# Table of Contents

**Foreword** ........................................................................................................................................... xviii

**Preface** .................................................................................................................................................. xix

**Acknowledgment** ............................................................................................................................ xxviii

**Section 1**

**Teaching and Learning in STEM**

**Chapter 1**
Using Technology to Enhance Science Literacy, Mathematics Literacy, or Technology Literacy: Focusing on Integrated STEM Concepts in a Digital Game................................................................. 1

*Isha DeCoito, Western University, Canada*

*Tasha Richardson, University of Toronto, Canada*

**Chapter 2**
Media Literacy as a Pathway to Bridge the Digital and STEM Divides: Interest Driven Media Projects for Teachers in the Trenches ........................................................................................................... 23

*Lesley K. Smith, University of Colorado, USA*

*Juliette N. Rooney-Varga, University of Massachusetts, USA*

*Anne U. Gold, University of Colorado, USA*

*David J. Oonk, University of Colorado, USA*

*Deb Morrison, Broomfield Heights Middle School, USA*

**Chapter 3**
Sounding Out Science: Using Assistive Technology for Students with Learning Differences in Middle School Science Classes ........................................................................................................... 44

*Clement Vashkar Gomes, Teachers College, Columbia University, USA*

*Felicia Moore Mensah, Teachers College, Columbia University, USA*
Chapter 4
Promoting English Language Acquisition in Secondary Mathematics through Dialogic Integration of Instructional Technology ................................................................. 68
Bethany Reichen, State University of New York at Albany, USA
Alandeom W. Oliveira, State University of New York at Albany, USA
Gretchen Oliver, State University of New York at Albany, USA
Autumn Joy Florencio-Wain, State University of New York at Albany, USA

Chapter 5
Examining the Levels of Reasoning Used by Urban Elementary Black Girls Engaging in Technology-Enhanced Inquiry .............................................................................................................. 86
Gayle A. Buck, Indiana University, USA
Nicole Beeman-Cadwallader, Project Lead the Way, USA
Amy Trauth-Nare, University of Delaware, USA

Chapter 6
Motivating Inquiry-Based Learning Through a Combination of Physical and Virtual Computer-Based Laboratory Experiments in High School Science ............................................................................................................................ 108
Niwat Srisawasdi, Khon Kaen University, Thailand

Chapter 7
The Power of Computational Modeling and Simulation for Learning STEM Content in Middle and High Schools ................................................................................................................................. 135
Mahnaz Moallem, University of North Carolina – Wilmington, USA
Shelby P. Morge, University of North Carolina – Wilmington, USA
Sridhar Narayan, University of North Carolina – Wilmington, USA
Gene A. Tagliarini, University of North Carolina – Wilmington, USA

Chapter 8
Visualizing Condensation: Integrating Animation-Developing Technology in Chemistry Classes... 172
Sevil Akaygun, Bogazici University, Turkey

Section 2
Real-World Contexts for STEM

Chapter 9
STEM Learning in Middle Grades by Technology-Mediated Integration of Science and Mathematics: Results of Project SMILE ................................................................................................................................. 187
Pradeep Maxwell Dass, Northern Arizona University, USA
John T. Spagnolo, Appalachian State University, USA
Chapter 10
A Qualitative Study of Teachers’ Understanding of Sustainability: Education for Sustainable Development (ESD), Dimensions of Sustainability, Environmental Protection

Hsiaowei Cristina Chang, San Jose State University, USA
Resa Marie Kelly, San Jose State University, USA
Ellen P. Metzger, San Jose State University, USA

Chapter 11
Coupling Geospatial and Computer Modeling Technologies to Engage High School Students in Learning Urban Ecology

Dennis J. DeBay, University of Colorado – Denver, USA
Amie Patchen, Boston College, USA
Anne C. Vera Cruz, Boston College, USA
Paul E. Madden, Boston College, USA
Yang Xu, Boston College, USA
Meredith Houle, San Diego State University, USA
Michael Barnett, Boston College, USA

Chapter 12
Using Technology to Rethink the Intersection of Statistics Education and Social Justice

Lisa L. Poling, Appalachian State University, USA
Nirmala Naresh, Miami University, USA
Tracy J. Goodson-Espy, Appalachian State University, USA

Chapter 13
Using Authentic Earth Data in the K-12 Classroom

Meghan E. Marrero, Mercy College, USA
Amanda M. Gunning, Mercy College, USA
Karen Woodruff, U.S. Satellite Laboratory, USA

Section 3
Educational Technologies for Use in STEM

Chapter 14
Exploring Physics and Technology: A Study in Teaching Kinematics to Student-Athletes

Loraine Snead, YSC Academy, USA
Yushaneen Simms, YSC Academy, USA
Chapter 15
Computer Programming in Elementary and Middle School: Connections across Content.................. 337
  Danielle Boyd Harlow, University of California – Santa Barbara, USA
  Hilary Dwyer, University of California – Santa Barbara, USA
  Alexandria K. Hansen, University of California – Santa Barbara, USA
  Charlotte Hill, University of California – Santa Barbara, USA
  Ashley Iveland, University of California – Santa Barbara, USA
  Anne E. Leak, University of California – Santa Barbara, USA
  Diana M. Franklin, University of Chicago, USA

Chapter 16
Technology’s Role in Supporting Elementary Preservice Teachers as They Teach: An Urban
STEM Afterschool Enrichment Program............................................................................................ 362
  Anne Pfitzner Gatling, Merrimack College, USA

Chapter 17
Technology-Assisted Formative Assessment...................................................................................... 380
  Karen E. Irving, The Ohio State University, USA

Chapter 18
Using Reason Racer to Support Argumentation in Middle School Science Instruction .................. 399
  Marilyn Ault, University of Kansas, USA
  Jana Craig-Hare, University of Kansas, USA
  James D. Ellis, University of Kansas, USA
  Janis Bulgren, University of Kansas, USA
  Isa Kretschmer, Independent Researcher, USA
  Bruce B. Frey, University of Kansas, USA

Compilation of References .................................................................................................................. 432

About the Contributors ....................................................................................................................... 485

Index.................................................................................................................................................. 495