Contents

Part I Twenty-First Century Skills Education on the Whole

1 Introduction .................................................. 3
   1.1 Goal for the Book: Fostering Meaningful Learning 
       Experiences and a Love for Learning .................. 4
   1.2 Key Domains of Scholarship .......................... 5
       1.2.1 Theoretical Perspectives of Influence .......... 5
       1.2.2 Twenty-First Century Skills .................... 8
       1.2.3 Inquiry-Based Learning .......................... 9
       1.2.4 Collaborative Teaching .......................... 9
       1.2.5 Collaborative Learning ......................... 10
       1.2.6 Social Media for Learning ...................... 10
       1.2.7 Gamification/Games for Learning .............. 11
   1.3 Organization of the Book .............................. 12
   1.4 A Note About the Book’s Drafting ................... 13
   References ................................................. 13

2 Twenty-First Century Skills and Global Education 
   Roadmaps .................................................. 17
   2.1 Frameworks Developed for Twenty-First Century 
       Skills .................................................. 18
       2.1.1 International Frameworks ......................... 19
   2.2 Twenty-First Century Skills in Comparison ........... 20
   2.3 Twenty-First Century Skills in Detail ................ 21
       2.3.1 Skill Set 1: Learning and Innovation .......... 22
       2.3.2 Skill Set 2: Digital Literacies ................. 22
       2.3.3 Skill Set 3: Life and Career Skills .......... 23
   2.4 A Formula of Twenty-First Century Learning ........... 23
   2.5 Twenty-First Century Skills and the Education Roadmap 
       in Hong Kong, Switzerland, and the U.S. .......... 24
4 Twenty-First Century Skills Education in Switzerland: An Example of Project-Based Learning Using Wiki in Science Education ................................. 61
  4.1 Notable Aspects of Science Education .......................... 62
    4.1.1 Models of Science Education ............................... 62
    4.1.2 Supporting Science Education with the Use of Technology .......................... 67
    4.1.3 European Policy Concerning Twenty-First Century Skills .......................... 68
  4.2 An Example of a Project-Based Inquiry Learning Approach in Switzerland Using Wiki as a Co-authoring and Collaboration Tool ........................................ 70
    4.2.1 Implementation Model .................................. 70
  4.3 Case Study: Creating a Collaborative Glossary in Science Education: “Evolution” .......................... 72
    4.3.1 Time Schedule, Group Building ......................... 73
    4.3.2 Specific Goal .................................... 73
    4.3.3 The Collaborative Glossary ............................. 73
  4.4 Conclusion ........................................... 75
References ................................................ 76

5 Twenty-First Century Skills Education in the U.S.: An Example of an Inquiry-Based Game Design Learning Approach ............. 79
  5.1 Technology Education in the United States ................... 80
    5.1.1 Policies and National Standards, and Implementation Challenges ......................... 80
    5.1.2 Smaller Scale Pilots of Instructional Design Innovations ................................ 82
    5.1.3 Industry Forces as Drivers of Educational Technology Innovations ...................... 84
  5.2 Research Cases on Inquiry-Based Learning Through a U.S.-Based Game Design Curriculum, Circa 2012/2013 .......... 85
    5.2.1 Inquiry-Based Game Design Program Features in 2012/2013 ................................ 85
    5.2.2 Theoretical Underpinnings of Globaloria .................. 88
    5.2.3 Six Contemporary Learning Abilities Framework .......... 89
    5.2.4 Study 1: Cultivation of the “CLAs” Among Student Participants in Globaloria: Research Results on Effects .................................................. 92
    5.2.5 Summary of Other Globaloria “Effects” Type Research ........................................ 93
5.2.6 Debates Concerning Structure in Inquiry-Based Learning Contexts ................................ 93
5.2.7 Investigating Inquiry and Discovery Processes in Globaloria .................................... 97
5.3 Conclusion ..................................................................................................................... 99
References ....................................................................................................................... 101

Part III  Twenty-First Century Skills Education in Schools

6 Teachers’ Professional Development ................................................................. 109
   6.1 Skills Needed for a New Teaching Style ......................................................... 110
   6.2 Teachers’ Adoption of Twenty-First Century Skills .................................... 110
      6.2.1 Information Technology Literacy ......................................................... 111
      6.2.2 Information Literacy (IL) ................................................................. 112
      6.2.3 Media Literacy (ML) ....................................................................... 113
      6.2.4 Collaboration Skills ............................................................................. 114
   6.3 Acquisition of Twenty-First Century Teaching Skills ..................................... 116
      6.3.1 Twenty-First Century Skills Standards for Teachers ......................... 116
      6.3.2 Strategies to Develop Teachers’ Twenty-First Century Skills ............ 117
      6.3.3 Tools for Twenty-First Century Skills Development ......................... 120
   6.4 Conclusion ............................................................................................................. 124
References ....................................................................................................................... 124

7 Guides and Suggestions for Classroom Implementation ....................................... 131
   7.1 Step-by-Step Guide to the Implementation of Inquiry PjBL in the Classroom ...... 131
      7.1.1 Teachers’ Readiness ............................................................................. 132
      7.1.2 Students’ Readiness ............................................................................ 134
      7.1.3 Inquiry Design Process ........................................................................ 135
      7.1.4 Strategies for Teaching and Learning .................................................. 139
      7.1.5 Evaluation Mechanisms ..................................................................... 140
   7.2 Case Study on Collaborative Teaching and Inquiry PjBL Learning ............... 141
      7.2.1 Suggested Timetable for Collaborative Teaching and Inquiry PjBL (Second Year of Intervention) ................................................................. 145
      7.2.2 Teachers’ Role in the Second Year of Intervention ......................... 147
   7.3 Teaching Suggestions for Subject Teachers (Second Year of Intervention) .... 147
      7.3.1 Suggested Teaching Schedule for General Studies (GS) Teachers .......... 147
      7.3.2 Suggested Teaching Schedule for English Teachers ......................... 148
      7.3.3 Suggested Teaching Schedule for Computer Studies (CS) Teachers .......... 151
7.3.4 Suggested Teaching Schedule for School Librarians ........................ 155
7.3.5 Suggested Teaching Schedule for Language (Chinese)
   Teachers (Optional) ........................................ 155
7.4 Using Online LMS and Authoring Tools to Support
   and Scaffold Student Inquiry ................................ 155
7.5 Conclusion ................................................................ 157
Appendix 7.1 Sample of Reading and Writing Worksheet
   (Chu et al. 2012b, p. 102) ....................................... 158
Appendix 7.2 Assessment Rubrics of Writing Task ..................... 159
References ............................................................ 159

8 Assessment Instruments for Twenty-First Century Skills .......... 163
8.1 Overview of Assessment Instruments for Twenty-First Century
   Skills .................................................................... 163
8.2 Case Studies on Assessing Twenty-First Century Skills ........... 164
   8.2.1 Assessing Reading Literacy Through Gamification ........... 164
   8.2.2 Assessing Collaboration .................................... 168
   8.2.3 Assessing Information Literacy (IL) Using IL
      Assessment Tools .................................................. 172
   8.2.4 Assessing IL and IT Literacy by Perceived Learning
      Progress .............................................................. 174
   8.2.5 Assessing Media Awareness of Primary Four Students .... 177
   8.2.6 Measuring Knowledge Outcomes by Evaluating
      Product Artifacts .................................................. 180
8.3 Conclusion ................................................................ 182
Appendix 8.1 Back-Translated Version of the IL Assessment Tool
   (Adopted from Chu 2012) ......................................... 183
Appendix 8.2 Questionnaire on Students’ Familiarity
   with IL and IT Skills (Taken from Chu et al. 2011) .............. 185
Appendix 8.3 Coding Protocol for a Digital Literacy Intervention
   Involving Student Inquiry-Based Learning and Construction
   of Digital Artifacts ................................................ 186
References ............................................................. 189

Part IV Summary and Conclusions

9 Summary and Conclusions ........................................... 195
  9.1 For Teachers ..................................................... 196
  9.2 For Professors and Teacher Educators ......................... 198
  9.3 For School Librarians .......................................... 199
  9.4 For Policymakers ............................................... 200
  9.5 For Researchers ................................................ 201
  9.6 What is Next? .................................................. 203
References ............................................................ 204
21st Century Skills Development Through Inquiry-Based Learning
From Theory to Practice
Chu, S.K.W.; Reynolds, R.B.; Tavares, N.J.; Notari, M.; Lee, C.W.Y.
2017, XV, 204 p. 14 illus., Hardcover