

Introduction

Human history becomes more and more
a race between education and catastrophe.

— H. G. Wells

If you haven't already done so, I hope you'll take a moment to read the quote from H. G. Wells above. Think about what it means to you, both as a person and as an educator. I've chosen to open with this quote because I suspect that it will ring true to anyone involved in education, and especially to those in science education. Science and technology have put vast power into our hands, but with power comes responsibility, and responsibility requires understanding. I believe that many of the most serious challenges to our survival as a civilization stem from the fact that so many people, including far too many policy makers, do not understand the challenges well enough to face them wisely. As teachers and educators — and this latter category includes not only those making education a career, but also parents, community leaders, and students who are considering teaching as a career — our most important job is to change this dynamic, so that we as a civilization can successfully understand and address the many challenges to our future.

Of course, we have many other jobs as well. At the same time that we must educate the broader public, we must also train the next generation of experts and innovators. With younger children, whether our own or those we teach, we need to provide the inspiration that will make them want to learn enough so that they can make their own contributions to a better future. As students get older, we must provide them with the preparation they need to move along to each next step in achieving their long-term goals. In high school that means preparing students for college, while also making sure that those who don't go to college still learn enough to partici-

pate as educated citizens in our democracy. In college, it means preparing students for the coursework that will follow in their major courses, along with teaching them the practices they'll need for their careers, while at the same time giving them the critical reasoning skills that they will need to succeed in the modern world.

The good news is that, despite the wide variety of settings in which we may work, I believe that a few simple ideas can help all of us become better teachers. This short book is my attempt to summarize these ideas in a way that will (hopefully) make it easy for you to apply them in your own work. Please note that this is *not* a book based on the latest educational research; indeed, as I'll discuss later, most of what I'll be telling you has been known and practiced by great teachers for thousands of years. Nor is this book designed to tell you how to teach your specific subject matter, or to provide you with specific activities or resources. Rather, my aim is simply to offer a few general reminders of principles that you've probably thought about before and that are crucial to student learning, in hopes that by thinking about them again, we'll all be able to make a greater contribution to winning the race between education and catastrophe.

Because this book is meant to be a relatively short set of useful ideas, it could in principle be organized in many different ways. I've settled on an approach that I hope will make the ideas a little easier to remember, which is to use a sequence of odd numbers for my major topic areas, as follows:

- After a brief discussion of the definition of teaching and the nature of science, I'll focus on what I believe to be the ONE key to student success.
- Next, I'll present what I call THREE big picture ideas about teaching.
- Then we'll turn to FIVE general suggestions on how to be a successful teacher.
- Finally, I'll offer SEVEN more specific pedagogical strategies that I believe can help in any teaching, but especially in the teaching of science and math.

This book is adapted and expanded from a talk I've given primarily to college faculty and most commonly to faculty teaching astronomy or physics. As a result, most of my examples are drawn from those areas. Nevertheless, I will try to keep the examples general enough so that you'll be able to see how similar examples could apply to your own teaching. Special notes call out ideas that might apply more specifically to particular educational levels or subjects. I therefore hope that you'll be able to adapt these ideas to your

own teaching, no matter what grade level or subject area you happen to be teaching.

Please also note that while most of my specific suggestions are aimed at those readers who teach courses in science (or the other so-called STEM fields: science, technology, engineering, and mathematics), I hope that the general discussion will be of interest to readers who are involved with science teaching more indirectly, including parents, school administrators, policy makers, community leaders, and research scientists. Indeed, I hold out at least some small hope that the ideas in this book will help contribute to the national conversation about education by helping readers think about the challenges we must meet in order to improve our educational system.

On a final introductory note, I have created a web site for this book, OnTeachingScience.com. I'm cautiously optimistic that I'll find a way to make this an interactive site, where you will be able to post your own comments or additional suggestions to accompany those I've offered in this book. Please visit the site to see if it is useful to you.

With that, it's time to begin. I hope you will find the short time needed to read this book to be time well spent.