Contents

Part I Conceptual

1 Metacognitive Strategy Instruction that Highlights the Role of Monitoring and Control Processes .................... 3
Gregory Schraw and Antonio P. Gutierrez
1.1 Introduction ............................................ 4
1.2 Models of Strategy Instruction .............................. 4
1.3 A Typology of Strategy Use ................................ 5
1.4 A Hybrid Strategy Instruction Model ......................... 9
    1.4.1 Instructional Strategies for Teaching Monitoring
    and Control Processes .............................. 12
1.5 Discussion and Implications for Practice and Research .......... 12
1.6 Conclusions ............................................ 13
References .................................................. 14

2 Regulating Metacognitive Processes—Support for a Meta-metacognitive Ability ........................................ 17
Sandra Buratti and Carl Martin Allwood
2.1 Introduction ............................................ 18
2.2 What Is Metacognition? ................................... 20
2.3 How Does Metacognition Relate to Meta-Metacognition? .... 21
2.4 Recent Research on Second-Order Metacognitive Judgments . . . . 22
2.5 New Method for Studying Second-Order Judgments ............ 25
2.6 The Making of Successful Second-Order Confidence Judgments .... 26
    2.6.1 Strategies Used When Making Second-Order Judgments ... 27
    2.6.2 Cues for Making Second-Order Confidence Judgments .... 29
    2.6.3 Individual Differences in Second-Order Judgment ........ 30
2.7 Does Research Really Support that We Have a Meta-Metacognitive Ability? ........................................ 31
2.8 Illustration of Computer Implementation of the New Method for Improving Second-Order Judgments in a Learning Context . . . . 32
5 Metacognition, Self-regulation and Assessment in Problem-Solving Processes at University

María Consuelo Sáiz-Manzanares and Eduardo Montero-García

5.1 Introduction ............................................ 108
5.2 Metacognitive Skills and Self-regulation ...................... 110
5.3 Instruments for the Evaluation of Aspects Relating to Processes of Self-regulation ........................................ 112
   5.3.1 Student Self-assessment of the Self-learning Process and Evaluation by the Teacher of the Student Learning Process ................................... 113
   5.3.2 Instruments to Measure Self-assessment ................. 114
5.4 Training, Metacognition, and Self-regulation ................. 118
5.5 An Example of Intervention in Self-regulation ................. 119
   5.5.1 Analysis of the Problem to Solve ...................... 120
5.6 Research and Results ..................................... 129
5.7 Conclusions ............................................ 130
References .................................................. 130

6 Engaging Adolescent Students’ Metacognition Through WebQuests: A Case Study of Embedded Metacognition

Hope J. Hartman

6.1 Introduction ............................................ 136
   6.1.1 WebQuests and Metacognition . ........................ 137
   6.1.2 Theoretical Framework ............................. 143
6.2 Method ................................................ 144
   6.2.1 Participants ....................................... 144
   6.2.2 Metacognitive Engagement Preparation ................. 144
   6.2.3 WebQuests Development ............................ 147
6.3 Results ................................................ 147
   6.3.1 Required Versus Expected Metacognition ............... 148
   6.3.2 Executive Management Metacognition ................... 148
   6.3.3 Strategic Knowledge Metacognition ................... 155
   6.3.4 Social Metacognition ................................ 155
   6.3.5 Affective Self-reflections ............................ 160
6.4 Discussion and Conclusion ................................ 161
References .................................................. 163

Part III Studies

7 The Role of Metacognitive Awareness of Listening Strategies in Listening Proficiency: The Case of Language Learners with Different Levels of Academic Self-regulation

Mehrak Rahimi and Sajad Abedi

7.1 Introduction ............................................ 170
   7.1.1 Cognitive Processes Involved in Listening ............... 172
7.1.2 Listening Strategies ........................................ 174
7.1.3 Metacognitive Awareness of Listening Strategies .......... 176
7.1.4 Metacognition and Self-regulation .......................... 177

7.2 Method ........................................................ 179
7.2.1 The Context of the Study .................................. 179
7.2.2 Participants ................................................ 180
7.2.3 Instruments ................................................ 180
7.2.4 The Procedure .............................................. 182

7.3 Results .......................................................... 182
7.3.1 Metacognitive Awareness of Listening Strategies and Listening Comprehension ......................... 182
7.3.2 Metacognitive Awareness of Listening Strategies and Listening Comprehension Among Groups of Learners with Different Levels of SR ......................... 183
7.3.3 MALQ as the Predictor of PET Among Three Groups of Learners with Different Levels of SR ................. 184

7.4 Discussion ...................................................... 185
7.5 Conclusions ..................................................... 188
7.6 Suggestions for Further Studies ............................... 188
References ........................................................ 189

8 Fostering Student Metacognition and Motivation in STEM through Citizen Science Programs ............... 193
Suzanne E. Hiller and Anastasia Kitsantas
8.1 Introduction .................................................... 194
8.2 A Description of Citizen Science Programs .................... 195
8.3 Student Metacognition and Motivation in Science Contexts ........ 197
8.4 The Impact of Citizen Science Programs on Metacognition, Motivational Processes, and Career Planning .......... 204
8.5 Creating Effective Citizen Science Programs .................. 210
8.5.1 Citizen Science Programs and Training Protocol ........ 211
8.5.2 An Example of Citizen Science Training .................. 212
8.5.3 The Structure of Citizen Science Programs for Students ... 214
8.6 Implications for Educators, Students, Parents, and Policymakers .................................................. 217
8.7 Conclusion and Future Directions ............................. 218
References ........................................................ 218

9 Personal Self-regulation, Self-regulated Learning and Coping Strategies, in University Context with Stress .......... 223
Jesús de la Fuente, Lucía Zapata, José Manuel Martínez-Vicente, Paul Sander and Dave Putwain
9.1 Introduction ..................................................... 224
9.2 The Process of Teaching-Learning as a Source of Stress .......... 225
9.3 Personal Self-regulation as a Student Meta-Cognitive and Meta Motivational Presage Variable ................................. 226
  9.3.1 Prior Evidence on Personal Self-regulation ................. 229
9.4 Self-regulated Learning as a Meta-Cognitive and Meta-Motivational Process Variable of Students .............. 230
  9.4.1 Dimensions of Self-regulation Learning .................. 233
  9.4.2 Self-regulated Learning as a Socio-Cognitive Process . 233
  9.4.3 Cyclical Nature of Self-regulation Learning ............. 234
9.5 Strategies for Coping with Stress as a Meta-Affective Variable of Learning and Buffer of Academic Stress .............. 236
  9.5.1 Concept of Coping .................................... 237
  9.5.2 Coping Strategies ...................................... 238
  9.5.3 Transactional Model ..................................... 239
9.6 Initial Assessment .............................................. 242
  9.6.1 Prediction Between Personal Self-regulation,
        Self-regulated Learning and Coping Strategies ........ 242
  9.6.2 Interdependence Between Personal Self-regulation,
        Self-regulated Learning and Coping Strategies:
        Transactional Model ..................................... 242
9.7 Applications: e-Assessment and e-Intervention Based on ICTs ... 243
9.8 Conclusions .................................................. 249
References ........................................................ 250

Part IV Approaches

10 What Makes Metacognition as Socially Shared in Mathematical Problem Solving? .............................................. 259
  Tarja-Riitta Hurme, Sanna Järvelä, Kaarina Merenluoto
  and Pekka Salonen
  10.1 Introduction .............................................. 260
  10.2 Metacognition in Computer-Supported Collaborative
        Mathematical Problem Solving ............................ 260
        10.2.1 Mathematical Tasks and Data Analysis ............ 262
  10.3 Success in Collaborative Problem Solving Requires
        Socially Shared Metacognition ............................ 264
        10.3.1 Group’s Intention to Solve a Problem Quickly
                and Reach a Right Solution Damages Metacognition .. 264
        10.3.2 Metacognitive Messages Are Converged into
                Individuals’ Own Thinking or Ignored in Discussion .. 268
        10.3.3 Socially Shared Metacognition ...................... 271
  10.4 Discussion ................................................ 273
References ........................................................ 275
## 11 Enhancing the Metacognitive Skill of Novice Programmers Through Collaborative Learning

Margaret Bernard and Eshwar Bachu

### 11.1 Introduction

### 11.2 Description of Problem

### 11.3 Metacognition in Programming

### 11.4 Promoting Metacognition in Programming Using Collaboration and Computer Games

#### 11.4.1 Collaborative Learning

#### 11.4.2 Collaboration Enhances Programming Metacognition

#### 11.4.3 Computer Supported Collaborative Learning (CSCL)

### 11.5 Multiplayer Games to Support Programmers Problem Solving

#### 11.5.1 Educational Multiplayer Games

#### 11.5.2 Guidelines for Designing Multiplayer Games to Support Problem Solving

### 11.6 Implementation and Experimental Findings

#### 11.6.1 Implementation

#### 11.6.2 Experimental Findings

### 11.7 Conclusion

### References

## 12 Designing a Metacognitive Approach to the Professional Development of Experienced Science Teachers

Osнат Eldar and Shirley Miedijensky

### 12.1 Introduction

### 12.2 Theoretical Background

#### 12.2.1 Professional Development of In-service Science Teachers

#### 12.2.2 Teachers’ Metacognitive Knowledge

#### 12.2.3 Metacognition in the Present Study

### 12.3 The Study

#### 12.3.1 The M.Ed. Program Structure

#### 12.3.2 The Study Goals

#### 12.3.3 Participants

#### 12.3.4 Data Collection

### 12.4 Findings

#### 12.4.1 The Courses’ Design Principles

#### 12.4.2 Expression of Teachers’ Metacognition

#### 12.4.3 Resources for the Teachers’ Meta-Cognitive Development

### 12.5 Discussion

### References
Part V Tools

13 Modeling Metacognitive Activities in Medical Problem-Solving with BioWorld ............................................. 323
   Susanne P. Lajoie, Eric G. Poitras, Tenzin Doleck and Amanda Jarrell
   13.1 Modeling Metacognitive Activities in Medical Problem-Solving with BioWorld ............................... 324
   13.2 A Model of Metacognitive Activities in Problem-Solving ................................................................. 325
   13.3 BioWorld: A Deliberate Practice Environment for Diagnostic Reasoning with Virtual Patients .......... 328
   13.5 Developing an Expert Model to Trace Metacognitive Activities in Problem-Solving ............................. 331
   13.6 Examining Help-Seeking as an Indicator of Metacognition ................................................................. 332
   13.7 Overview of Empirical Evidence of BioWorld’s Role in Fostering Help-Seeking ............................... 334
      13.7.1 Study 1: Using Process Data to Examine Self-Regulatory Behaviors During Clinical Problem Solving Using Technology ................................................................. 334
      13.7.2 Study 2: Supporting Diagnostic Reasoning by Modeling Help-Seeking in BioWorld ...................... 335
      13.7.3 Study 3: Case Summary Data-Diagnostic Learning Outcomes ...................................................... 337
      13.7.4 Study 3: Text Mining Algorithms  ....................................................................................................... 338
      13.7.5 Study 3: Dataset .............................................................................................................................. 338
      13.7.6 Study 3: Results .............................................................................................................................. 339
   13.8 Conclusion ................................................................. 340
   References ................................................................................................................................. 341

14 The MetaHistoReasoning Tool: Studying Domain-Specific Metacognitive Activities in an Intelligent Tutoring System for History ................................................................. 345
   Eric G. Poitras
   14.1 Introduction ................................................................. 346
   14.2 The Three-Phase Model of Cognitive and Metacognitive Activities in Historical Inquiry ..................... 348
   14.3 The MetaHistoReasoning Tool Training Module ................................................................. 350
      14.3.1 The Design Guidelines of the Training Module ............................................................................ 350
      14.3.2 Modeling Skill Acquisition in the Training Module ................................................................. 351
   14.4 The MetaHistoReasoning Tool Inquiry Module .................................................................................. 353
      14.4.1 The Design Guidelines of the Inquiry Module ............................................................................ 353
      14.4.2 Modeling Skill Practice and Refinement in the Inquiry Module ................................................ 355
Metacognition: Fundaments, Applications, and Trends
A Profile of the Current State-Of-The-Art
Peña-Ayala, A. (Ed.)
2015, XIX, 367 p. 46 illus., Hardcover
ISBN: 978-3-319-11061-5