

# Introduction

**T**eaching science is exciting. Teachers enjoy using a scientific lens to introduce students to the biological, physical, and social dimensions of the world. Students love to learn about themselves and their world and are often thrilled with lab experiences and other hands-on learning opportunities occurring in the science classroom. Science is an important part of the school day, and most students look forward to it with great anticipation and joy.

We all love investigations because humans are naturally curious. We want to find things out. We want to understand how things work. We want to experiment and see what happens. Anyone who has ever been around young children knows the hundreds of questions they ask. Their minds are attentive to differences and experiences, and they beg for explanations. Middle and high school science classrooms have the power to keep the curiosity flame burning bright. Of course, some students need their sparks rekindled, and powerful teachers can do just that. The vast majority of students are curious and will engage in learning tasks if they think their questions will be answered.

As Loewenstein (1994) noted, “Curiosity has been consistently recognized as a critical motive that influences human behavior in both positive and negative ways at all stages of the life cycle” (p. 75). We see science classrooms as one of the most powerful places for ensuring that students positively develop their curiosity. After all, it’s curiosity that spurs invention, entrepreneurship, critical thinking, and creativity. Society has known about the challenge in creating curious citizens for decades. Way back in 1757, Edmund Burke wrote, “Curiosity is the most superficial of all the affections; it changes its object perpetually; it has an appetite which is very sharp, but very easily satisfied; and it has always had an appearance of giddiness, restlessness, and anxiety” (1958, p. 31). And therein lies the challenge. What intrigues one student may not ignite another. What fascinates and motivates a student today may not do so next month. The same could be said for teachers. A very exciting lecture, lab, experiment, field trip, guest speaker, close reading, or whatever, will hold our attention only for a time. We’re

fickle, and when our curiosity is satisfied, we move on. That's why we wrote this book. It's about keeping it fresh and exciting.

These are exciting times. We have new standards, the Next Generation Science Standards. We have new ways for thinking about literacy as we learn more about the Common Core State Standards for literacy in science. And we live in a technology-rich world in which students can Google anything they want. All of this has piqued our curiosity and interest, not to mention the wonderful teachers we work with. As a result, we have explored new ways of engaging tweens and teens in scientific thinking and learning.

Our purpose in writing this book is to share a few ideas with you. If we have done our job well it will ignite your curiosity, and you will pay it forward by figuratively lighting a fire for each of your students. We do get a little melodramatic about this. Boring science classes that lack that spark that we've all seen do harm to our society, to all of us. Who knows what new inventions we have missed out on when a student disengages from science? After all, science is everywhere. It's everything about us, our physical and biological world. And our students deserve to understand that world and contribute to it. How else will they be prepared for jobs we can't even imagine? Okay, we'll step off our soapbox and focus on the contents of this book.

We start in Chapter 1 by exploring the successes and challenges in science education in a global society awash with information. In addition, we explore the nature of the new science standards and how they link with the literacy expectations. In this chapter, we focus on the needs and general ideas that are important as science educators assume increased responsibility for students' passion about learning.

In Chapter 2, we turn our attention to the role of language, speaking, and listening. Communication and collaboration are key skills for the 21st century, and our students deserve to learn and practice these skills every day in every class. As described by the Partnership for 21st Century Skills, students will need to:

- Articulate thoughts and ideas effectively using oral, written, and nonverbal communication skills in a variety of forms and contexts.
- Listen effectively to decipher meaning, including knowledge, values, attitudes, and intentions.
- Use communication for a range of purposes (e.g., to inform, instruct, motivate, and persuade).
- Utilize multiple media and technologies, and know how to judge their effectiveness a priority as well as assess their impact.
- Communicate effectively in diverse environments (including multilingual).

## x • Reading and Writing in Science

- Demonstrate ability to work effectively and respectfully with diverse teams.
- Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal.
- Assume shared responsibility for collaborative work, and value the individual contributions made by each team member.

That's a tall order and will take every teacher in a school to accomplish it. But we can't think of a better place to start than in science. Earth, biological, and physical sciences classrooms are the perfect place for students to develop these skills.

In the third chapter, we turn our attention to reading. Real scientists read, and they read a lot. They know how to read complex texts, check their own understanding, and use information from the texts they've read to make claims and support those claims. And that's part of what science teachers simply must require of their students. To accomplish this, we focus our attention on read-alouds, shared readings, wide reading, and close readings. These are instructional routines that help students build their knowledge bases. And increasingly sophisticated knowledge bases allow for way more interesting experiments and labs. Reading complex scientific texts also requires that students confront their misconceptions and become adept in analyzing information so that they are less likely to be victims of misinformation.

Chapter 4 focuses on writing. Not process writing like the English teachers assign, but rather writing based on information and data. We focus on the ways in which students can form an argument and supply evidence for their claims. And we provide a number of instructional routines that help students become better writers. Effective scientists write grants that get funded and get papers with new discoveries published. It's not that we expect every student in a biology class to become a PhD scientist, but we do expect that every student will learn to analyze data, present that data, and defend it, both orally and in writing.

We conclude this book with a discussion of assessments. As teachers, we have to regularly assess student learning to make decisions about next steps instruction. The final chapter focuses on a number of ideas about formative assessments, using language, to determine what students know and what they still need to know. After all, we have to know if anything we taught stuck, and if not what we can do about it next time.

Remember, as the poet Dorothy Parker noted, "*The cure for boredom is curiosity. There is no cure for curiosity.*" When we create curious students, they thrive in our classrooms. Even Albert Einstein recognized this. As he said, "*I have no special talents. I am only passionately curious.*"