Preface

In *Teaching Science in Elementary and Middle School Classrooms: A Project-Based Approach, Second Edition*, we present an approach to teaching science to all children. We believe that all children should develop an in-depth and meaningful understanding of enduring concepts, principles, and themes of science, as well as the processes of doing science. We define understanding as helping students to see relationships among ideas, finding underlying reasons for these relationships, using these ideas to explain and predict phenomena, and applying their understandings to new situations. Such a focus on science learning emphasizes less the coverage of content and more the in-depth exploration of major ideas and explanation. Moreover, we strongly believe that all students should understand how to apply the processes of scientific inquiry. Finally, we firmly believe that all students should have equitable opportunities to learn science. In this text we focus on helping both the novice and experienced teachers learn how to teach science to elementary and middle grades children.

A PROJECT-BASED APPROACH

To accomplish the goal of helping both new and experienced teachers learn how to teach science, we explore an exciting teaching method referred to as project-based science. A central tenet of this approach is that it engages young learners in exploring important and meaningful questions through a process of investigation and collaboration. Project-based science engages children in asking and refining questions; seeking background information; making predictions; designing investigations; collecting, analyzing, and interpreting data; making explanations; and creating products to share ideas. Project-based science stresses that science teaching should emphasize students actively engaging in science rather than teachers giving science information to students. The teaching of science should de-emphasize the simple recall of facts and focus on students using evidence and strategies for developing and revising explanations of phenomena. As a result, students learn fundamental science concepts and principles that they apply to their daily lives. As stated in the *National Science Education Standards,* inquiry should be the preferred mode of instruction at all grade levels and for all students. "Learning science is something students do, not something that is done to them" (NRC, 1996).

THE AUDIENCE

Although intended primarily for university students studying to become elementary and middle grades teachers, this text is also suitable for practicing teachers striving to find new, exciting approaches to science teaching. Throughout this text, we strive to answer important questions about teaching science to children and we included numerous strategies to support students in inquiry learning that will help both new and experienced teachers. We also pay attention to the important role collaboration plays in inquiry and in developing an understanding of science. Although teaching science to elementary and middle grades students is complex, it is also very rewarding.

ORGANIZATION AND COVERAGE

As in the first edition, various chapters in the book focus on helping students learn science through inquiry, as well as providing support in planning and managing science teaching. We present expanded and updated coverage of many important ideas. In Chapter 1, Why and How Should I Teach Science to Children?, we introduce you to project-based science. Chapter 2, How Do Children Construct Understanding in Science?, focuses on factors that influence students' construction of understanding, including prior experiences, social interactions, and teachers. In Chapter 3, What Is a Driving Question?, we examine one of the central features of project-based science because driving questions initiate, implement, and sustain inquiry. Chapter 4, How Are Scientific Investigations Developed?, explores how to support students engaged in investigations to find solutions to questions that are of interest to them. In Chapter 5, How Can Learning Technologies Be Used to Support Investigations?, we examine the theoretical ideas behind the value of using new learning technologies and explore how teachers can use new technology tools to help students investigate questions important to them. Chapter 6, How Do I Develop Collaboration in the Science Classroom?, discusses types of collaboration between students, teachers, and members of the community. In Chapter 7, How Do I Develop and Use Benchmark Lessons?, we focus on methods and procedures a teacher can use to help students learn fundamental science concepts. Chapter 8, Why Do We Assess Students in Science?, discusses the purpose of assessment and what and when we assess. In Chapter 9, How Is Student Understanding Assessed?, we focus on methods of assessment in a project-based environment, ways that project-based science enhances learning and improves students' scores on high-stakes tests, and advantages of assessment. Chapter 10, How Do I Manage the Project-Based Science Classroom?, discusses classroom climate, classroom organization, and management skills. Chapter 11, How Do I Plan a Project-Based Curriculum?, explains ways that teachers can plan projects that meet a school district's curricular objectives and frameworks. In Chapter 12, What Are the Next Steps?, we summarize features of project-based science, and we discuss benefits and challenges associated with a project environment.

NEW IN THE SECOND EDITION

In the Second Edition, we expanded our focus on certain topics of interest, updated the presentation of material, and included a number of features that will enhance using the materials.

- **National Science Education Standards.** Coverage of National Science Education Standards is integrated throughout the text. Marginal links highlight connections between specific content and the national standards.
-  **Coverage of Technology.** The coverage of the use of learning technologies has been ex-

panded. New to the text is a chapter on how technology can support students in inquiry (Chapter 5). In addition, each chapter now has a section that discusses the use of learning technologies as related to the chapter's topics.

- **Coverage of Assessment.** The coverage of assessment has been expanded into two chapters. Chapter 8, *Why Do We Assess Students in Science?*, discusses the purpose of assessment and what and when we assess. In Chapter 9, *How Is Student Understanding Assessed?*, we focus on methods of assessment in a project-based environment, ways that project-based science enhances learning and improves students' scores on high-stakes tests, and advantages of assessment.
-  **Portfolio Activities.** The Portfolio Activities provide exercises that explore and expand key content in an applied manner, and help the learner make connections between various ideas. They can be used as class activities, assignments, or assessments and may ultimately be added to the reader's portfolio.
- **Pedagogical System.** The text's pedagogical system has been expanded to provide the student with additional support and resources. The pedagogical system includes: **learning performances** at the beginning of each chapter that focus students on what they will learn through reading and engaging in the activities of the chapter; **chapter outlines**; **scenarios** that provide a look into classrooms and children learning science; marginal **links to the National Science Education Standards**; **Portfolio Activities; print forms; key ideas** listed in the margin; marginal **Web links; chapter summary**; **chapter highlights** link to the **student materials on the Online Learning Center**; and **key terms** with page references.
-  **Online Learning Center.** The new Online Learning Center located at **www.mhhe.com/krajcik2e** presents important content from the chapter, reviews key terms, provides a chapter assessment, and contains each chapter's Web links. Students will find this Online Learning Center a valuable feature as they learn to teach science.

SUPPLEMENTS

- **For the Instructor.** The text is accompanied by an Instructor's Manual that contains teaching and activity ideas, as well as assessment questions. Additional instructor resources are housed in the instructor's section of the Online Learning Center. at **www.mhhe.com/krajcik2e**.

    Within the text, instructors should watch for the marginal Web links and the printable tables and figures. Both of these reference content available on the Online Learning Center.
- **For the Student.** The Online Learning Center at **www.mhhe.com/krajcik2e** provides the student with study tools and resources.

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