Preface

Whenever you pick up any article on the state of education written for the general public, it is likely to be full of dire warnings about how the United States, the United Kingdom, and other Western nations, because of their students' poor performance in science and mathematics, are soon to be eclipsed economically by East Asia. Employers complain that they cannot hire enough qualified engineers, scientists, and technicians and have to seek abroad for people with strong STEM preparation.

These concerns may be valid, and we have reason within our own countries to be concerned about the slow pace of progress in math and science. But how do we solve the problem? How can entire countries enhance their students' skills in STEM subjects?

Clearly, throwing money at the problem is not sufficient. The United States already spends more on education than any other major country, yet its results are less than stellar. Improving outcomes may cost money, but new investments must be proven to work.

That's where this book comes in. Its chapters are updates of articles published in a unique journal called *Better: Evidence-Based Education. Better* is produced in a collaboration between the Institute for Effective Education at the University of York, England, and the Center for Research and Reform in Education at the Johns Hopkins School of Education. Each issue of *Better* focuses on a given topic, and the most respected researchers in the world on that topic are asked to write about their research or reviews of research in a way that makes them accessible, compelling, and interesting to practicing educators and educational leaders.

Each article in *Better,* and each chapter in this book, is based on top-quality research on practical issues of teaching and learning. How can mathematics and science be taught in ways that are motivating, engaging, and effective for all students? How can strategies such as cooperative learning, inquiry, and laboratory explorations enhance learning of science and math? How can technology be used effectively to improve math and science outcomes?

The chapters in this book address these and other issues of effective teaching of STEM subjects at all grade levels. In each case, the chapters are based on research in which innovative approaches to math or science were introduced to groups of teachers and students and compared to teachers and students using traditional approaches. If the classes using the innovative methods showed greater gains on valid assessments of the objectives, this was taken as an indication that the method is effective. If many

studies showed similar outcomes, our confidence grows that the method is more effective than ordinary approaches.

Chapter authors were asked not to hold back on the richness of their ideas and findings but to present them in a pragmatic way, with many examples. Each chapter contains listings of sources for more detail on the research for readers who want to know more, but each chapter presents enough to allow the reader to understand the author's work and its meaning for their own teaching or leadership.

As editor-in-chief of *Better,* it's my job to invite respected researchers to submit articles. These are very busy, much sought-after people, yet I've been delighted to find that nearly every person I invite accepts the invitation. In fact, most are happy to have an opportunity to explain their work to front line educators. The people who write for *Better* are not ivory-tower theoreticians. They are people who use the tools of science to improve schools. They work in real schools all the time, testing out their ideas where they matter and learning from teachers, principals, and students.

This book is the product of the talents of many people. I'd like to thank all of the researchers who have contributed to *Better:* to Jonathan Haslam, Jeannette Bollen-McCarthy, and Bette Chambers at the University of York; to Beth Comstock at Johns Hopkins University; and to Arnis Burvikovs at Corwin.

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—Robert Slavin