# Table of Contents

- **Foreword** ........................................................................................................................................... xvi
- **Preface** ............................................................................................................................................... xviii
- **Acknowledgment** ............................................................................................................................. xxv

## Section 1
### Theoretical and Instructional Perspectives

**Chapter 1**  
Educational Robotics Theories and Practice: Tips for how to do it Right ................................................. 1  
*Amy Eguchi, Bloomfield College, USA*

**Chapter 2**  
Designing Evaluations for K-12 Robotics Education Programs ................................................................. 31  
*Kristen Stubbs, Electra Studios, formerly of iRobot Corporation, USA*  
*Jennifer Casper, The MITRE Corporation, USA*  
*Holly A. Yanco, University of Massachusetts Lowell, USA*

**Chapter 3**  
Generating Transferable Skills in STEM through Educational Robotics .................................................... 54  
*Carl Nelson, University of Nebraska-Lincoln, USA*

**Chapter 4**  
In and out of the School Activities Implementing IBSE and Constructionist Learning  
Methodologies by Means of Robotics ........................................................................................................ 66  
*G. Barbara Demo, University of Torino, Italy*  
*Michele Moro, University of Padova, Italy*  
*Alfredo Pina, Public University of Navarra, Spain*  
*Javier Arlegui, Public University of Navarra, Spain*
Section 2
Educational Robotics in K-12 Formal Learning

Chapter 5
Robotics and Problem-Based Learning in STEM Formal Educational Environments .......................... 94
Neal Grandgenett, The University of Nebraska at Omaha, USA
Elliot Ostler, The University of Nebraska at Omaha, USA
Neal Topp, The University of Nebraska at Omaha, USA
Robert Goeman, The University of Nebraska at Omaha, USA

Chapter 6
Medical Robotics in K-12 Education ................................................................. 120
Ronald Rockland, New Jersey Institute of Technology, USA
Howard Kimmel, New Jersey Institute of Technology, USA
John Carpinelli, New Jersey Institute of Technology, USA
Linda S. Hirsch, New Jersey Institute of Technology, USA
Levelle Burr-Alexander, New Jersey Institute of Technology, USA

Chapter 7
Elisabeth McGrath, Stevens Institute of Technology, USA
Susan Lowes, Teachers College, Columbia University, USA
Mercedes McKay, Stevens Institute of Technology, USA
Jason Sayres, Stevens Institute of Technology, USA
Peiyi Lin, Teachers College, Columbia University, USA

Chapter 8
Programming Robots in Kindergarten to Express Identity: An Ethnographic Analysis .................. 168
Marina Umaschi Bers, Tufts University, USA
Alyssa B. Ettinger, Tufts University, USA

Section 3
Educational Robotics in Out-of-School Time

Chapter 9
The Impact of Educational Robotics on Student STEM Learning, Attitudes, and Workplace Skills .......................................................... 186
Gwen C. Nugent, University of Nebraska-Lincoln, USA
Bradley Barker, University of Nebraska-Lincoln, USA
Neal Grandgenett, University of Nebraska-Omaha, USA
Chapter 10
The Mediating Role of Context in an Urban After-School Robotics Program: Using Activity Systems to Analyze and Design Robust STEM Learning Environments

John Y. Baker, University of Pennsylvania, USA

Chapter 11
Building Technical Knowledge and Engagement in Robotics: An Examination of two Out-of-School Programs

Kimberley Gomez, University of California Los Angeles, USA
Debra Bernstein, TERC, USA
Jolene Zywica, University of Pittsburgh, USA
Emily Hamner, Carnegie Mellon University, USA

Chapter 12
STEM Outreach with the Boe-Bot®

Ronda K. Cole, New Mexico Institute of Mining and Technology, USA

Chapter 13
Developing and Evaluating a Web-Based, Multi-Platform Curriculum for After-School Robotics

Fred G. Martin, University of Massachusetts Lowell, USA
Michelle Scribner-MacLean, University of Massachusetts Lowell, USA
Sam Christy, Machine Science Inc., USA
Ivan Rudnicki, Machine Science Inc., USA

Chapter 14
Learning Geospatial Concepts as Part of a Non-Formal Education Robotics Experience

Viacheslav Adamchuk, McGill University, Canada
Bradley Barker, University of Nebraska-Lincoln, USA
Gwen Nugent, University of Nebraska-Lincoln, USA
Neal Grandgenett, University of Nebraska at Omaha, USA
Megan Patent-Nygren, University of Nebraska-Lincoln, USA
Kathy Morgan, University of Nebraska-Lincoln, USA
Collin Lutz, Virginia Polytechnic Institute and State University, USA

Section 4
Learning through Educational Robotics Competitions

Chapter 15
From Grade School to Grad School: An Integrated STEM Pipeline Model through Robotics

Ross A. Mead, University of Southern California, USA
Susan L. Thomas, SIU Edwardsville, USA
Jerry B. Weinberg, SIU Edwardsville, USA
Chapter 16
Promoting Diversity and Public School Success in Robotics Competitions .................................................. 326
  Jeffrey Rosen, Georgia Institute of Technology, USA
  Fred Stillwell, Georgia Institute of Technology, USA
  Marion Usselman, Georgia Institute of Technology, USA

Chapter 17
Educational Robotics and Broadening Participation in STEM for Underrepresented Student Groups .................................................. 343
  Stephanie Ludi, Rochester Institute of Technology, USA

Compilation of References ............................................................................................................ 362

About the Contributors .................................................................................................................... 393

Index ................................................................................................................................................... 404