Preface

Where is the knowledge we lost in information?
—T. S. Eliot, *The Rock*

In the early 1980s a visionary teacher used this quote to capture his beliefs and passion for statistics. His belief was that statistics should be an important field of study for all students, and his passion was that the stories in data were fascinating and important to understand. The quote is more apt in 2006 than ever before as information continues to increase at ever-growing rates, signifying both the potential for learning in the twenty-first century, often called the age of information, and the danger that this potential will be ignored.

Statistics is about data—information presented numerically—and about using that information in ways that inform the user, providing a knowledge base for making decisions and for facing uncertainties. In modern democratic societies, individual citizens are empowered perhaps more than ever in any society to make countless decisions affecting education, health, money, careers, even the way they are governed. Citizens also have more access to data, from public opinion polls to medical research findings to millions of Web pages with content of widely varying veracity. Faced with such freedoms, a barrage of information, and inevitably the uncertain consequences of their choices, an understanding of statistics and probability is increasingly important for every citizen. For the health of our society, pre-K–16 education must ensure that students learn to reason about and with data while taking into account uncertainty.

In 1981, the National Council of Teachers of Mathematics (NCTM) published its first yearbook on statistics and probability, *Teaching Statistics and Probability.* This yearbook reflected the fact that dedicated individuals throughout the world recognized the importance of statistics and probability and were working to incorporate the teaching of probability and statistics into schools. The visionary who quoted T. S. Eliot, Jim Swift, at that time a high school teacher in Nanaimo, British Columbia, was on the editorial panel for that yearbook and was the driving force and creative impetus behind much of the Quantitative Literacy (QL) materials, originally a series of four booklets that capitalized on Tukey's approach to data analysis bringing important statistical concepts within reach of secondary school students. The QL materials, published in 1987 (Gnanadesikan et al.), were developed through the work of the NCTM/American Statistical Association (ASA)'s Joint Committee

on the Curriculum in Statistics and Probability. Since the publication of that first yearbook in 1981, spurred by the early work of the Joint Committee, by advances in technology, and by the demands of society, the role of statistics and probability in the school curriculum changed significantly over the next twenty-five years.

The NCTM (1989) *Curriculum and Evaluation Standards for School Mathematics* included statistics and probability as essential strands in the K–12 curriculum. A wide variety of activities and publications, sponsored by many different individuals and organizations, followed the release of the *Curriculum and Evaluation Standards,* including the NCTM Addenda Series of booklets on data and chance. The 1990s saw an increasing role for statistics and probability in schools and in the growing world of assessment. In 1997, the first Advanced Placement Statistics test was given, and the number of students taking statistics in high school has grown phenomenally since then (see the article by Franklin and Garfield in this yearbook). In 2000, *Principles and Standards for School Mathematics* reaffirmed the importance of statistics and probability by identifying them as one of the five crosscutting content strands (NCTM 2000). Most state standards and instructional materials now include work with data and chance. In the early 2000s, to support the implementation of its *Principles and Standards,* NCTM published the Navigations Series booklets on data analysis and probability, grade-level booklets framing classroom activities for teachers.

A comparison of the two yearbooks (1981 and 2006) illustrates some of the changes during the twenty-five years as well as what has remained the same. Examining children's beliefs about "what is fair" appears in both yearbooks, as do specific articles on developing an understanding of measures of center. Simulation techniques are the focus of articles in both yearbooks, although more explicitly so in the first. In 1981, probability had a much more central role, with eight of its thirty chapters devoted to probability, whereas in 2006, probability is the focus of only two articles. Representations such as the "median-hinge box plot," common today, were considered new techniques in 1981 (Maher). The 1981 Yearbook deliberately tried to lay the foundation for helping teachers begin to teach probability and statistics, with many of the articles devoted to actual classroom-tested activities. The focus in 2006 is more on student and teacher learning around a set of activities. New topics in 2006 include the relation between mathematics and statistics, developing and enriching mathematical concepts through the use of statistics, and a discussion of the research related to teaching and learning statistics. The Sixty-eighth Yearbook (2006) also reflects the influence of the Advanced Placement (AP) program and contains several articles on advanced statistical topics.

"Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning" (NCTM 2000, p. 11). Technology has clearly changed teaching and learning about data and chance. In 1981, three of the yearbook articles involved computers and writing programs. The emergence of graphing calculators in the mid-eighties, of interactive data visualization software (e.g., TableTop [Hancock 1995], TinkerPlots [Konold and

Miller 2004], and Fathom [Finzer 1999, 2005], and the functionality of the Web has changed what is possible in teaching and learning about statistics and probability. Half of the articles in the 2006 yearbook involve technology. Some of these employ technology to enhance students' learning (see the articles by Koehler, Flores, and Tarr and his colleagues); Thompson and her colleagues use statistical software to compare two approaches to designing an experiment. Rubin and Hammerman, Friel and her associates, and Lane-Getaz discuss how to help students and teachers understand data and use technology as a vehicle to do so. Other articles involve the use of technology to teach topics that were not accessible without it (Flannagan-Hyde and Lieb, Bohan, and Hesterberg). Technology is also featured as a means of developing learning communities: using the Internet to collect data across nations (Connor and associates; McNab and colleagues) and providing a support network for teachers (Velleman and Bock).

Principles and Standards (NCTM 2000) states that students should be able to—

- formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them;
- select and use appropriate statistical methods to analyze data;
- develop and evaluate inferences and predictions based on data;
- understand and apply basic concepts of probability.

The yearbook articles make this vision come alive, with the first section devoted to Learning about Data and Chance; the second to Reasoning with Data and Chance; and the third to Reflecting on Issues Related to Data and Chance. Descriptions of each section are given in the introduction to each section. The CD that accompanies this yearbook provides supporting material for many of the articles. These materials range from video clips of classrooms to lessons to software demonstrations. The CD also includes articles from past NCTM journals that the Editorial Panel considered particularly appropriate for a given article or section. In each instance the article contains a reference to the CD.

Putting together a yearbook is a challenging and labor-intensive task, and without the support and help of many talented and dedicated people, it would not be possible. First and foremost is the Editorial Panel for the Sixty-eighth Yearbook, who shaped the direction of the yearbook, assembled the articles, and offered suggestions for authors, in addition to responding to urgent pleas for help as the deadlines grew near:

Alfinio Flores, Arizona State University, Tempe, Arizona

Christine Pateracki, Bluffton High School, Bluffton, South Carolina

Floyd Bullard, North Carolina School of Science and Mathematics and Duke University, Durham, North Carolina

James M. Landwehr, Avaya Labs Research, Summit, New Jersey

Sister Alice Hess, I.H.M., Archbishop Ryan High School, Philadelphia, Pennsylvania

As we poured over manuscripts, Jim and Floyd kept a keen eye on the statistics, Sister Alice and Tina kept us grounded in the classroom, and Alfinio brought the perspective of a university mathematics educator. Alfinio and Tina also contributed to the section introductions. Portia Elliott, the general editor for the 2005–2007 yearbooks, helped throughout the entire process, offering guidance and advice, reminding us of deadlines and procedures as well as taking an active role in reading and commenting on the manuscripts. Charles Clements and the NCTM Reston staff worked many hours on the project, editing and advising along the way. Special thanks go to Sharon Strickland, who provided advice on individual manuscripts as they were developing, and to Margaret Iding, who organized and managed the manuscripts.

The world is full of information. It is our hope that the discussion in the yearbook articles will help students and teachers learn to capture the knowledge this vast and growing array of information contains by thinking and reasoning about data and chance and to use that knowledge to make informed decisions about their lives and the world in which they live.

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