

Contents

<i>List of Figures</i>	x
<i>List of Tables</i>	xii
<i>Preface</i>	xiv
1 Teaching as a Design Science	1
<i>The Role of Technology</i>	2
<i>Harnessing Technology for Educational Ends</i>	3
<i>Learning about Teaching</i>	5
<i>Education as a Design Science</i>	5
<i>Design Patterns for Learning</i>	7
<i>The Foundations for Teaching as Design</i>	9
2 What is Formal Learning?	11
<i>Introduction</i>	11
<i>The View from the Educational Establishment</i>	12
<i>The View from the Workplace</i>	14
<i>The View from Educational Theorists</i>	16
<i>Teachers' Views of Formal Learning</i>	19
<i>Summary</i>	24
3 What Students Bring to Learning	26
<i>Introduction</i>	26
<i>Student Engagement</i>	28
<i>Intellectual Characteristics</i>	33
<i>Formal and Informal Learning Contexts</i>	39
<i>Summary</i>	42
4 What it Takes to Learn	44
<i>Introduction</i>	44
<i>What Happens in Learning</i>	44
<i>Making Learning Happen</i>	58
<i>Summary</i>	63

5 What it Takes to Teach

- Introduction* 64
- Factors Influencing the Design of Teaching* 64
- Approaches to Designing for Learning* 66
- Aligning Goals, Activities, and Assessment* 68
- Monitoring Alternative Conceptions* 70
- Scaffolding Theory-Generated Practice* 72
- Fostering Conceptual Change* 73
- Encouraging Metacognition* 76
- Teaching as Design* 77
- A Principled Approach to Designing for Learning* 80
- Summary* 80

6 Motivating and Enabling the Learning Cycle

82

- Introduction* 82
- The Under-Performance of Learning Technologies* 83
- A Framework for Analyzing Formal Learning* 84
- Technologies for Teaching-Learning Activities* 95
- The Framework as a Design Analysis Tool* 100
- The Idea of Pedagogical Patterns* 102
- Summary* 103

7 Learning Through Acquisition

105

- Introduction* 105
- Learning Through Acquisition* 106
- Teaching Using Narrative Presentation* 106
- Structuring a Narrative Presentation* 107
- How Can Digital Technologies Help?* 112
- Preparing Students for Learning Through Acquisition* 116
- Capturing Pedagogical Patterns* 119
- Summary: Designing for Learning Through Acquisition* 120

8 Learning Through Inquiry

122

- Introduction* 122
- Learning Through Inquiry* 123
- Inquiry Learning in the Conversational Framework* 129
- How Can Digital Technologies Help?* 131
- Pedagogical Patterns for Inquiry Learning* 138
- Summary: Designing for Learning Through Inquiry* 140

9	Learning Through Discussion	141
	<i>Introduction</i>	141
	<i>Learning Through Discussion</i>	142
	<i>Discussion-Based Methods</i>	144
	<i>How Can Digital Technologies Help?</i>	146
	<i>The Pedagogy of Learning Through Discussion</i>	149
	<i>Pedagogical Patterns for Discussion Learning</i>	157
	<i>Summary: Designing for Learning Through Discussion</i>	161
10	Learning Through Practice	162
	<i>Introduction</i>	162
	<i>Learning Through Practice</i>	163
	<i>Learning Through Practice in Formal Education</i>	170
	<i>How Can Digital Technologies Help?</i>	174
	<i>Pedagogical Patterns for Learning Through Practice</i>	184
	<i>Summary: Designing for Learning Through Practice</i>	186
11	Learning Through Collaboration	187
	<i>Introduction</i>	187
	<i>Learning Through Collaboration</i>	188
	<i>The Teacher's Role in Collaborative Learning</i>	192
	<i>How Can Digital Technologies Help?</i>	194
	<i>Pedagogical Patterns for Collaborative Learning</i>	205
	<i>Summary: Designing for Learning Through Collaboration</i>	208
12	Teaching as Developing Pedagogical Patterns	210
	<i>Introduction</i>	210
	<i>Requirements for a Design Science</i>	211
	<i>Representing Patterns for Learning</i>	212
	<i>Exploring the Idea of Pedagogical Patterns</i>	215
	<i>Learning Design Tools and Resources</i>	221
	<i>Collaborative Learning for Teachers</i>	222
	<i>Concluding Points</i>	225
	<i>References</i>	227
	<i>Index</i>	248

Figures

3.1	Conceptual framework showing influences on student learning	38
4.1	Consolidation of theories on what is involved in learning from the external environment, and in learning from a teacher	60
5.1	The principal context factors influencing the design of teaching and learning	65
6.1	The learner learning, represented as a cyclical iteration within their conceptual organization, within their practice, and between the two, while interacting with the teaching-learning environment	86
6.2	The learner learning concepts (LC) and practice (LP) through interaction in (a) the teacher communication cycle, (b) the teacher practice cycle, (c) the teacher modeling cycle, from the teacher's conceptual organization (TC), and the practice/modeling environment set up by the teacher (TPME)	88
6.3	The learner learning through interaction with peers' concepts and practice (PC, PP), exchanging concepts and the outputs of their practice	92
6.4	Types of individual learning mapped to the Conversational Framework (a) learning through acquisition, (b) learning through inquiry, (c) learning through practice, and (d) learning through production	97
6.5	Types of social learning mapped to the Conversational Framework (a) learning through discussion, and (b) learning through collaboration	99
7.1	Sequences for the alternative learning patterns (a) "Double telling," and (b) "Discovery and telling," for learning through acquisition, mapped to the Conversational Framework	118

8.1	(a) Individual independent, and (b) individual supervised inquiry learning mapped to the Conversational Framework	130
8.2	Collaborative supervised inquiry learning, showing the additional demands on the learner to share their ideas and output, and the support provided through access to other learners' ideas and outputs	131
9.1	Learning through peer discussion	144
9.2	<i>InterLoc</i> : A dialogue environment that prompts each student to think about the nature of their contribution before they type their text	154
9.3	Discussion learning using (a) "class-wide discussion," and (b) "peer instruction"	159
10.1	(a) Kolb's Experiential Learning Cycle, and (b) The Experiential Learning Cycle (<i>bold italics</i>) mapped onto the Conversational Framework	168
10.2	Kolb's Experiential Learning Cycle extended to include "Conversational Learning," which affords "meaning making" through reflection on experience	169
10.3	(a) How teacher reflection on the learner's actions provides extrinsic feedback, and (b) How the practice/modeling environment provides intrinsic feedback, prompting learner reflection	173
10.4	(a) An over-defined task for students working on a real or simulated environment, and (b) Goals set for the student to achieve through their own actions on the environment, are more likely to elicit an internal learning cycle	178
11.1	Learning through collaboration as a combination of learning through discussion and sharing of the outputs from practice and inquiry	191
11.2	The pedagogical pattern for collaborative learning mapped onto the Conversational Framework, showing the succession of teaching-learning activities planned into the design outlined in Table 11.2	208
12.1	The Conversational Framework for teachers' learning collaboratively about teaching and learning	225

Tables

2.1	Comparison of Selected Learning Outcomes for History Defined by Individual Academics, the Tuning Process, and the QAA Benchmarking Exercise	22
4.1	The Concepts and Relations Involved in Learning	59
4.2	Consequences for the Teacher of the Conditions for Active Learning	62
5.1	Teaching Principles and the Strategies Proposed to Meet Them	79
6.1	The Mechanisms Involved in Learning without a Teacher	85
6.2	Design Elements Mapped to Activities within the Conversational Framework Cycles	95
6.3	Types of Learning and the Different Types of Conventional and Digital Learning Technologies that Serve Them	96
6.4	Using the Conversational Framework to Show how Digital Tools Create a Richer Learning Design Pattern	101
6.5	Design Criteria for the Teaching-Learning Cycles to Motivate and Enable Learning	102
7.1	Alternative Pedagogical Patterns Mapped to Conversational Framework Cycles with their Respective Outcomes	117
8.1	A Consolidated Pedagogical Pattern for Learning Through Inquiry	139
9.1	Alternative Pedagogical Patterns for Class-Based Discussion Learning	158
9.2	A Consolidated Pedagogical Pattern for Learning Through Peer Discussion Online	160
10.1	A Generic Design Pattern for Learning Through Practice, Mapped to the Teacher Modeling Cycle (TMC), Teacher Practice Cycle (TPC), and the Learner's Internal Learning Cycle (ILC) in the Conversational Framework	185

11.1	A Summary of how Digital Technologies can Support the Requirements of Collaborative Learning	196
11.2	A Generic Pedagogical Pattern for Collaborative Learning Designed to Elicit the Successive Cycles in the Conversational Framework	207
12.1	How Digital Technologies Contribute to the Pedagogic Design Criteria	216
12.2	Format for a Pedagogical Pattern	218
12.3	A Pedagogical Pattern to Substitute Physical Resources and Tools with Digital Equivalents	221
12.4	A Pedagogical Pattern Adapted for a Different Topic Area	223