Yagnesh Jani for their patience, guidance, and attention to the details of this book.  
D. D.