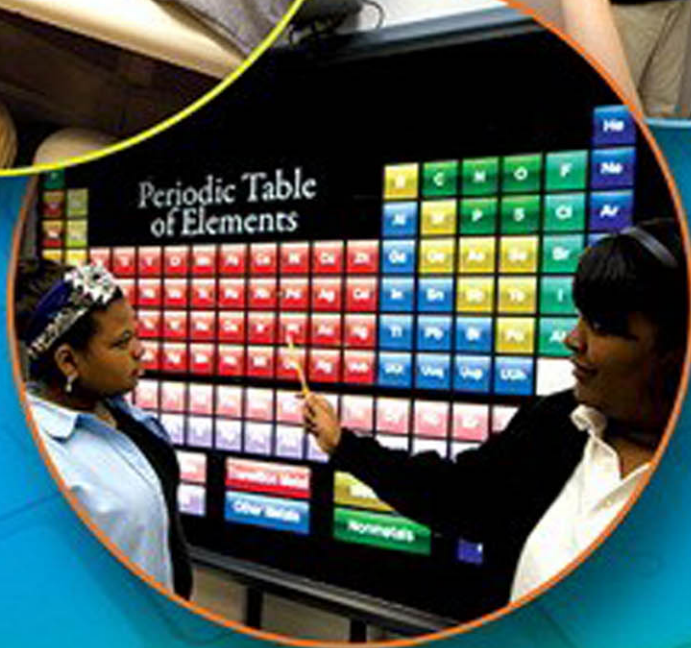


M.D. Roblyer

# INTEGRATING EDUCATIONAL TECHNOLOGY *into* TEACHING

SEVENTH EDITION



SEVENTH EDITION

# Integrating Educational Technology into Teaching

M. D. Roblyer

*Nova Southeastern University*

**PEARSON**

Boston Columbus Indianapolis New York San Francisco Upper Saddle River  
Amsterdam Cape Town Dubai London Madrid Milan Munich Paris Montréal Toronto  
Delhi Mexico City São Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo

**Vice President and Editorial Director:** Jeffery Johnston  
**Executive Editor & Publisher:** Meredith Fossel  
**Editorial Assistant:** Maria Feliberty  
**Marketing Managers:** Christopher Barry and Krista Clark  
**Senior Content Editor:** Maxine Effenson Chuck  
**Program Manager:** Maren Beckman  
**Project Manager:** Karen Mason  
**Manufacturing Buyer:** Deidra Skahill  
**Full-Service Project Management:** MPS North America LLC  
**Compositor:** Jouve  
**Rights and Permissions Research Project Manager:** Tania Zamora  
**Manager, Cover Visual Research & Permissions:** Diane Lorenzo  
**Cover Image Credits:** Courtesy of the Author and W. Wiencke  
**Printer/Binder:** Courier Kendallville, Inc.

Photo Credits: Appear on the page with the image. Design credits: Technology Integration in Action header: Vs148/Shutterstock; Big Ideas icon: Floral\_set/Fotolia; Footer watermark: Venimo/Fotolia; Open Source Options header: Scyther5/Shutterstock; Media callout screen: Rawpixel/Fotolia; Technology Integration Example image: Ra2 studio/Fotolia; Hot Topic Debate icon: Arcady/Fotolia; Hot Topic Debate header: Photo Lux/Shutterstock; Adapting for Special Needs icon: Zentilia/Fotolia; Adapting for Special needs background: Alphaspirt/Shutterstock; Summary watermark: Alexey Boldin/Shutterstock; Collaborate, Discuss, Reflect header background: Artant/Fotolia

Text Credits: Credits and acknowledgments borrowed from other sources and reproduced, with permission, in this textbook appear on appropriate page within text.

Copyright © 2016, 2013, 2010, by Pearson Education, Inc. All rights reserved. Manufactured in the United States of America. This publication is protected by Copyright, and permission should be obtained from the publisher prior to any prohibited reproduction, storage in a retrieval system, or transmission in any form or by any means, electronic, mechanical, photocopying, recording, or likewise. To obtain permission(s) to use material from this work, please submit a written request to Pearson Education, Inc., Permissions Department, One Lake Street, Upper Saddle River, New Jersey 07458, or you may fax your request to 201-236-3290.

Many of the designations by manufacturers and sellers to distinguish their products are claimed as trademarks. Where those designations appear in this book, and the publisher was aware of a trademark claim, the designations have been printed in initial caps or all caps.

Between the time website information is gathered and then published, it is not unusual for some sites to have closed. Also, the transcription of URLs can result in typographical errors. The publisher would appreciate notification where these errors occur so that they may be corrected in subsequent editions.

#### **Library of Congress Cataloging-in-Publication Data**

Roblyer, M. D.

Integrating educational technology into teaching / M.D. Roblyer. – Seventh edition.  
pages cm

Includes bibliographical references and index.

ISBN 978-0-13-379279-9 – ISBN 0-13-379279-X 1. Educational technology–United States. 2. Computer-assisted instruction–United States. 3. Curriculum planning–United States. I. Title.

LB1028.3.R595 2016

371.33—dc23

2014043396

10 9 8 7 6 5 4 3 2 1

**PEARSON**

ISBN-10: 0-13-379279-X

ISBN-13: 978-0-13-379279-9

For Bill and Paige Wiencke, whose love is,  
as Arthur Clarke said of advanced technology,  
indistinguishable from magic.

**—MDR**

# ABOUT THE AUTHOR



Photo courtesy Paige Wiencke

**M. D. Roblyer** has been a technology-using professor and contributor to the field of educational technology for over 30 years and has authored or coauthored hundreds of books, monographs, articles, columns, and papers on educational technology research and practice. Her other books for Pearson Education include *Starting Out on the Internet: A Learning Journey for Teachers*; *Technology Tools for Teachers: A Microsoft Office Tutorial* (with Steven C. Mills); *Educational Technology in Action: Problem-Based Exercises for Technology Integration*; and the most recent text, *Introduction to Instructional Design for Traditional, Online, and Blended Environments* (2015).

She began her exploration of technology's benefits for teaching in 1971 as a graduate student at one of the country's first successful instructional computer training sites, Pennsylvania State University, where she helped write tutorial literacy lessons in the Coursewriter II authoring language on an IBM 1500 dedicated instructional mainframe computer. While obtaining a PhD in instructional systems at Florida State University, she worked on several major courseware development and training projects with Control Data Corporation's PLATO system. In 1981–1982, she designed one of the early microcomputer software series, *Grammar Problems for Practice*, in conjunction with the Milliken Publishing Company.

Currently, Dr. Roblyer is Adjunct Professor of Instructional Technology and Distance Education (ITDE) at Nova Southeastern University, chairing dissertations for ITDE doctoral students. She serves on editorial boards of various technology and research journals and is past-president of two AERA special interest groups. She is married to fellow FSU PhD William R. Wiencke and is the mother of a daughter, Paige.

# BRIEF CONTENTS

## PART 1 **Introduction and Background on Integrating Technology in Education**

---

- 1 Educational Technology in Context: The Big Picture 1
- 2 Theory into Practice: Foundations for Effective Technology Integration 31

## PART 2 **Technology Tools for 21st Century Teaching**

---

- 3 Instructional Software for 21st Century Teaching 72
- 4 Technology Tools for 21st Century Teaching: The Basic Suite 106
- 5 Technology Tools for 21st Century Teaching: Beyond the Basics 138

## PART 3 **Linking to Learn: Technology Tools and Strategies**

---

- 6 Online Tools, Uses, and Web-Based Development 170
- 7 Introduction to Distance Education: Online and Blended Environments 203
- 8 Online Models, Courses, and Programs 231

## PART 4 **Integrating Technology Across the Curriculum**

---

- 9 Teaching and Learning with Technology in English and Language Arts 258
- 10 Teaching and Learning with Technology for Foreign and Second Languages 284
- 11 Teaching and Learning with Technology in Mathematics and Science 305
- 12 Teaching and Learning with Technology in Social Studies 333
- 13 Teaching and Learning with Technology in Music and Art 352
- 14 Teaching and Learning with Technology in Health and Physical Education 378
- 15 Teaching and Learning with Technology in Special Education 400

# CONTENTS

PREFACE xx

## PART 1 Introduction and Background on Integrating Technology in Education

### 1 Educational Technology in Context: The Big Picture 1

LEARNING OUTCOMES 1

#### TECHNOLOGY INTEGRATION IN ACTION: THEN AND NOW 2

#### INTRODUCTION: THE “BIG PICTURE” ON TECHNOLOGY IN EDUCATION 3

Why We Need the “Big Picture” 3

Perspectives That Define Educational Technology 3

How This Textbook Defines Technology in Education 5

#### YESTERDAY’S EDUCATIONAL TECHNOLOGY: HOW THE PAST HAS SHAPED THE PRESENT 6

Era 1: The Pre-Microcomputer Era 7

Era 2: The Microcomputer Era 7

Era 3: The Internet Era 8

Era 4: The Mobile Technologies, Social Media, and Open Access Era 8

What We Have Learned from the Past 9

#### TODAY’S EDUCATIONAL TECHNOLOGY RESOURCES: SYSTEMS AND APPLICATIONS 10

An Overview of Digital Technology Tools 10

Technology Facilities: Hardware and Configurations for Teaching 10

Types of Software Applications in Schools 12

#### TODAY’S EDUCATIONAL TECHNOLOGY ISSUES: CONDITIONS THAT SHAPE PRACTICE 12

Social Issues 12

Educational Issues 15

Cultural and Equity Issues 15

Legal and Ethical Issues 16

#### TODAY’S EDUCATIONAL TECHNOLOGY SKILLS: STANDARDS, ASSESSMENTS, AND TEACHING COMPETENCIES 17

The Common Core State Standards (CCSS) 17

ISTE Standards for Teachers, Students, and Administrators 18

The Partnership for 21st Century Skills (P21) for Students and Teachers 18

The ICT Competency Framework for Teachers 18

The Tech-PACK Framework 19

Demonstrating Technology Skills: Portfolio Options and Tech-PACK 20

#### TODAY’S EDUCATIONAL TECHNOLOGY USES: DEVELOPING A SOUND RATIONALE 21

What Does Research on Technology in Education Tell Us? 22

A Technology-Use Rationale Based on Problem Solving 22

#### TOMORROW’S EDUCATIONAL TECHNOLOGY: EMERGING TRENDS IN TOOLS AND APPLICATIONS 25

Trends in Hardware, Software, and System Development 25

Trends in Educational Applications 26



COLLABORATE, DISCUSS, REFLECT 28  
 SUMMARY 28  
 TECHNOLOGY INTEGRATION WORKSHOP 30

**2 Theory into Practice: Foundations for Effective Technology Integration 31**

LEARNING OUTCOMES 31

TECHNOLOGY INTEGRATION IN ACTION: THE ROLE OF CONTEXT 32

OVERVIEW OF FACTORS IN SUCCESSFUL TECHNOLOGY INTEGRATION 33

- Learning Theory Foundations 33
- Technology Integration Planning (TIP) Model 33
- Essential Conditions for Effective Technology Integration 33

OVERVIEW OF TWO PERSPECTIVES ON TECHNOLOGY INTEGRATION 34

- Two Perspectives on Effective Instruction 34
- Where Did the Perspectives Come From? 34

LEARNING THEORY FOUNDATIONS OF DIRECTED INTEGRATION MODELS 36

- Behaviorist Theories 37
- Information-Processing Theories 37
- Cognitive-Behaviorist Theory 38
- Systems Approaches: Instructional Design Models 39
- Objectivist Theory Foundations for Directed Methods 40

LEARNING THEORY: FOUNDATIONS OF CONSTRUCTIVIST INTEGRATION MODELS 41

- Social Activism Theory 42
- Social Cognitive Theory 42
- Scaffolding Theories 43
- Child Development Theory 43
- Discovery Learning 44
- Multiple Intelligences Theory 44
- Constructivist Theory Foundations for Inquiry-Based Methods 46

TECHNOLOGY INTEGRATION STRATEGIES BASED ON DIRECTED AND CONSTRUCTIVIST THEORIES 48

- Future Directions for Merging Directed and Constructivist Approaches 48
- Technology Integration Strategies Useful for Either Model 50
- Technology Integration Strategies Based on Directed Models 52
- Technology Integration Strategies Based on Constructivist Models 53

A TECHNOLOGY INTEGRATION PLANNING (TIP) MODEL FOR TEACHERS 54

- Phase 1: Analysis of Learning and Teaching Needs 55
- Phase 2: Design of an Integration Framework 58
- Phase 3: Post-Instruction Analysis and Revisions 62

WHEN TECHNOLOGY WORKS BEST: ESSENTIAL CONDITIONS FOR TECHNOLOGY INTEGRATION 64

- Essential Condition: A Shared Vision for Technology Integration 65
- Essential Condition: Standards and Curriculum Support 65
- Essential Condition: Required Policies 65
- Essential Condition: Access to Hardware, Software, and Other Resources 66
- Essential Condition: Skilled Personnel 67
- Essential Condition: Technical Assistance 68
- Essential Condition: Appropriate Teaching and Assessment Models 68
- Essential Condition: Engaged Community 69





## PART 2 **Technology Tools for 21st Century Teaching**

### **3** **Instructional Software for 21st Century Teaching** 72 LEARNING OUTCOMES 72

#### TECHNOLOGY INTEGRATION IN ACTION: **MATH BY DESIGN** 73

#### AN INTRODUCTION TO INSTRUCTIONAL SOFTWARE 75

- Basic Information about Instructional Software 75
- Teaching Roles for Instructional Software 77

#### DRILL-AND-PRACTICE TEACHING FUNCTIONS 79

- Selecting Good Drill-and-Practice Software 80
- Benefits of Drill and Practice 80
- Limitations and Problems Related to Drill and Practice 81
- Using Drill and Practice in Teaching 83

#### TUTORIAL TEACHING FUNCTIONS 83

- Selecting Good Tutorial Software 84
- Benefits of Tutorials 84
- Limitations and Problems Related to Tutorials 85
- Using Tutorials in Teaching 86

#### SIMULATION TEACHING FUNCTIONS 87

- Simulations That Teach About Something 87
- Simulations That Teach How to Do Something 88
- Selecting Good Simulation Software 88
- Benefits of Simulations 88
- Limitations and Problems Related to Simulations 90
- How to Use Simulations in Teaching: Integration Strategies and Guidelines 92

#### INSTRUCTIONAL GAME TEACHING FUNCTIONS 92

- Selecting Good Instructional Games 93
- Benefits of Instructional Games 94
- Limitations and Problems Related to Instructional Games 94
- Using Instructional Games in Teaching 95

#### PROBLEM-SOLVING TEACHING FUNCTIONS 97

- Selecting Good Problem-Solving Software 97
- Benefits of Problem-Solving Software 97
- Limitations and Problems Related to Problem-Solving Software 99
- Using Problem-Solving Software in Teaching 100

#### PERSONALIZED LEARNING SYSTEMS 101

- Selecting PLSs 101
- Benefits of PLSs 102
- Limitations and Problems Related to PLSs 102

#### COLLABORATE, DISCUSS, REFLECT 103

#### SUMMARY 103

#### TECHNOLOGY INTEGRATION WORKSHOP 105



## **4** Technology Tools for 21st Century Teaching: The Basic Suite 106

LEARNING OUTCOMES 106

### **TECHNOLOGY INTEGRATION IN ACTION: CAN YOU AFFORD YOUR DREAM CAR? 107**

#### **INTRODUCTION TO THE BASIC SOFTWARE TOOL SUITE 109**

Why Use Software Tools? 109

Overview of Uses for the “Basic Three” Software Tools 109

Recent Developments in Software Tools 111

#### **USING WORD PROCESSING SOFTWARE IN TEACHING AND LEARNING 112**

The Impact of Word Processing in Education 112

Word Processing in the Classroom: Productivity and Teaching Strategies 117

Teaching Word Processing Skills: Recommended Skills and Activities 118

#### **USING SPREADSHEET SOFTWARE IN TEACHING AND LEARNING 121**

The Impact of Spreadsheets in Education 121

Spreadsheets in the Classroom: Productivity and Teaching Strategies 123

Teaching Spreadsheet Skills: Recommended Skills and Activities 125

#### **USING PRESENTATION SOFTWARE IN TEACHING AND LEARNING 125**

The Impact of Presentation Software in Education 127

Presentation Software in the Classroom: Productivity and Teaching Strategies 129

Teaching Presentation Software Skills: Recommended Skills and Activities 133

### **COLLABORATE, DISCUSS, REFLECT 135**

### **SUMMARY 136**

### **TECHNOLOGY INTEGRATION WORKSHOP 137**



## **5** Technology Tools for 21st Century Teaching: Beyond the Basics 138

LEARNING OUTCOMES 138

### **TECHNOLOGY INTEGRATION IN ACTION: SHARING A PASSION FOR POETRY 139**

#### **INTRODUCTION TO OTHER SOFTWARE SUPPORT TOOLS 141**

Types of Software Support Tools 141

Recent Developments in Software Support Tools 141

#### **USING MATERIALS GENERATORS 143**

Desktop Publishing Software 144

Web Design Software 146

Interactive Whiteboard Activity Software 146

Worksheet and Puzzle Generators 147

Individualized Education Program (IEP) Generators 147

Graphic Document Makers 148

PDF and Forms Makers 148

#### **USING DATA COLLECTION AND ANALYSIS TOOLS 149**

Database Software 149

Statistical Software Packages 151

Online Survey Tools 151

Student Information Systems 153

Student Response Systems (Clickers) 153



## USING TESTING AND GRADING TOOLS 154

- Electronic Gradebooks 155
- Test Generators and Rubric Generators 155
- Computer-Based Testing Systems 156

## USING GRAPHICS TOOLS 156

- Draw/Paint Programs 157
- Image Editing Tools 157
- Charting and Graphing Tools 158
- Clip Art, Photo, Animation, Sound, Video, and Font Collections 158
- Word Cloud Generators 159

## USING PLANNING AND ORGANIZING TOOLS 160

- Outlining Tools and Concept Mapping Software 160
- Lesson Planning Software 161
- Scheduling, Calendar, and Time Management Tools 161

## USING RESEARCH AND REFERENCE TOOLS 162

- Online Encyclopedias 162
- Digital Atlases and Mapping Tools 162
- Digital Dictionaries (Word Atlases) 163

## USING TOOLS TO SUPPORT SPECIFIC CONTENT AREAS 163

- CAD and 3-D Modeling/Animation Systems 163
- Music Editors, Sequencers, and MIDI Tools 164
- Reading Tools 164
- Microcomputer-Based Labs (Probeware) 165
- Calculators, Graphing Calculators and Calculator-Based Labs 165
- Geographic Information Systems and Global Positioning Systems 166
- Online Foreign Language Dictionaries and Language Translators (Machine Translation) 166

## COLLABORATE, DISCUSS, REFLECT 167

## SUMMARY 167

## TECHNOLOGY INTEGRATION WORKSHOP 168

# PART 3 **Linking to Learn: Technology Tools and Strategies**

## **6** Online Tools, Uses, and Web-Based Development 170

### LEARNING OUTCOMES 170

### TECHNOLOGY INTEGRATION IN ACTION: A RESEARCH PAPER 171

### DIGITAL CITIZENSHIP ISSUES AND NEEDS FOR THE ONLINE ENVIRONMENT 173

- How “Online” Emerged: A Brief History 173
- Online Safety and Security Issues 174
- Online Ethical and Legal Issues 176
- Rules and Guidelines for Online Behavior: Digital Citizenship, Netiquette, and More 177

### NAVIGATION OPTIONS 179

- Using Uniform Resource Locators (URLs) 179
- Four Methods for Navigating the Net 180
- Bookmarks, Favorites, and Online Organizers 181
- Basic Internet Troubleshooting 181



## SEARCHING AND STORING OPTIONS 182

Types of Search Engines 183

Search Tools and Strategies 183

## COMMUNICATIONS OPTIONS 184

Email and Listservs 184

Instant Messaging and Text Messaging 184

Videoconferencing in Online and Blended Environments 185

## SOCIAL NETWORKING AND COLLABORATING OPTIONS 185

Blogs and Microblogs 186

Chatrooms 188

Wikis and Crowdsourcing Sites 188

Video- and Photo-Sharing Communities 189

Social Networking Sites 190

## APPLYING APPS IN EDUCATION 191

Locating Apps 191

Using Apps in Education 191

## WEB PAGE AND WEBSITE AUTHORING SKILLS AND RESOURCES 191

Web Development Skills 191

Hypermedia Resources for Web Page and Website Development 192

Web Authoring Tools 192

Downloading Images, Programs, and Plug-Ins 195

## WEB PAGE AND WEBSITE AUTHORING STEPS AND CRITERIA 196

Recommended Sequence for Authoring Web Pages and Sites 196

Criteria for Evaluating Website Information and Design 199

## COLLABORATE, DISCUSS, REFLECT 200

## SUMMARY 200

## TECHNOLOGY INTEGRATION WORKSHOP 202

# 7 Introduction to Distance Education: Online and Blended Environments 203

## LEARNING OUTCOMES 203

## TECHNOLOGY INTEGRATION IN ACTION: FLIPPING FOR PRE-ALGEBRA MASTERY 204

## OVERVIEW OF DISTANCE EDUCATION 206

Distance Learning Models 206

Current Issues in Distance Learning 207

Distance Learning Research 208

## BLENDED LEARNING ENVIRONMENTS 211

Blended Learning Models 212

Implementing a Flipped Classroom Model 212

## ONLINE AUDIO AND VIDEO STRATEGIES IN BLENDED ENVIRONMENTS 214

Background on Podcasts and Vodcasts 215

Audio and Video Development 215

Audio and Video Lesson Integration Strategies 215

## TYPES OF WEB-BASED LESSONS IN BLENDED MODELS 219

Types of Web-Based Lessons and Projects 219

Social Action Projects 221

Integration Strategies for Web-Based Activities 222



**IMPLEMENTING WEB-BASED LESSONS IN BLENDED ENVIRONMENTS 225**  
 Support Sites for Web-Based Activities 226  
 Evaluating Quality of Web-Based Lessons and Student Products from Lessons 227  
**COLLABORATE, DISCUSS, REFLECT 228**  
**SUMMARY 228**  
**TECHNOLOGY INTEGRATION WORKSHOP 230**

**8 Online Models, Courses, and Programs 231**  
**LEARNING OUTCOMES 231**

**TECHNOLOGY INTEGRATION IN ACTION: VIRTUAL HEALTH 232**

**DEVELOPING ONLINE COURSES: MODELS 234**

- The Noninteractive Online Model 234
- The Interactive, Asynchronous Online Model 234
- The Interactive Online Model with Synchronous Events 235
- The MOOC Model 235

**DEVELOPING ONLINE COURSES: CONTENT MANAGEMENT SYSTEMS (CMS) AND OTHER REQUIRED INFRASTRUCTURE 236**

- Content Management Systems (CMS) 236
- Course Support Tools 237
- Technical Support 237
- Support for Students with Special Needs 237
- Resources to Monitor Course Outcomes 237
- Resources and Strategies to Ensure Academic Integrity 238

**DEVELOPING ONLINE COURSES: PROCEDURES 238**

- Step 1: Select the Online Model 238
- Step 2: Design and Document Learning Activities 239
- Step 3: Create Course Space Structure 239
- Step 4: Create Assignment Materials 241
- Step 5: Create Assessment Materials 241
- Step 6: Create Content Presentation Materials 241
- Step 7: Create Small-Group Activities 241
- Step 8: Create Resource Links and Other Materials 242
- Step 9: Decide On and Signal the Course Path 243
- Step 10: Determine and Document Course Logistics and Requirements 243

**BEST PRACTICES FOR EFFECTIVE ONLINE COURSES 243**

- Best Practices for Teaching Online Programs 243
- Best Practices for Managing Online Small-group Work 244
- Best Practices for Assessing Quality of Online Courses 245

**VIRTUAL SCHOOLS 245**

- Background on Virtual Schools 245
- Virtual School Issues 248
- Virtual School Research 249

**VIRTUAL REALITY ENVIRONMENTS 251**

- Types of Virtual Reality Environments 251
- Integration Strategies for Virtual Environments 253

**COLLABORATE, DISCUSS, REFLECT 254**

**SUMMARY 254**

**TECHNOLOGY INTEGRATION WORKSHOP 257**



## PART 4 Integrating Technology Across the Curriculum

### 9 Teaching and Learning with Technology in English and Language Arts 258

LEARNING OUTCOMES 258

**TECHNOLOGY INTEGRATION IN ACTION: MY SIDE OF THE STORY: TEACHING DIGITAL LITERACIES WITH A MULTIMEDIA STORYTELLING PROJECT 259**

**ISSUES AND CHALLENGES IN ENGLISH AND LANGUAGE ARTS 261**

Teachers' Changing Responsibilities for the "New Literacies" 261

New Instructional Strategies to Address New Needs 263

Challenges of Working with Diverse Learners 266

Challenges of Motivating Students to Read and Write 266

Teachers' Growth as Literacy Professionals and Leaders 267

QWERTY Keyboarding: To Teach or Not to Teach? 268

The Cursive Writing Controversy 269

**TECHNOLOGY INTEGRATION STRATEGIES FOR ENGLISH AND LANGUAGE ARTS 269**

Strategies to Support for Word Fluency and Vocabulary Development 271

Strategies to Support Reading Comprehension and Literacy Development 272

Strategies to Support Teaching the Writing Process 273

Strategies to Support Literature Learning 277

Enabling Multimodal Communication and Digital Publishing 278

**TEACHING ENGLISH AND LANGUAGE ARTS TEACHERS TO INTEGRATE TECHNOLOGY 279**

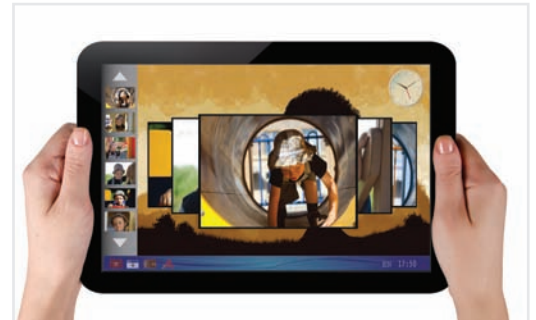
Rubric to Measure Teacher Growth in English and Language Arts Technology Integration 279

Learning the Issues and Applications 281

**COLLABORATE, REFLECT, DISCUSS 281**

**SUMMARY 282**

**TECHNOLOGY INTEGRATION WORKSHOP 283**



### 10 Teaching and Learning with Technology for Foreign and Second Languages 284

LEARNING OUTCOMES 284

**TECHNOLOGY INTEGRATION IN ACTION: WRITING IN BLOGS EN FRANÇAIS 285**

**ISSUES AND CHALLENGES IN FOREIGN AND SECOND LANGUAGE LEARNING 287**

ELL Issue #1: Demands on Content Area Teachers 287

ELL Issue #2: Academic and Language Prerequisites for ELLs 288

ELL Issue #3: The Need to Differentiate Instruction 288

ELL Issue #4: Challenges of Integrating the Students' Native Languages 290

FL Issue #1: The Need for Authentic Materials and Perspectives 291

FL Issue #2: The Need for Creating Audience and Purpose 291

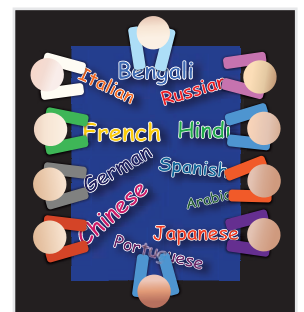
**TECHNOLOGY INTEGRATION STRATEGIES FOR ELL AND FL INSTRUCTION 292**

Support for Authentic Oral Language Practice and Assessment 293

Virtual Collaborations 294

Virtual Field Trips for Modified Language Immersion Experience 295

Teletandem Experiences for Modified Language Immersion 296



- Support for Practice in Language Subskills 296
- Presentation Aids 297
- Support for Text Production 297
- Use of Apps to Support Language Learning and Use 298
- Productivity and Lesson Design Support for Teachers 299

**TEACHING FOREIGN LANGUAGE AND SECOND LANGUAGE TEACHERS TO INTEGRATE TECHNOLOGY 300**

- Rubric to Measure Teacher Growth in Foreign and Second Language Technology Integration 300
- Learning the Issues and Applications 300

**COLLABORATE, DISCUSS, REFLECT 302**

**SUMMARY 303**

**TECHNOLOGY INTEGRATION WORKSHOP 303**

**11 Teaching and Learning with Technology in Mathematics and Science 305**

**LEARNING OUTCOMES 305**

**TECHNOLOGY INTEGRATION IN ACTION: HOT AND COLD DATA 306**

**ISSUES AND CHALLENGES IN MATHEMATICS INSTRUCTION 308**

- Accountability for Standards in Mathematics 308
- Challenges in Implementing the Common Core State Standards for School Mathematics 310
- Directed versus Social-Constructivist Teaching Strategies: Ongoing “Math Wars” 311

**TECHNOLOGY INTEGRATION STRATEGIES FOR MATHEMATICS INSTRUCTION 311**

- Bridging the Gap Between Abstract and Concrete with Virtual Manipulatives 313
- Allowing Representation of Mathematical Principles 313
- Supporting Mathematical Problem Solving 315
- Implementing Data-Driven Curricula 317
- Supporting Math-Related Communications 317
- Motivating Skill Building and Practice 317

**ISSUES AND CHALLENGES IN SCIENCE INSTRUCTION 318**

- Accountability for Standards in Science 318
- The Narrowing Pipeline of Scientific Talent 319
- Increasing Need for Scientific Literacy 320
- Difficulties in Teaching K–8 Science 320
- Objections to Virtual Science Labs 320

**TECHNOLOGY INTEGRATION STRATEGIES FOR SCIENCE INSTRUCTION 321**

- Involving Students in Scientific Inquiry Through Authentic Online Projects 323
- Support for Specific Processes in Scientific Inquiry 323
- Supporting Science Skills and Concept Learning 325
- Engaging Students in Engineering Topics through Robotics 325
- Accessing Science Information and Tools 326

**TEACHING MATHEMATICS AND SCIENCE TEACHERS TO INTEGRATE TECHNOLOGY 327**

- Rubric to Measure Teacher Growth in Mathematics and Science Technology Integration 327
- Learning the Issues and Applications 327

**COLLABORATE, DISCUSS, REFLECT 330**

**SUMMARY 330**

**TECHNOLOGY INTEGRATION WORKSHOP 332**



## 12 Teaching and Learning with Technology in Social Studies 333

LEARNING OUTCOMES 333

### TECHNOLOGY INTEGRATION IN ACTION: I WITNESS ACCOUNTS – SURVIVOR VIDEOS 334

#### ISSUES AND CHALLENGES IN SOCIAL STUDIES INSTRUCTION 336

- Meeting Standards Across Social Studies Areas 336
- Challenges in Teaching Social Studies 338
- The “History Wars” and Other Debates on the Content and Focus of Social Studies 339
- Perils of the Information Explosion 339

#### TECHNOLOGY INTEGRATION STRATEGIES FOR SOCIAL STUDIES 340

- Using Simulations and Problem-Solving Environments 340
- Accessing Primary Sources 341
- Digital Information Critiques 341
- Electronic Research Strategies 341
- Information Visualization Strategies 343
- Virtual Field Trips 343
- Adventure Learning (AL) 344
- Digital Storytelling 344
- Geospatial Analysis Strategies 346

#### TEACHING SOCIAL STUDIES TEACHERS TO INTEGRATE TECHNOLOGY 348

- Rubric to Measure Teacher Growth in Social Studies Technology Integration 348
- Learning the Issues and Applications 348

#### COLLABORATE, DISCUSS, REFLECT 350

#### SUMMARY 350

#### TECHNOLOGY INTEGRATION WORKSHOP 351



## 13 Teaching and Learning with Technology in Music and Art 352

LEARNING OUTCOMES 352

### TECHNOLOGY INTEGRATION IN ACTION: THE FINE ART OF ELECTRONIC PORTFOLIOS 353

#### A RATIONALE FOR INCLUDING TECHNOLOGY IN THE ARTS 355

#### ISSUES AND CHALLENGES IN MUSIC INSTRUCTION 356

- A Changing Definition for Music Literacy 356
- Training Teachers to Meet Music Standards 356
- Downloading of Music Illegally 357
- The Intersection of Popular Music, Technology, and Music Instruction 357
- The Music Director as Small Business Administrator 358

#### TECHNOLOGY INTEGRATION STRATEGIES FOR MUSIC INSTRUCTION 358

- Support for Music Composition and Production 360
- Support for Music Performance 362
- Support for Self-Paced Learning and Practice 363
- Support for Teaching Music History 364
- Support for Interdisciplinary Strategies 365

#### ISSUES AND CHALLENGES IN ART INSTRUCTION 365

- Funding for Art Instruction 365
- Ethical Issues Associated with the Use of Images and Other Materials 366





Accessing Images Used in Art Instruction 366  
The Challenge of Meeting Standards in Arts Instruction 366

#### **TECHNOLOGY INTEGRATION STRATEGIES FOR ART INSTRUCTION 367**

Accessing Art Examples for Classroom Use 367  
Using Teaching Examples and Materials 367  
Producing and Manipulating Digitized Images 367  
Supporting Graphic Design and 3-D Modeling 369  
Supporting Student Development of Publications 370  
Virtual Field Trips to Art Museums 370  
Creating Movies as an Art Form 370  
Sharing Students' Creative and Research Works 371

#### **TEACHING MUSIC AND ART TEACHERS TO INTEGRATE TECHNOLOGY 371**

Rubric to Measure Teacher Growth in Music and Art Technology Integration 371  
Learning the Issues and Applications 374

#### **COLLABORATE, DISCUSS, REFLECT 375**

#### **SUMMARY 375**

#### **TECHNOLOGY INTEGRATION WORKSHOP 376**

## **14 Teaching and Learning with Technology in Health and Physical Education 378**

### **LEARNING OUTCOMES 378**

#### **TECHNOLOGY INTEGRATION IN ACTION: DEVELOPING A PERSONAL FITNESS AND NUTRITION PLAN 379**

#### **ISSUES AND CHALLENGES IN PHYSICAL AND HEALTH EDUCATION 381**

Instructional Time and Quality Physical Education Programs 382  
The Link Between Physical Inactivity and Obesity 382  
Accuracy of Internet Information on Health and Physical Education 383  
Addressing Physical Education and Health Standards 383  
Handling Controversial Health Issues 384

#### **TECHNOLOGY INTEGRATION STRATEGIES FOR HEALTH AND PHYSICAL EDUCATION 384**

Supporting Improved Physical Fitness 387  
Developing and Improving Motor Skill Performance 388  
Assessing Student Learning in the Context of Teaching 390  
Supporting Students' Work in Dance 391  
Shaping Students' Beliefs and Interactions Related to Physical Activity 391  
Helping Students Obtain Valid Health Information 392  
Influencing Health Behaviors 393  
Supporting Interdisciplinary Instruction 394  
Offering Online Health and Physical Education 394

#### **TEACHING HEALTH AND PHYSICAL EDUCATION TEACHERS TO INTEGRATE TECHNOLOGY 395**

Rubric to Measure Teacher Growth in Health and Physical Education Technology Integration 395  
Learning the Issues and Applications 397

#### **COLLABORATE, DISCUSS, REFLECT 397**

#### **SUMMARY 398**

#### **TECHNOLOGY INTEGRATION WORKSHOP 398**





## Teaching and Learning with Technology in Special Education 400

LEARNING OUTCOMES 400

### TECHNOLOGY INTEGRATION IN ACTION: CO-TEACHING TO MEET DIVERSE NEEDS 401

#### INTRODUCTION TO SPECIAL EDUCATION 403

#### ISSUES AND CHALLENGES IN SPECIAL EDUCATION 403

- Special Education and Inclusion Requirements 404
- Policy Drivers of Technology Use in Special Education 405
- Educational Reform and Accountability in Special Education 406
- Trends in the Prevalence of Autism Spectrum Disorders (ASD) 407

#### TECHNOLOGY INTEGRATION STRATEGIES TO MEET SPECIAL NEEDS 407

- Foundations of Integration Strategies for Special Education 407
- Strategies for Students with Cognitive Disabilities 410
- Strategies for Students with Physical Disabilities 412
- Strategies for Students with Sensory Disabilities 413
- Strategies for Students with ASD 414
- Strategies for Students with Gifts and Talents 415

#### TEACHING TEACHERS TO INTEGRATE TECHNOLOGY FOR STUDENTS WITH SPECIAL NEEDS 416

- Rubric to Measure Teacher Growth in Special Education Technology Integration 416
- Learning the Issues and Applications 416

#### COLLABORATE, DISCUSS, REFLECT 419

#### SUMMARY 419

#### TECHNOLOGY INTEGRATION WORKSHOP 420



---

GLOSSARY 421

REFERENCES 429

NAME INDEX 442

SUBJECT INDEX 445

# SPECIAL FEATURES



## HOT TOPICS FOR DEBATE

- Multitasking with Social Networking as Distraction? 14
- What Are “Best Practices” in Technology Integration? 35
- Should Students Play Video Games in School? 95
- Is PowerPoint Really Evil? 129
- Do Classrooms Need Interactive Whiteboards? 147
- Does Social Networking Promote Cyberbullying? 175
- Can Students Learn as Well Online as Face-to-Face? 210
- Are Virtual Schools Widening the Digital Divide? 251
- Should Word Processing Replace Cursive Writing? 269
- What is the Role of Online (Machine) Translators When Learning a Foreign Language? 291
- Do Calculators Mean the End of Memorizing Math Facts? 311
- Should Wikipedia Be Forbidden in Students’ Social Studies Research? 342
- Can an Electronic Music Ensemble Supplant a Traditional One? 356
- Should Exergaming be Included in Physical Education Programs? 388
- Does Online Learning Discriminate Against Students with Disabilities? 406



## ADAPTING FOR SPECIAL NEEDS

- Assistive Technologies and Universal Design Resources 16
- Universal Design for Learning 63
- Instructional Apps, Software, and Web Resources 77
- Word Processing and Other Basic Software Tools 110
- Software Tools 149
- Online Teaching and Learning: Web-Based Tools, Uses, and Development 195
- Online Teaching and Learning: Blended Environments 216

- Online Teaching and Learning: Online-Only Environments 237
- Reading and Writing Tools 267
- English as a Second Language Learning 292
- Problem-Solving Aids, Simulations, and Games for Mathematics and Science 315
- Social Studies 339
- Music and the Arts 364
- Physical Education and Health Education 389

## TOP TEN (POP-UP FEATURE)

- Issues Shaping Today’s Technology Uses in Education 17
- Integration Strategies for Instructional Software 79
- Integration Strategies for the Basic Tool Software 111
- Integration Strategies for Interactive Whiteboards 147
- Sites for Locating Apps in Education 191
- Strategies for Integrating the Internet into the Curriculum 222
- Virtual Education Environments 251

## TOP TEN MUST-HAVE APPS (POP-UP FEATURE)

- Top Ten Must-Have Apps for English and Language Arts 263
- Top Ten Must-Have Apps for ELL/FL 298
- Top Ten Must-Have Apps for Science and Mathematics 326
- Top Ten Must-Have Apps for Social Studies 340
- Top Ten Must-Have Apps for Music 356
- Top Ten Must-Have Apps for Art 367
- Top Ten Must-Have Apps for Health and Physical Education 391
- Top Ten Must-Have Apps for Special Education 407



## OPEN SOURCE OPTIONS

Electronic Portfolios	21
Assessment Tools for Teachers	60
Instructional Software Sites	76
Software Tools from the Basic Suite	111
Software Tools Beyond the Basics	143
Web Development Tools	187
Web-Hosting Sites	225
Online Content	236
English and Language Arts	275
ELL and FL Classrooms	295
Mathematics and Science Classrooms	316
Software in Social Studies Classrooms	338
Software in Art and Music Classrooms	362
Health and Physical Education	390
Special Education	418



## TECHNOLOGY INTEGRATION EXAMPLES

2.1	Phase 1: Analyzing Learning and Teaching Needs	55
2.2	Phase 2: Design of an Integration Framework	59
2.3	Phase 3: Post-Instruction Analysis and Revisions	63
3.1	Using Ratios	83
3.2	Minds on Physics	87
3.3	Crisis at Fort Sumter	92
3.4	Do I Have a Right?	96
3.5	Wait for a Date: Calculating Probability with Geometer's Sketchpad	100
4.1	Mystery Writers!	118
4.2	The Language of Jazz—An Integral Part of American History and Culture	119
4.3	How the Electoral College Works—A Visual Demonstration	124
4.4	Comparing the Weather in Two Locations	125
4.5	Talking Books Enhance Literacy for Kids with Special Needs	132
4.6	Cave Drawings	133
4.7	Here's My Hero	133
5.1	The Road to Revolution	148
5.2	Polling the Class Prior to a Statewide Vote	152
5.3	Fraction to Decimal Jeopardy	154
5.4	Bringing the Planets Closer to Home	158
5.5	Engaging Special Education Students in Math Concepts	159
5.6	Writing Our Own Fairy Tales	161
5.7	Car Lab Project	165
6.1	Online Safety: What Would You Do?	178
6.2	Wiki Tales	189
7.1	Student-Generated Flipped Review Exercises	214
7.2	Webcams Bring Weather to Life	217
7.3	Students as Feature Filmmakers	218
7.4	Webquest—Introducing the English Language!	221
7.5	Connecting Science Students with NASA Resources	222
7.6	Fractured Fairy Tales	222
7.7	Westward Expansion	223
7.8	OF2—Our Footprints, Our Future	224
7.9	Writing with Scientists	224
7.10	Comparing Local Histories	225
8.1	Immerse Yourself in the Smithsonian	253
9.1	“My Pet is Special” Blog	275
9.2	Important Moments: A Narration	279
10.1	My Favorite Museum!	296
10.2	The ABCs of Learning (Language Name)!	298
11.1	Virtual Manipulatives Help Teach Platonic Solids	314
11.2	Think Before You Drink!	324
12.1	Using QR Codes to Tell Our Digital Histories	346
12.2	Are We There Yet?	347
13.1	Why is Downloading Music Illegal?	358
13.2	Organize and Create Music	361
13.3	Visual Biography	369
14.1	Interdisciplinary Activities for Physical Education Concepts	386
14.2	What's the Buzz? Exploring Concepts About Caffeine	392
15.1	Kurzweil 3000- <i>firefly</i>	411
15.2	Collecting and Analyzing Data	413

# PREFACE

After a three-year gestation, the first edition of this textbook emerged in 1996—and what a time to be born! Digital technology in education too, was an infant, on the threshold of becoming a very capable, very unpredictable child. It appeared to have potential, as any youngster does, but how could we have known how far it would go and how thoroughly and unexpectedly its transformation would transform us? This book has grown along with it, chronicling its advances and our responses to them over the years. In those early days of the Digital Age, educators, like the rest of the planet, were taking their fledgling first steps onto the World Wide Web; the first edition of this text was also the first to predict that the Internet would become a major distance education technology. Since then, the tools have become more capable, diverse, and ubiquitous, and societal interest in digital technologies has segued into obsession. But the greatest challenge remains as constant as a compass: deciding how best to make use of technology’s prodigious possibilities. As Richard Florida (2013) said when describing the rise of robots in the workplace, it is not our technology that defines us. Rather it is how we choose to fit it to our needs.

In this seventh edition of *Integrating Educational Technology into Teaching*, as in past ones, I seek to go beyond describing the technical features and capabilities of 21st century technology tools to focus ever more on the teaching and learning strategies they can support. What have we learned so far that enables an enlightened view of technology in education? The following are some clearly defined guidelines on what works best when it comes to matching the needs of the educational community with technology’s capabilities:

- **Good pedagogy comes first**—Advancements in distance education in the late 1990s and in knowledge sharing in the years afterward gave renewed support to those who predicted, as did their predecessors in the 1960s, that technology would decrease or eliminate the need for teachers. However, our experience with these very capable technologies has shown more clearly than ever that the interaction between teachers and students remains an essential quality of effective education. This textbook proposes that technologies are, above all, channels for helping teachers communicate better with students—ways of making their relationships more meaningful and productive. It can make good teaching even better; it cannot make bad teaching good. Consequently, technology-using teachers can never be a force for improved education unless they are first and foremost informed, knowledgeable shapers of their craft. Before integrating technology into their teaching, educators must know a great deal, for example, about why there are different views on appropriate teaching strategies, how societal factors and learning theories have shaped these views, and how each strategy can address differing needs.
- **Technology is us**—Rather than seeing technology as some foreign invader here to confuse and complicate the simple life of the past, we can recognize that technology is very much our own response to overcoming obstacles that stand in the way of a better, more productive way of life. As Walt Kelly’s “profound ’possum” Pogo said, “We have met the enemy, and he is us.” Technology is the tools we fashion and the ways we choose to use them to solve problems in our environment. Turmoil will accompany the transitions as we adapt to the new environment we ourselves have created. But technology is, by definition, intended to be part of our path to a better life, rather than an obstacle in its way.
- **We control how technology is used in education**—Finally, we must recognize the truth of Peter Drucker’s statement: “The best way to predict the future is to create it.” Both individual teachers and teaching organizations must see themselves as enlightened shapers of our future. Each teacher must help to articulate the vision for what the future of education should look like; each should acquire skills that will help realize that vision.

# WHAT'S NEW IN THE SEVENTH EDITION

Best known for its technology integration strategies grounded in strong research, the seventh edition of *Integrating Educational Technology into Teaching* offers a total technology integration package across all content areas that gives your students practice with technology tools as they learn how to incorporate technology into the curriculum to support and shape learning. This edition includes a number of additions that reflect changes in the field of educational technology.

- **NEW!** Chapter 1 has new coverage of issues that affect technology integration such as the need for digital literacy and digital citizenship, as well as information on new methods and technology formats such as Bring Your Own Device (BYOD) and Massive Open Online Courses (MOOCs), and expanded uses of access tools such as tablets.
- **NEW!** Chapter 2 has expanded coverage of each of the relevant behaviorist, cognitive, and constructivist learning theories that underlie technology integration strategies.
- **NEW!** Chapters 6 through 8 have been re-organized to emphasize the rapidly expanding role of online tools and strategies. New coverage includes methods to teach digital literacy and digital citizenship, new uses of social media, and design and use of online and blended learning formats such as flipped classrooms.
- **NEW!** Chapters 9 through 15 each offer strategies and a content-specific rubric that teachers can use to direct and self-assess their growth in technology integration.
- **UPDATED!** All chapters have updated research and examples for tools and/or strategies.
- **UPDATED!** Each chapter has been updated and new content has been added to document and illustrate major changes and trends in the field, such as the new emphasis on:
  - Blended learning (e.g., the flipped classroom)
  - Social media and networking
  - Virtual courses and virtual schools
- **NEW INTERACTIVE ETEXT FEATURES!** An all-new Pearson eText version includes the following interactive features in each chapter:
  - **Author-recorded BIG IDEAS OVERVIEWS (BIO)** on main chapter concepts and points to guide reading.
  - **Top Ten** (in Chapters 1 and 3–8) features highlight and describe the best software features, uses, and strategies for teachers to apply.
  - **Top Ten Must-Have Apps** (in Chapters 9–15) have been recommended by experts in the content area and present apps that are widely used in society; examples help educators see the role these tools are beginning to play in education.
  - **Links to video** illustrations and commentaries from practitioners in the field.
  - **Interactive Technology Learning Checks (TLCs)** at the end of each major section are matched to each chapter learning outcome. These help readers apply the concepts and ensure that they master each chapter outcome.
  - **End-of-chapter Technology Integration Workshops** now include links to a **Technology Application Activities** and a **Technology Lesson Plan Evaluation Checklist** that teachers can use to select most effective integration strategies.

## CORE PRINCIPLES AT THE CENTER OF THIS TEXT

The purpose of this book is to show how we are challenged to shape the future of technology in education. How we respond to this challenge is guided by how we see it helping us accomplish our own informed vision of what teaching and learning should be. Our approach to accomplishing this rests on four premises:

1. **Instructional technology methods should be based in both learning theory and teaching practice**—There is no shortage of innovative ideas in the field of instructional technology; new and interesting methods come forth about as often as new and improved gadgets. Those who would build on the knowledge of the past should know why they do what they do, as well as how to do it. Thus, various technology-based integration strategies are linked to well-researched theories of learning, and we have illustrated them with examples of successful practices based on these theories.
2. **Uses of technology should match specific teaching and learning needs**—Technology has the power to improve teaching and learning, but it can also make a teacher's life more complicated. Therefore, each resource should be examined for its unique qualities and its potential benefits for teachers and students. Teachers should not use a tool simply because it is new and available; each integration strategy should be matched to a recognized need. Do not oppose experimentation, but do advocate informed use.
3. **Old integration strategies are not necessarily bad; new strategies are not necessarily good**—As technologies change and evolve at lightning speed, there is a tendency to throw out older teaching methods with the older machines. Sometimes this is a good idea; sometimes it would be a shame. Each of the integration strategies recommended in this book is based on methods with proven usefulness to teachers and students. Some of the strategies are based on directed methods that have been used for some time; other strategies are based on the newer, constructivist learning models. Each is recommended on the basis of its usefulness rather than its age.
4. **A combination of technological, pedagogical, and content knowledge is necessary**—This textbook maintains that teachers not only need to know the content they are teaching and good pedagogical strategies for connecting students with content, but must also recognize how to integrate technology into pedagogy to achieve greatest impact on desired outcomes. In other words, teachers need what the field now refers to as a combination of Technological Pedagogical Content Knowledge or Tech-PACK.

The goal of this edition is for teachers to see more clearly their role in shaping the future of technology in education. This book illustrates that great education means employing technologies to fulfill the vision they make possible: a worldwide social network and a global community that learns and grows together.

# FEATURES OF THIS TEXT

For the seventh edition, the author maintains a cohesive, comprehensive technology integration framework that builds on strong research and numerous integration strategies. This Technology Integration Framework achieves the following goals:

## Introduces Your Students to Technology Integration

### TECHNOLOGY INTEGRATION IN ACTION SHARING A PASSION FOR POETRY

GRADE LEVEL: Grades 4–5 • CONTENT AREA/TOPIC: Language arts, poetry • LENGTH OF TIME: An hour each day for 6 days

#### PHASE 1 ANALYSIS OF LEARNING AND TEACHING NEEDS



**Step 1: Determine relative advantage.**  
Mr. Lipe is a fifth grade teacher who has great difficulty getting his young students to share his passion for poetry. He tried various teaching approaches, but many students remained indifferent, and few are interested enough to read or write poems after the unit is over. When he taught mathematics activities, he had found that using his interactive whiteboard made it easier to engage students, especially if they played a part in illustrating and practicing concepts. He felt that with the right kinds of activities, he might also engage them in learning about and writing poetry. From a blog for teachers, he learned about some online materials to help teach poetry, some of which could be used with interactive whiteboards and allowed students to publish their work online. After reviewing the materials, he decided to restructure his poetry unit around these activities. He would display the online "poetry engine" on the whiteboard to illustrate several types of poems that kids can write, and it would also allow students some initial practice in writing poems. After more practice in pairs and small groups, each would have to write one poem of each kind, with or without the poetry engine, and each would be allowed to publish one poem on the website.

**Step 2: Assess required resources and skills.**  
Mr. Lipe felt he knew a great deal about writing poetry, since he had had good instructors in his undergraduate program and was a poet himself. But after three years of unsuccessful efforts to engage his students in poetry writing, he felt less confident in his ability to motivate young people on this topic. To improve his instructional approaches, he read through a variety of blogs and online materials looking for ideas on how to teach poetry better. After reading these materials and blogging with colleagues who gave him good leads, he felt more confident that the new approach would be much more motivating to students.

#### PHASE 2 PLANNING FOR INTEGRATION

**Step 3: Decide on objectives and assessments.**  
To help him see if students were achieving what he hoped in the poetry unit, Mr. Lipe created objectives and assessments to measure students' progress in poetry skills, as well as their attitudes toward poetry. The outcomes, objectives, and assessments were:  
**Outcome:** Write three different poems reflecting three different poetry genres.  
**Objective:** After participating in the practice activities, each student writes three poems in correct format, using either a poetry engine or writing on the word processor, and provides an illustration for at least one.  
**Assessment:** A rubric of criteria and points.  
**Outcome:** Feel more positively about poetry.  
**Objective:** At least 80% of students express interest in reading or writing additional poems, reflected in comments to the teacher or poems they offer.  
**Assessment:** Teacher observation.

**Step 4: Design integration strategies.**  
Mr. Lipe knew that the initial activities would be group based, following the organizational abilities of the students. Suddenly, they have to do assignments individually, most middle school students find this difficult. He decided to use assignment notebooks, folders, homework-help Web pages) to help students get organized and keep track of all they are supposed to know and do. However, by October each year some students are "organizationally failing," which makes it difficult for them to do well in their classes.  
While staying organized and keeping track of important details is a lifelong challenge for everyone, difficulties with memory storage and retrieval is a fundamental characteristic of many individuals with learning disabilities. As a result, it is important to help these students find an information management system that is highly effective for them. Many of the following organizational tools have features that offer benefits to these students. However, please note that tools alone will not help students overcome deficits in organization and planning. Teachers and parents must commit to monitor the use of the tools and teaching new strategies to that the student can maximize the power of the tool.

CHAPTER 5 | Technology Tools for 21st Century Teaching

Technology Integration in Action examples, located at the beginning of Chapters 2 through 15, are classroom-based scenarios that provide a classroom context for chapter content by focusing on the selection and use of specific technology within a classroom environment. Each walks the reader through the steps of the Technology Integration Lesson Planning exercise (TIP) Model and is tied to chapter objectives.

Hot Topics for Debate help teachers address social issues that may present obstacles to effective technology integration.

### Hot Topic Debate Can Students Learn as Well Online as Face-to-Face?

Take a position for or against (based either on your own position or one assigned to you) on the following controversial statement. Discuss it in class or on an online discussion board, blog, or wiki, as assigned by your instructor. When the discussion is complete, write a summary of the main pros and cons that you and your classmates have stated, and put the summary document in your Teacher Portfolio.

One of the biggest debates and discussions in distance education is whether learning online is as effective as face-to-face learning. There have been decades of media comparison studies prepared in classrooms using and

not using various technologies. Similar studies have been done comparing distance learning and traditional learning (Bernard et al., 2009), yielding the same results: no significant differences. However, we also know that the dropout rate is higher in distance learning. Many recent studies report the quality and experiences of online student learning are impacted by issues ranging from the amount of interaction with the instructor to the type of media used. If researchers are correct that the learning medium or distance format makes no difference in learning outcomes, why is the dropout rate so high? Can you cite evidence to support or refute the position that all students are able to learn well online?

### Adapting for Special Needs

#### Software Tools

As students enter middle school, the demands of changing classroom organization and the organizational abilities of the students. Suddenly, they have to do assignments individually, most middle school students find this difficult. He decided to use assignment notebooks, folders, homework-help Web pages) to help students get organized and keep track of all they are supposed to know and do. However, by October each year some students are "organizationally failing," which makes it difficult for them to do well in their classes.  
While staying organized and keeping track of important details is a lifelong challenge for everyone, difficulties with memory storage and retrieval is a fundamental characteristic of many individuals with learning disabilities. As a result, it is important to help these students find an information management system that is highly effective for them. Many of the following organizational tools have features that offer benefits to these students. However, please note that tools alone will not help students overcome deficits in organization and planning. Teachers and parents must commit to monitor the use of the tools and teaching new strategies to that the student can maximize the power of the tool.

- Evernote (at the Evernote website) – Helps users organize and make artifacts (a note, image, or link) of things they do, which are then indexed and made searchable.
- PocketMod (at the PocketMod website) – Provides a way of creating a pocket guide of things to do and remember.
- Remember the Milk (at the Remember the Milk website) – Helps users create a system of reminders of tasks to do.
- Things 2 (at the Cultured Code website) – Lets users create an agenda and daily/weekly/monthly to-do lists.
- Toadledo (at the Toadledo website) – Helps users organize tasks they have to do into lists.
- To-doist (at the To Do List website) – Lets users create to-do lists.
- Vivaldi! (at the Vivaldi! website) – Helps users organize their productivity system.
- Voc2do (at the Voc2do website) – An online system that helps users track priority, due dates, and time estimates for a number of different tasks.

#### Characteristics of successful distance learners.

Some researchers have tried to identify student capabilities or other factors that could predict whether a student might drop out, be less satisfied, or not perform as well in an online activity. A study conducted by Patterson and McFadden (2009) concluded that there is no single theory that can fully explain student attrition in distance learning; students likely drop out due to a combination of variables. Hypothesized characteristics of successful distance learners include self-motivation and ability to implement survey and learning (Huang, Chou, & Sebba, 2010), previous experience with technology (Huang, Chou, & Sebba, 2010), a positive attitude toward course subject matter (Huang, Chou, & Sebba, 2010), a sense of control, or a personality characteristic of believing in the benefits of technology (Vandewater & Clarebout, 2011). A study conducted by Damianov et al. (2009) suggested that spending more time online can predict whether students will be successful in online learning environments. Some studies that support a correlation between self-efficacy and improved outcomes in online courses. For example, Alshahr, Freeze, Lane, and Wen (2011) found that students level of comfort with online learning and their "Web self-efficacy" (p. 437), or belief that they were good at using the Internet, could predict their satisfaction in online courses.

#### Characteristics of successful distance instructors.

Fish and Wickersham (2009) found that distance learning instructors need different skills than instructors for

Adapting for Special Needs features give your students alternative software and technology suggestions to consider for use in supporting students with special needs.

TECHNOLOGY LEARNING CHECK  
Complete TLC 5.2 to review what you have learned from reading this section about materials generator features and uses.

### USING DATA COLLECTION AND ANALYSIS TOOLS

Data collection and analysis tools include database software, statistical software packages, online survey sites, student information systems, online and computer-based testing systems, and student response systems, or clickers. A summary of these tools, with sample products and classroom uses, is shown in Table 5.3.

#### Database Software

Databases are computer programs that allow users to store, organize, and manipulate information, including both text and numerical data. Database software can perform some calculations, but its real power lies in allowing people to locate information through keyword searches. A database program is most often compared to a file cabinet or a Rolodex card file. Like these precomputer devices, the purpose of a database is to store important information in a way that makes it easy to locate later. This capability has become increasingly important as society's store of essential information grows in volume and complexity.

CHAPTER 5 | Technology Tools for 21st Century Teaching—Beyond the Basics | 149



# Helps Your Students Plan for Effective Technology Integration

## Technology Integration Examples (TIEs) ▶

located in Chapters 3 through 15 offer numerous technology lesson ideas that can be incorporated into lesson planning across the curriculum. Each lesson suggestion is correlated to the ISTE National Educational Technology Standards for Students (ISTE Standards•S) and Common Core State Standards.

## TECHNOLOGY INTEGRATION

### Example 5.1

**TITLE:** The Road to Revolution  
**CONTENT AREA/TOPIC:** Social studies, history  
**GRADE LEVELS:** 9–12  
**NETS FOR STUDENTS:** Standard 1—Creativity and Innovation; Standard 2—Communication and Collaboration; Standard 6—Technology Operations and Concepts  
**CCSS:** CCSS.ELA-LITERACY.RH.9–10.2, CCSS.ELA-LITERACY.RH.9–10.3, CCSS.ELA-LITERACY.RH.11–12.6  
**NCSST THEMES:** Thematic Standards: 1- Culture and Diversity; 3- People, Places, and Environments; 6- Power, Authority, and

Governance; Disciplinary Standards: 1 - History  
**DESCRIPTION:** Students listen to scenarios of events leading up to the Revolutionary War as the teacher displays information about the events on the whiteboard. As a whole group, students choose what they would do in response to each event. Each choice leads them to the next event where they see results of their choices. In the end, they reach the point where Britain closes Boston Harbor, and students must decide whether they identified most with Loyalists, Patriots, or Neutralists.  
**SOURCE:** Based on a concept from the Smart Exchange lesson “The Road to Revolution” at <http://exchange.smarttech.com>.

## USING MATERIALS GENERATORS

Materials generators include desktop publishing software, Web page editors, whiteboard activity software, worksheet and puzzle generators, IEP generators, graphic document makers, and PDF and forms makers. A summary of these, with sample products and classroom uses, is shown in Table 5.2. Also see here a summary of free software tools in Open Source Options.

## OPEN SOURCE OPTIONS

for Tool Software Sites

TYPES	FREE SOURCES
Materials generators	Scribus: <a href="http://scribus.net">scribus.net</a> NVU Web design software: <a href="http://nvu.com">nvu.com</a> Puzzle maker: <a href="http://discoveryeducation.com/tree-puzzlemaker/">discoveryeducation.com/tree-puzzlemaker/</a> Certificate maker: <a href="http://certificatemaker.com">certificatemaker.com</a> PDFforge PDF maker: <a href="http://pdfforge.org">pdfforge.org</a> PageBreeze forms maker: <a href="http://formbreeze.com">formbreeze.com</a> Listing of free statistical software: <a href="http://freestatistics.info/en">freestatistics.info/en</a>
Data collection and analysis tools	Gradesbook (Engrade): <a href="http://engrade.com">engrade.com</a> Test generator: <a href="http://mytest.vocabtest.com">mytest.vocabtest.com</a> Rubric maker—Rubistar (use program to create a rubric or use pre-made rubrics): <a href="http://rubistar.4teachers.org">rubistar.4teachers.org</a>
Testing and grading tools	Inkscape graphics editor Tux Paint drawing software Gimp image editing software Charting/graphing tools Free WAV sound files: <a href="http://thesourceforge.net">thesourceforge.net</a> Open font library: <a href="http://launchfont.com">launchfont.com</a> Free animations: <a href="http://free-an.com">free-an.com</a>
Graphics tools	OpenSIS student information system SchoolForge SIS: schoolforge.org Parent-teacher conference tool: <a href="http://parentteacher.com">parentteacher.com</a>
Planning and organizing tools	GoldenDict: <a href="http://goldendict.com">goldendict.com</a> Lingoes: <a href="http://lingoes.net/">lingoes.net/</a> Wikipedia: <a href="http://en.wikipedia.org/">en.wikipedia.org/</a>
Research and reference tools	Archimedes CAD system Audacity sound editor software Music Editor Free: musiceditor.com Free online readability calculator: <a href="http://www.readability.com">www.readability.com</a> Online graphing calculator: <a href="http://www.desmos.com">www.desmos.com</a> U.S. Census Bureau TIGER: <a href="http://tiger.census.gov">tiger.census.gov</a> Language translators: <a href="http://www.google.com/translate">www.google.com/translate</a>
Content-area tools	

## COLLABORATE, DISCUSS, REFLECT



Monkey Business/Fotolia

The following questions may be used either for in-class, small-group discussions or may initiate discussions in blogs or online discussion boards:

1. Visit the Common Sense Media website and review its Digital Citizenship Curriculum (under the Education menu button). How could a grasp of these skills and attitudes help young people in learning and in their social contacts with other students?
2. In his 2012 editorial “Will MOOCs Destroy Academia?” from the *Communications of the ACM*, Vardi opines that “due to the seductive possibilities of lower costs . . . the very value of college education is being seriously questioned” (p. 5). What evidence can you cite to support or refute the idea that MOOCs will threaten education as we know it? Will it have any impact on K–12 schools?
3. Gene Glass, originator of meta-analysis techniques, said, “Experienced education leaders worry that something is lost when teachers are replaced by avatars and real life is replaced by Facebook . . . only a fool believes everything that can be gained from face-to-face teaching and learning also can be acquired online” (2010, p. 34). Give examples from research and practice to support or refute Glass’s analysis.
4. Go to Edutopia’s website and do the following two activities:
  - a. In Edutopia’s “Technology Integration Research Review” from February 5, 2013, there is evidence summarizing the impact of educational technologies; learn what research can teach us about effective uses of technology for learning. Read especially the studies by subject area, such as science or writing. Summarize what you learned about the overall benefits of technology-based strategies and of using technology to teach your subject.
  - b. Also at the Edutopia website, click on the Video tab to access the video collection. In the Search by Topic window, use the menu to browse videos by topic, and select Technology Integration. Watch one of the videos. (i) Which of the perspectives that shaped educational technology is evident in the video? (ii) Refer to Figure 1.7 in the text, and list elements that show which reasons the technology in the video is being used.
5. Educational technology historian Paul Saettler (1990) said, “Computer information systems are not just objective recording devices. They also reflect concepts, hopes, beliefs, attitudes” (p. 539). Contrast the concepts, hopes, beliefs, and attitudes that our past versus current uses of technology in education reflect.
6. Richard Clark’s now-famous comment about the impact of computers on learning was that the best current evidence is that media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes change in our nutrition (Clark, 1983, p. 445). Why has this statement had such a dramatic (and, in some cases, emotional) impact on educational technology practitioners? What evidence could you cite to respond to it?
7. In their study of students’ reasons for online plagiarism, Comas-Forgas and Sureda-Negre (2010) found that some students say it “is easier, simpler and more comfortable than doing the work yourself” (p. 223). Can you suggest arguments that would help persuade students that online plagiarism, while easy and quick, is not in their best interests?

◀ **Collaborate, Discuss, Reflect features** provide students with questions they can use either for in-class, small-group discussions or to initiate discussions in blogs or online discussion boards.

◀ **Summaries** at the end of each chapter tie back to the learning outcomes and act as study aids by summarizing and reviewing critical chapter content.

▶ **Open Source Options** are free resources that help teachers stretch their limited budgets for educational materials.

## Chapter 1 Summary

The following is a summary of the main points covered in this chapter.

**1. Introduction: The “Big Picture” on Technology in Education**

- This chapter’s “big picture” review provides an important framework for viewing the field and consists of key terminology, reflections on the past, considerations about the present, and a look ahead to the future.
- Four perspectives help define today’s educational technology: educational technology as communications media (originally represented by AECT); educational technology as instructional systems and instructional design (originally represented by ISPI); educational technology as vocational training

# Helps Your Students Practice Technology Integration

## TECHNOLOGY INTEGRATION WORKSHOP

### 1. APPLY WHAT YOU LEARNED

To apply the concepts and skills you've read about throughout this chapter, go to the [Chapter 2 Technology Application Activity](#).

### 2. TECHNOLOGY INTEGRATION LESSON PLANNING: PART 1—EVALUATING AND CREATING LESSON PLANS

Complete the following exercise using the sample lesson plans found on any lesson planning site that you find on the Internet.

- Locate lesson ideas—Identify three lesson plans that focus on any of the tools or strategies you learned about in this chapter. For example, select those that reflect:
  - Directed integration strategies
  - Constructivist integration strategies
  - Integration strategies useful to support with directed or constructivist approaches
- Evaluate the lessons—Use the [Technology Lesson Plan Evaluation Checklist](#) to evaluate each of the lessons you found.
- Create your own lesson—After you have reviewed and evaluated some sample lessons, create one of your own using a lesson plan format of your choice (or one your instructor gives you). Be sure the lesson focuses on one of the strategies discussed in this chapter.

### 3. TECHNOLOGY INTEGRATION LESSON PLANNING: PART 2—IMPLEMENTING THE TIP MODEL

Review how to implement the TIP Model in your classroom by doing the following activities with the lesson you created in the Technology Integration Lesson Planning exercise above.

- Describe the Phase 1—Planning activities you would do to use this lesson in your classroom:
  - What is the relative advantage of using the technology(ies) in this lesson?
  - Do you have resources and skills you need to carry it out?
- Describe the Phase 2—Implementation activities you would do to use this lesson in your classroom:
  - What are the objectives of the lesson plan?
  - How will you assess your students' accomplishment of the objectives?
  - What integration strategies are used in this lesson plan?
  - How would you prepare the learning environment?
- Describe the Phase 3—Evaluation/Revision activities you would do to use this lesson in your classroom: What strategies and/or instruments would you use to evaluate the success of this lesson in your classroom, in order to determine revision needs?
- Add lesson descriptors—Create descriptors for your new lesson (e.g., grade level, content and topic areas, technologies used, NETS standards, 21st Century Learning standards).
- Save your new lesson—Save your lesson plan with all its descriptors and TIP Model notes.

### 4. FOR YOUR TEACHING PORTFOLIO

- Lesson plan evaluations, lesson plans and products you created above
- Products of your group's Hot Topic Debates
- Products of your group's Collaborate, Discuss, Reflect online or in-class activities.

CHAPTER 2 | Theory into Practice—Foundations for Effective Technology Integration | 71

◀ **A Technology Integration Workshop**, located at the end of every chapter, includes hands-on, interactive activities that connect chapter content to real-life practice. Each Workshop contains the following:

- Technology Integration Lesson Planning** exercises, which provide students the opportunity and resources to evaluate a set of technology integration lessons and to modify or create their own lesson plans to meet their classroom needs.
- An Implementing the TIP Model** activity, which asks teachers to show how they would implement the TIP Model in their classrooms by doing activities with the lesson(s) they created in the Technology Integration Lesson Planning exercise.
- For Your Teaching Portfolio** feature, which directs students to save the material they created in each chapter in a personal portfolio.

## NEW INTERACTIVE ETEXT FEATURES!

An all-new Pearson eText version includes the following interactive features in each chapter:

**Author-recorded BIG IDEAS OVERVIEW (BIO)** on main chapter concepts and points to guide reading. ▶



### CHAPTER 4 BIG IDEAS OVERVIEW

Before you begin reading the rest of this chapter, listen to the [Chapter 4 Big Ideas Overview](#). It will give you a two-minute audio overview of main concepts to look for and help prepare you to work through information and exercises to achieve this chapter's outcomes.

### VIRTUAL REALITY ENVIRONMENTS

The potential of virtual reality (VR) systems to make cyberspace seem real has been talked about since William Gibson's 1984 novel, *Neuromancer*, in which people used **avatars**, or graphic icons, to represent themselves in virtual environments. Until recently, however, that potential has been tapped more for video games than for education. That is changing as better, more useful educational tools become available. Three types of environments are described here, along with integration strategies for them. Also, a sample of these virtual tools is shown in the [Top Ten Virtual Education Environments](#).

◀ **Top Ten** (in Chapters 1, 3–8) pop up features highlight and describe the best software features, uses, and strategies for teachers to apply.

**Top Ten Must-Have Apps** (in Chapters 9–15) present apps that are widely used in society, and examples help educators see the role these tools are beginning to play in education. ▶

### A Changing Definition for Music Literacy

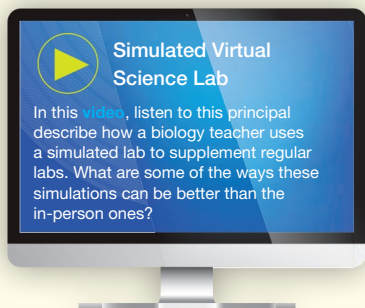
In music education, the term *music literacy* usually means an ability to read standard music notation. But the computer enables—if not encourages—experimentation with alternative ways to represent music. The earliest **music sequencers**, even those with notation capability, have always included a "graphic" or "matrix" editor, a window in which the user could edit music by dragging, deleting, or expanding small rectangles on a grid. Touchscreen interfaces such as those found on tablets have also led to apps that use similar drawing metaphors for creating music. These include apps such as Beatwave, Kaossilator, and Musyc, among others. See a list of the [Top Ten Must-have Apps for Music](#).

**Interactive Technology Learning Checks (TLCs)** at the end of each major section matched to each chapter learning outcome. These help readers apply the concepts and ensure that they master each chapter outcome. ►



#### TECHNOLOGY LEARNING CHECK

Complete **TLC 2.5** to review what you have learned from reading this section about technology integration strategies based on both models.



◀ **Links to video** illustrations and commentaries from practitioners in the field.

**End-of-chapter Technology Integration Workshops** now include: **Technology Application Activities and Technology Lesson Plan Evaluation Checklists** ►

## TECHNOLOGY INTEGRATION WORKSHOP

### 1. APPLY WHAT YOU LEARNED

To apply the concepts and skills you've read about throughout this chapter, go to the [Chapter 7 Technology Application Activity](#).

### 2. TECHNOLOGY INTEGRATION LESSON PLANNING: PART 1—EVALUATING AND CREATING LESSON PLANS

Complete the following exercise using the sample lesson plans found on any lesson planning site that you find on the Internet.

- Locate lesson ideas—Identify three lesson plans that focus on any of the tools or strategies you learned about in this chapter. For example:
  - Web-based lessons and projects
  - Podcasts and vodcasts
  - Flipped classroom and other blended models
- Evaluate the lessons—Use the [Technology Lesson Plan Evaluation Checklist](#) to evaluate each of the lessons you found.
- Create your own lesson—After you have reviewed and evaluated some sample lessons, create one of your own using a lesson plan format of your choice (or one your instructor gives you). Be sure the lesson focuses on one of the technologies or strategies discussed in this chapter.

## SUPPORT MATERIALS FOR INSTRUCTORS

The following resources are available for instructors to download on [www.pearsonhighered.com/educators](http://www.pearsonhighered.com/educators). Instructors enter the author or title of this book, select this particular edition of the book, and then click on the “Resources” tab to log in and download textbook supplements.

### Instructor's Resource Manual and Test Bank (0133955389)

The *Instructor's Resource Manual and Test Bank* includes a wealth of interesting ideas and activities designed to help instructors teach the course. Each chapter contains learning outcomes, key terms, key concepts, and group activities, as well as a comprehensive test bank containing multiple choice, short answer and essay questions.

## PowerPoint Slides (0133971988)

Designed for teachers using the text, the *PowerPoint™ Presentation* consists of a series of slides that can be shown as is or used to make handouts or overhead transparencies. The presentation highlights key concepts and major topics for each chapter.

## TestGen (0133944859)

*TestGen* is a powerful test generator available exclusively from Pearson Education publishers. You install TestGen on your personal computer (Windows or Macintosh) and create your own tests for classroom testing and for other specialized delivery options, such as over a local area network or on the web. A test bank, which is also called a Test Item File (TIF), typically contains a large set of test items, organized by chapter and ready for your use in creating a test, based on the associated textbook material.

The tests can be downloaded in the following formats:

- TestGen Testbank file—PC
- TestGen Testbank file—MAC
- TestGen Testbank—Blackboard 9 TIF
- TestGen Testbank—Blackboard CE/Vista (WebCT) TIF
- Angel Test Bank (zip)
- D2L Test Bank (zip)
- Moodle Test Bank
- Sakai Test Bank (zip)

## ACKNOWLEDGMENTS

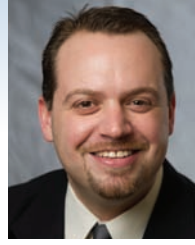
Both the goal and challenge of this book have been to provide the reader with the most up-to-date, yet foundational, theory, research, and practices in educational technology across the disciplines. I believe this goal has been achieved. As in any project, realizing this goal would not have been possible without the assistance of numerous individuals who helped sharpen the focus of this edition. These individuals include the reviewers for this edition: Li-Ling Chen, California State University at East Bay; Mary Jo Dondlinger, Texas A&M University, Commerce; Lynne M. Pachnowski, University of Akron; Karen M. McFerrin, Ed.D., Northwestern State University; Kevin Oliver, North Carolina State University.

Very special, heartfelt thanks go out to the school principals who agreed to share on video their invaluable perspectives on how current technologies are being used in their schools: Dr. Tony Donen, principal at the STEM School Chattanooga; Ms. Tammy Helton, Principal at East Ridge High School in Chattanooga; and Dr. Sonja Rich, Principal at the Hamilton County Virtual School. I learned so much from each of you! Thanks also to my two “in-house photographers,” Bill Wiencke and Paige Wiencke, for all your work to capture the essence of this edition with their photos; and to the students at East Ridge High School and Dalewood Middle School in Chattanooga, who served as our model technology users. We appreciated the special assistance of Talley Caldwell and principal Christian Earl to make possible photos at Dalewood Middle School. Thanks also go out to Stacey Hill of the STEM School Chattanooga for her informed—and quick—work with CCSS labels.

I would also like to thank Aaron Doering, who contributed to the last two editions, and to our contributors for the current edition who include the following:



**Chapter 9**  
Teaching and Learning with Technology  
in English and Language Arts  
**Joan E. Hughes**, Professor  
*University of Texas, Austin*  
*College of Education*



**Chapter 13**  
Teaching and Learning with Technol-  
ogy in Music and Art  
**Jay Dorfman**, Assistant Professor  
*Boston University*  
*College of Fine Arts*



**Chapter 10**  
Teaching and Learning with Technology  
in Foreign and Second Languages  
**Phillip Hubbard**, Director, English for  
Foreign Students  
*Stanford University*  
*School of Humanities and Sciences*



**Chapter 14**  
Teaching and Learning with Technol-  
ogy in Health and Physical Education  
**Derrick Mears**, Program Coordinator,  
Ed.S. in Curriculum and Instruction  
*University of Arkansas*  
*College of Education*



**Chapter 11**  
Teaching and Learning with Technology  
in Mathematics and Science  
**Maggie Niess**, Professor Emeritus  
*Oregon State University*  
*College of Education*



**Chapter 15**  
Teaching and Learning with Technol-  
ogy in Special Education and Adapting  
for Special Needs features  
**Dave Edyburn**, Professor  
*University of Wisconsin, Milwaukee*  
*School of Education*



**Chapter 12**  
Teaching and Learning with Technology  
in Social Studies  
**Michael J. Berson**, Professor  
*University of South Florida*  
*College of Education*

And finally, the incredible support from the Pearson Education staff is impossible to measure. I could not have survived the massive amount of revision work and logistical challenges of this edition if it were not for the clear vision, high expertise, and caring support of our Senior Development Editor, Max Chuck. Max, you're still the best! I would also like to recognize the rest of the editorial and production team—Senior Acquisitions Editor, Meredith Fossel; Editorial Assistant, Maria Feliberty; Executive Field Marketer, Krista Clark; Senior Marketing Manager, Christopher Barry; Program Managers Janet Domingo and Karen Mason; Project Managers, Cynthia DeRocco and Jessica Sykes; Media Producer, Allison Longley; and Art Director, Diane Lorenzo—who made this version of the book useful, attractive, and meaningful. Thank you for your indispensable contributions to this text.

I would like to recognize the enduring love and patience of my family, Bill and Paige Wiencke, and the tenacious loyalty of all our friends in various parts of our global village. Also, I would like to continue to remember and acknowledge the incalculable contributions of those who are with us now only in memory: parents Servatius L. and P. Catherine Roblyer and Raymond and Marjorie Wiencke, and mentor and friend FJ King. Finally, I would like to acknowledge all the educators whose perseverance and commitment to their students remains a constant we can count on as we face the challenges of technological change.

—M. D. Roblyer

# 1

# Educational Technology in Context

## THE BIG PICTURE

### Learning Outcomes

After reading this chapter and completing the learning activities, you should be able to:

1. Analyze how the following work together to shape today's educational technology events and trends in schools: (a) different groups' historical perspectives on educational technology; and (b) current definitions for educational technology, instructional technology, and integrating educational technology. (ISTE Standards•T 5)
2. Identify periods in the history of digital technologies, and describe what we have learned from this history that can help us use educational technology effectively today. (ISTE Standards•T 5)
3. Place a given educational technology resource in one of the general hardware categories (microcomputer, handheld, display, imaging, peripheral, or external storage), software categories (instructional, productivity, and administrative), or media (e.g., flash drive, CD, DVD). (ISTE Standards•T 4, 5)
4. Identify and analyze the impact of societal, educational, cultural/equity, and legal/ethical issues on current uses of technology in education. (ISTE Standards•T 4, 5)
5. Identify examples of technology literacy and other 21st-century skills that teachers and their students need in order to be prepared for future learning and the world of work, and select a teaching portfolio format from available technology-based platforms to document your accomplishment of these skills and Tech-PACK growth. (ISTE Standards•T 5)
6. Generate a personal rationale for using technology in teaching based on research findings, popular teaching practices, and types of problems that technology applications can solve. (ISTE Standards•T 5)
7. Identify trends in emerging technologies and describe how they shape trends in teaching and learning. (ISTE Standards•T 5)

Vladgrin/Shutterstock



# TECHNOLOGY INTEGRATION IN ACTION: THEN AND NOW

## THEN . . .

Anna was almost as proud of her new classroom computers as she was of her new teaching degree. She had high hopes for the 1980–1981 school year in her first teaching position, especially since the principal had asked her if she could use two brand-new Apple computer systems that had been donated to the school. As a student teacher, she had helped children use **computer-assisted instruction (CAI)** on terminals that were located in the school's computer lab and connected by telephone lines to her university's big mainframe computer, but this would be much different. Now the computers would be located right in her classroom, and how she used them would be completely up to her. With her new skills and these marvelous devices at her disposal, she felt a heady sense of power and anticipation.

She found some shareware and other free drill-and-practice and instructional game software packages, and successfully lobbied the principal to buy others. She planned to buy yet more with money she would raise from bake sales. All the students wanted to use the computers, but with only two machines, Anna quickly devised activities that allowed everyone to have a turn. She had relay-race math practices to help students prepare for tests, and she created a computer workstation where they could play math games as a reward for completing other activities and where she could send students in pairs to practice basic skills.

As Anna used her new computers, she coped with a variety of technical problems. Some of the software was designed for an earlier version of the Apple operating system, and each disk required a format adjustment every time it was used. Programs would stall when students entered something the programmers had not anticipated; students had to either adjust the code or restart the programs. Despite these and other difficulties, by the end of the year Anna was still enthusiastic about her hopes, plans, and expectations. She felt she had seen a glimpse of a time when computers would be an integral part of everyday teaching activities. She planned to be ready for the future.

## NOW . . .



As she prepared to begin another school year, Anna found it difficult to believe it had been over 35 years since that first pioneering work with her Apple microcomputers. This school year, she had received a set of tablet computers, part of the district's one child-one computer initiative, and an **interactive whiteboard**, a device that would allow her to project information from a computer to a screen and then manipulate it either with special pens or hands. The school district had offered these tools to any teachers who proposed innovative ways to engage girls and minority students in math and science projects. With these devices, it would be so much easier for her students to access online math manipulatives and science simulations and collaborate with students in other locations. Her class's favorite activity this year was working with students around the state to gather and compare data on local environmental conditions, but they also liked the spreadsheet software's "Buy a Car" activity.

Anna also marveled at how most other teachers in the school were using technology in productive ways. Everyone communicated via email or online chats, and many, like herself, had their own, school-approved social network site so that students and parents could get up-to-date information on school and classroom activities. Students were using graphing calculators to solve problems, and they used online programs to practice foreign languages. She often heard them talking about webquests and virtual field trips they were doing in science and social studies. A video project to interview war veterans had drawn a lot of local attention, and the student projects displayed on school bulletin boards were ablaze with screen captures from websites and images students had taken with digital cameras.

There were still problems, of course. Computer viruses and spam sometimes slowed the district's network, and the firewall that had been put in place to prevent students from accessing undesirable Internet sites also prevented access to many other, perfectly good sites. Teachers reported intermittent problems with online bullying and inappropriate postings on social network sites, despite the schools' Acceptable Use Policies. Some teachers complained that they had no time for innovative technology-based projects because they were too busy preparing students for the new state and national tests that would determine their schools' ratings and their own teacher effect scores.

Yet despite these concerns, Anna was amazed at how far educational technology had come from those first, hesitant steps in the classroom, and how much more there still was to try. She knew other teachers her age who had retired, but she was too interested in what she was doing to think about that. She was helping with a virtual program for homebound students and leading a funded project to develop curricula for the district’s social media. Not a day went by that a teacher didn’t come to her for help with a new project. She couldn’t wait to see what challenges lay ahead. She looked forward to the future.



## CHAPTER 1 BIG IDEAS OVERVIEW

Before you begin reading the rest of this chapter, listen to the [Chapter 1 Big Ideas Overview](#). It will give you a two-minute audio overview of main concepts to look for and help prepare you to work through information and exercises to achieve this chapter’s outcomes.

### INTRODUCTION: THE “BIG PICTURE” ON TECHNOLOGY IN EDUCATION

Today’s educators tend to think of educational or instructional technology as devices or equipment—particularly the more modern, digital devices, such as computers, cell phones, and tablets. But educational technology is not new at all, and it is by no means limited to the use of devices. Modern tools and techniques are simply the latest developments in a field that is as old as education itself. This chapter begins our exploration of educational technology with an overview of the field, from the early perspectives that shaped and defined it to the tools and conditions that determine the role it is able to play in today’s society.

### Why We Need the “Big Picture”

The “big picture” review in this section serves an important purpose: It helps new learners develop mental pictures of the field, what Ausubel (1968) might call cognitive frameworks, through which to view all applications and consider best courses of action. This framework takes the following form.

- **Key terminology.** Talking about a topic requires knowing the vocabulary relevant to that topic. Educators who want to study the field must recognize that language used to describe technology reflects differing perspectives on the appropriate uses of educational technology.
- **Reflecting on the past.** Showing where the field began helps us understand where it is headed and why. Reflecting on changes in goals and methods in the field over time casts new light on the challenges and opportunities of today’s technologies.
- **Considering the present.** The current role of educational technology is shaped primarily by two factors: available technology resources and our perspectives on how to use them. Available technologies dictate what is possible; a combination of social, instructional, cultural, and legal issues influence the directions we choose to take.
- **Looking ahead to the future.** Technology resources and societal conditions change so rapidly that today’s choices are always influenced as much by emerging trends as by current conditions. To be informed citizens of an information society, teachers must be futurists.

### Perspectives That Define Educational Technology

Saettler (1990) says that the earliest references to the term *educational technology* were by radio instruction pioneer W. W. Charters in 1948, and *instructional technology* was first used by audiovisual expert James Finn in 1963. Even in those early days, definitions of these terms focused on more than just devices and materials. Saettler notes that the 1970 Commission on



Instructional Technology defined educational technology as both “the media born of the communication revolution which can be used for instructional purposes” (p. 6) and “a systematic way of designing, carrying out, and evaluating the total process of learning and teaching” (p. 6). As the 1970 commission concluded, a broader definition of educational technology that encompasses both tools and processes “belongs to the future” (Saettler, 1990, p. 6).

If educational technology is viewed as both processes and tools, it is important to begin by examining four different historical perspectives on these processes and tools, all of which have helped shape current practices in the field. These influences come to us from four areas of education and society, each with a unique outlook on what technology in education is and should be. Some of these views have merged over time, but each retains a focus that tends to shape integration practices. These four views and professional organizations that have represented them are summarized in Table 1.1.

**Perspective #1: Educational technology as communications media.** This perspective grew out of the audiovisual (AV) movement in the 1930s, when higher education instructors proposed that media such as slides and films delivered information in more concrete, and, therefore, more effective, ways than did lectures and books. This movement produced audiovisual communications, or the “branch of educational theory and practice concerned primarily with the design and use of messages that control the learning process” (Saettler, 1990, p. 9). The view of educational technology as delivery media has dominated areas of education and the communications industry.

**Perspective #2: Educational technology as instructional systems and instructional design.** This view originated with post–World War II military and industrial trainers who were faced with preparing large numbers of personnel quickly. Based on efficiency studies and learning theories from educational psychology, they advocated using more planned, systematic approaches to developing uniform, effective materials and training procedures. Their view was based on the belief that both human (teachers) and nonhuman (media) resources could be part of an efficient system for addressing any instructional need. Therefore, they equated “educational technology” with “educational problem solutions.” This perspective has evolved into **human performance technology** or a systematic approach to improving human productivity and competence by using strategies for solving problems.

**Perspective #3: Educational technology as vocational training.** Also known as **technology education**, this perspective originated with industry trainers and vocational educators in the 1980s. They believed (1) that an important function of school learning

**TABLE 1.1** Organizations with Various Perspectives on Technology in Education

Association for Educational Communications and Technology (AECT)	International Technology and Engineering Educators Association (ITEEA)	International Society for Performance Improvement (ISPI)	International Society for Technology in Education (ISTE)
<b>Perspectives on Technology in Education and Training</b>			
<i>Initial focus:</i> Audio-visual (AV) devices and media	<i>Initial focus:</i> Manufacturing and materials skills	<i>Initial focus:</i> Information concerned with programmed instruction	<i>Initial focus:</i> Computer systems
<i>Now:</i> Using any resources to improve teaching and learning	<i>Now:</i> STEM education and careers	<i>Now:</i> Improving human performance	<i>Now:</i> Digital devices and systems
<b>Current Definitions for Technology in Education/Training</b>			
<i>Educational technology</i> is facilitating learning and improving performance by creating and using technological processes and resources.	<i>Technology education</i> is problem-based learning using STEM principles.	<i>Human performance technology</i> is a systematic approach to improving productivity and competence.	<i>Educational technology</i> is the full range of digital hardware used to support teaching and learning.

is to prepare students for the world of work in which they will use technology, and (2) that vocational training can be a practical means of teaching all content areas, such as math, science, and language. This view brought about a major paradigm shift in vocational training in K–12 schools away from industrial arts curricula centered in woodworking/metals and graphics/printing shops and toward technology education courses taught in labs equipped with technology stations, such as graphics production, robotics systems, and **computer-aided design (CAD) software**, a program used by architects and others to aid in the design of structures such as houses and cars.

**Perspective #4: Educational technology as computer systems (a.k.a., educational and instructional computing).** This view began in the 1950s with the advent of computers and gained momentum when they began to be used instructionally in the 1960s. As computers began to transform business and industry practices, both trainers and teachers began to see that computers also had the potential to aid instruction. From the time computers came into classrooms in the 1960s until about 1990, this perspective was known as educational computing and encompassed both instructional and administrative support applications.

At first, programmers and systems analysts created all applications. But by the 1970s, many of the same educators involved with media, AV communications, and instructional systems also were researching and developing computer applications. By the 1990s, educators began to see computers as part of a combination of technology resources, including media, instructional systems, and computer-based support systems. At that point, educational computing became known as **educational technology**.

## How This Textbook Defines Technology in Education

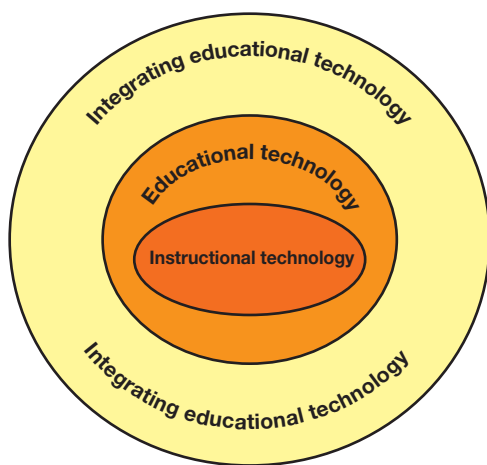
Each of these four perspectives on technology in education has contributed to the current body of knowledge about processes and tools to address educational needs. Since an informed use of educational technology must focus on all of these perspectives, this textbook attempts to merge them in the following ways:

- **Processes**—For the processes, or instructional procedures for applying tools, we look to (1) learning theories based on the sciences of human behavior, and (2) applications of technology that help prepare students for future jobs by teaching them skills in using current tools, as well as skills in “learning to learn” about tools of the future that have not yet been invented—or even imagined.
- **Tools**—This textbook looks at the roles technology tools play as delivery media, instructional systems, and technology support, and focuses primarily on those tools that play a current, high-profile role in furthering teaching and learning.

Figure 1.1 shows the framework in which to view these tools and processes. The terms shown in this figure have the following “evolving” definitions:

- **Educational technology** is a combination of the *processes* and *tools* involved in addressing educational needs and problems, with an emphasis on applying the most current digital and information tools.
- **Integrating educational technology** refers to the process of *matching digital tools and methods* to given educational needs and problems.
- **Instructional technology** is the *subset of educational technology* that deals directly with teaching and learning applications (rather than educational administrative ones).

**FIGURE 1.1** A Framework for Viewing Educational Technology



### TECHNOLOGY LEARNING CHECK

Complete **TLC 1.1** to review what you have learned from reading this section about basic perspectives and definitions underlying technology integration.

# YESTERDAY'S EDUCATIONAL TECHNOLOGY: HOW THE PAST HAS SHAPED THE PRESENT

Though a “technology” can be anything from a pencil to a virtual environment, the modern history of technology in education has been shaped in large part by developments in digital technologies, such as computers. The four eras in the history of digital technologies, shown in Figure 1.2, are described in this section, followed by a summary of what we have learned from the past that can help us become more effective technology users today.

**FIGURE 1.2** Digital Technologies in Education: A Timeline of Events That Shaped the Field



## Era 1: The Pre-Microcomputer Era

Many of today's teachers began using computer systems only since microcomputers came into common use, but a thriving educational computing culture predated microcomputers by 20 years. The first computers were used instructionally as early as the 1950s. In the late 1960s, IBM pioneered the IBM 1500, the first instructional **mainframe**, or large-scale computer with many users connected to it with terminals. On the IBM 1500, these terminals were **multimedia learning stations** capable of displaying animation and video. By the time IBM discontinued it in 1975, some 25 universities were using this system to develop **computer-assisted instruction (CAI)** materials that schools used via long-distance connections. CAI was software designed to help teach information and/or skills related to a topic. The most prominent of these efforts was led by Stanford University professor and “Grandfather of CAI” Patrick Suppes, who developed the Coursewriter programming language to create reading and mathematics lessons. Companies such as the Computer Curriculum Corporation (CCC, founded by Suppes) and the Programmed Logic for Automatic Teaching Operations (PLATO) system (developed by the Control Data Corporation) dominated the field for about 15 years. Universities also developed CAI for these large-scale computers, as well as **computer-managed instruction (CMI)** applications, or programs that kept track of students' performance data based on mastery learning models. Even after smaller **minicomputer** systems, then a designation for systems smaller than mainframes that could support fewer users at a time, replaced mainframes to deliver CAI and CMI to schools, systems were expensive to buy and complex to operate and maintain, so school district offices controlled their purchase and use. But by the late 1970s, it was apparent that there was little support for computer-based curriculum controlled by district data processing and industry personnel; schools began to reject the business office model of using computers to revolutionize instruction.

## Era 2: The Microcomputer Era

Integrated circuits made computers both smaller and more portable beginning in 1975, and teachers began to bring small, stand-alone, desktop computers called **microcomputers**, or systems designed for use by only one person at a time, into their classrooms. This grassroots movement wrested control of educational computers from companies, universities, and school districts and placed them directly into the hands of teachers and schools. Several initiatives emerged to shape this new teacher-centered control: a software publishing movement that catered to teachers quickly sprang up; organizations emerged to review software and help teachers select quality products; and professional organizations, journals, and magazines began to publish software reviews and recommend “top products.” Teachers clamored for more input into courseware design, so companies created authoring languages and systems (e.g., PILOT, SuperPILOT, GENIS, PASS). However, teacher authoring soon proved too time consuming, and interest faded. As schools searched for a way to make CAI more cost effective, districts began to purchase networked **integrated learning systems (ILSs)**, or networked systems that provide both CAI-based curriculum and CMI functions, to help teachers address required standards. Control of instructional computer resources moved once again to central servers in school district offices. Three other technology initiatives also became prominent in this era:

- **The computer literacy movement.** When author and researcher Arthur Luehrmann coined the term **computer literacy** to mean required levels of skills in using the computer, schools tried to implement computer literacy curriculum. However, these efforts were eventually dropped due to difficulties in defining and measuring skills.
- **Videodisc-based curriculum.** Companies such as ABC News and the Optical Data Corporation joined forces to offer curriculum on videodiscs, both standalone (level 1) and connected to microcomputers (level 3). But, when other forms of optical and digital storage replaced videodisc technology, curricula were not transferred.
- **The Logo movement.** A final focus during this period was teaching **Logo** programming, a high-level language originally designed as an **artificial intelligence (AI)** language designed to emulate decision-making capabilities of the human mind, but used by Seymour Papert (1980) to support his view that computers should be used as an aid to teach problem solving.

Logo began to replace CAI as the “best use” of computer technology. Despite its popularity and research showing it could be useful in some contexts, researchers could capture no Logo impact on mathematics or other curriculum skills, and interest in Logo, too, waned by the beginning of the 1990s.

### Era 3: The Internet Era

At the beginning of the 1990s, the **Internet**, a worldwide collection of university computer networks that could exchange information by using a common software standard had already been operating for many years. Then the **World Wide Web** was introduced in 1993. This was a system within the Internet that allowed graphic displays of Internet sites through hypertext links, or pieces of texts or images that allowed users to jump to other locations connected by the links. The first **browser** software (*Mosaic*) designed especially to allow users to use these links marked the beginning of the third era of educational technology. Teachers and students joined the throng of users on the “Information Superhighway,” and interest in computer technology’s potential for instruction once again sprang to life. By the beginning of the 2000s, email, online (i.e., Web-based) multimedia, and videoconferencing became standard tools of Internet users. Websites became a primary form of communication for educators, and distance education became a more prominent part of instructional delivery at all levels of education. The meaning of “online” changed from simply being on the computer to being connected to the Internet. **Virtual schools**, or schools in which “(K–12) students and teachers are separated by time and/or location and interact via computers and/or telecommunications technologies” (National Forum on Education Statistics, 2006, p. 1) began a steady growth that would see it become a mainstay of public education in the 2000s.

### Era 4: The Mobile Technologies, Social Media, and Open Access Era

The current era began the early 2000s, when portable devices such as smartphones and tablets made Internet access and computer power ubiquitous. As more and more individuals made texting and social networking sites like Facebook and Twitter part of their everyday lives, this constant connectedness transformed educational practice. The ease of access to online resources and communications drove several movements.

- **Distance learning.** A dramatic increase in the number and type of distance learning offerings came about, first in higher education and then in K–12 schools.
- **Electronic books (e-books or e-texts).** Texts in digital form on computers, e-book readers, and cell phones became increasingly popular alternatives to printed texts. Some school districts eschewed book adoptions in favor of allowing educators to choose their own digital materials.
- **Mobile access.** One-to-one laptop programs (and later tablet programs), as well as **Bring Your Own Device (or Technology, BYOD or BYOT) programs** were those that allowed students to use their own handheld devices for learning and accelerated the move to bring computer and Internet access into all classrooms. Another type of access that may be on the horizon is what some educators are calling **1:X Computing** or “one to many computing.” This is when students have access to many different digital devices from which they may choose “depending on the task at hand” (Herold, 2013, p. s2).
- **Open access.** Around 2008, open-access university offerings called **Massive Open Online Courses (MOOCs)**, which allowed anyone anywhere in the world to participate in college courses for free, became available. By 2011, MOOC projects at MIT, Harvard, and Stanford popularized the concept, and MOOCs came into common use in other colleges and universities. The later part of the decade would see the MOOC concept evolve, as higher education began charging fees for MOOC credit.

As ubiquitous communications and social networking defined social practices in modern life, educators struggled to create appropriate policies and uses that could take advantage of this new power while minimizing its risks and problems.

## What We Have Learned from the Past

In no small part, developments in digital technologies have shaped the history of educational technology. However, knowing the history of educational technology is useful only if we apply what we know about the past to future decisions and actions. What have we learned from more than 60 years of applying technology to educational problems that can improve our strategies now? The following points are among the most important:

**No technology is a panacea for education.** Great expectations for products such as Logo and programs such as BYOD and MOOCs have taught us that even the most current, capable technology resources offer no quick, easy, or universal solutions. Computer-based materials and strategies are usually tools in a larger system and must be integrated carefully with other resources and with teacher activities. Planning must always begin with this question: What specific needs do my students and I have that (any given resources) can help meet?

**Teachers usually do not develop technology materials or curriculum.** In the microcomputer era, companies tried to market authoring systems so teachers could create their own materials, but such systems were never widely adopted. Teaching is one of the most time- and labor-intensive jobs in our society. With so many demands on their time, most teachers cannot be expected to develop software or create complex technology-based teaching materials. Publishers, school or district developers, or personnel in funded projects have traditionally provided the majority of this assistance; this seems unlikely to change in the future, even for distance education courses or digital instructional materials.

**“Technically possible” does not equal “desirable, feasible, or inevitable.”** A popular saying is that today’s technology is yesterday’s science fiction. But science fiction also shows us that technology brings undesirable—as well as desirable—changes. For example, greater access to cell phones and tablets in classrooms means that online communications and information are increasingly available. But as recent events have shown, communications always come with caveats, and readily available information is not always reliable or helpful. New technological horizons make it clear that it is time to analyze carefully the implications of each implementation decision. Better technology demands that we become critical consumers of its power and capability. We are responsible for deciding just which science fiction becomes reality.

**Technologies change faster than teachers can keep up.** History in this field has shown that resources and accepted methods of applying them will change, often quickly and dramatically. This places a special burden on already overworked teachers to continue learning new resources and changing their teaching methods. Gone are the days—if, indeed, they ever existed—when a teacher could rely on the same handouts, homework, or lecture notes from year to year. Educators may not be able to predict the future of educational technology, but they know that it will be different from the present; that is, they must anticipate and accept the inevitability of change and the need for a continual investment of their time.

**Older technologies can be useful.** Technology in education is an area especially susceptible to fads. With so little time and resources dedicated to what actually works, anyone can propose dramatic improvements. When they fail to appear, educators move on to the next fad. This approach fails to solve real problems, and it draws attention away from the effort to find legitimate solutions. Worse, teachers sometimes throw out methods that had potential but were subject to unrealistic expectations. The past has shown that teachers must be careful, analytical consumers of technological innovation, looking to what has worked in the past to guide their decisions and measure their expectations in the present. Educational practice tends to move in cycles, and “new” methods often are old methods in new guise. In short, teachers must be as informed and analytical as they want their students to become.

**Teachers always will be more important than technology.** The developers of the first instructional computer systems in the 1960s foresaw them replacing many teacher positions; some advocates of today’s distance learning methods envision a similar impact on