

Contents

Preface	page xiii
List of Contributors	xv
Acknowledgements	xvii
Teaching Secondary Science and Cambridge Dynamic Science	xviii
Part 1: Theory	1
1.1 Contemporary issues in teaching and learning science	3
<i>Simon Leonard and Geoff Woolcott</i>	
Learning objectives	3
Introduction	3
Science, science education and society	5
Contemporary issues	10
STEM and changes in science learning and teaching	15
Summary	20
Review questions	20
Research topic	20
Further reading	21
References	21
1.2 On becoming a science teacher	24
<i>Robert Whannell and Linda Hobbs</i>	
Learning objectives	24
Introduction	24
The formation of identity	25
Developing a science teacher identity	29
The science teacher as an identity builder	33
Teacher learning and crossing boundaries	37
Summary	42
Review questions	43
Research topic	43
Further reading	43
References	44

1.3 Theory and practice in science education	45
<i>Robert Whannell and Tony Yeigh</i>	
Learning objectives	45
Introduction	45
Learning theories	47
Inquiry learning	61
The 5Es	62
Other relevant theories	65
The Australian national science syllabus	66
Summary	69
Review questions	70
Research topic	70
Further reading	70
References	71
1.4 Real-world science in the classroom	73
<i>Kay Lembo, Julie Crough and Geoff Woolcott</i>	
Learning objectives	73
Introduction	73
What is the Nature of Science?	75
Scientific inquiry in a science education context	78
Scientific misconceptions and how we can deal with them	83
Real-world science: reflecting theoretical knowledge	86
Summary	89
Review questions	89
Research topic	90
Further reading	90
References	90
1.5 Improving science teaching practice through collaboration and reflection	93
<i>Margaret Marshman and Geoff Woolcott</i>	
Learning objectives	93
Introduction	93
Collaborative enhancement	94
Collaborative reflection	100
Collaboration and iteration	104
Collaboration and transferable teaching skills	106
Summary	110
Review questions	110
Research topic	111
Further reading	111
References	112

1.6 Assessing science teaching and learning	116
<i>Robert Whannell and Neil Taylor</i>	
Learning objectives	116
Introduction	116
Principles of assessment	118
General principles of designing and writing an assessment task	121
Assessment in the ACARA science syllabus	122
Assessment of, for and as learning	122
Assessment methods	128
Assessment and the 5Es	131
Summary	137
Review questions	138
Research topic	138
Further reading	139
References	140
1.7 Teaching using student-generated representations in science	141
<i>John Kenny and Connie Cirkony</i>	
Learning objectives	141
Introduction	141
Using representations to learn science	143
Teaching science using representations	145
Representational reasoning	154
Summary	160
Review questions	161
Research topic	161
Further reading	162
References	162
1.8 Technology, electronic media and science education	168
<i>Annette Hilton and Geoff Hilton</i>	
Learning objectives	168
Introduction	168
Technology and its influence on science and science teaching	170
Technology integration within science teaching and learning	174
The roles of technology in students' science learning	177
Science teachers using the multiple affordances of technology	182
Summary	186
Review questions	186
Research topic	187
Further reading	187
References	188

1.9 Celebrating Australia's diversity through science education	191
<i>Angela Fitzgerald, Linda Pfeiffer and Geoff Woolcott</i>	
Learning objectives	191
Introduction	191
Diversity and cultural background	194
Disability in science education	198
The diversity in socioeconomic status (SES)	202
Diversity and geographic location	206
Summary	210
Review questions	211
Research topic	211
Further reading	212
References	212
Part 2: Practice	215
2.1 Engagement practices: a major issue in contemporary education	217
<i>Simon Leonard and Geoff Woolcott</i>	
Learning objectives	217
Introduction	217
Teaching for engagement	219
Signposting for significance and connection	221
Substantive conversations	224
Higher order learning	227
Feedback and metacognitive skills	230
Summary	233
Review questions	233
Research topic	234
Further reading	234
References	234
2.2 Building identity and commitment to the teaching of science	236
<i>Linda Hobbs and Robert Whannell</i>	
Learning objectives	236
Introduction	236
The identity and role of a science educator	238
Strategies to support academic identity development for science students	249
Summary	255
Review questions	256
Research topic	256
Further reading	256
References	257

2.3 Application of theory in science education classrooms	259
<i>Robert Whannell and Tony Yeigh</i>	
Learning objectives	259
Introduction	259
Inquiry-based learning (IBL)	261
Learning theories and IBL	266
IBL and cognitive load	271
Summary	278
Review questions	279
Research topic	279
Further reading	279
References	280
2.4 Bringing real-world science into the classroom	283
<i>Kay Lembo, Julie Crough and Geoff Woolcott</i>	
Learning objectives	283
Introduction	283
Nature of Science and application to real-world scenarios	285
Inquiry approaches and development of scientific understandings	288
Formulate clear understanding of concepts and resolve commonly held alternative conceptions or misconceptions	291
Apply theoretical knowledge to examining real-world scenarios	293
Summary	297
Review questions	297
Research topic	298
Further reading	298
References	299
2.5 Creating a classroom for engagement with scientific thinking, problem solving and real-world contexts	300
<i>Margaret Marshman and Geoff Woolcott</i>	
Learning objectives	300
Introduction	300
Collaborative enhancement in practice	302
Collaborative reflection in practice	306
Collaborative iterations in practice	312
Collaboration and transferable teaching skills in the classroom	316
Summary	319
Review questions	319
Research topic	320
Further reading	320
References	322

2.6 Assessing science teaching and learning in the classroom	323
<i>Neil Taylor and Robert Whannell</i>	
Learning objectives	323
Introduction	323
Writing and returning an assessment task	324
Writing an open-ended inquiry task	329
Designing a marking rubric	338
Using experiments in teaching, learning and assessment	341
Summary	345
Review questions	345
Research topic	346
Further reading	346
References	347
2.7 Using representations in the science classroom	348
<i>John Kenny and Connie Cirkony</i>	
Learning objectives	348
Introduction	348
Engaging students by encouraging them to think scientifically	351
Getting started with student-generated representations	358
Planning a unit using the 5Es and the representational reasoning approach	362
Starting your journey	370
Summary	372
Review questions	372
Research topic	372
Further reading	373
References	373
2.8 Digital technologies in the science classroom and beyond	375
<i>Annette Hilton and Geoff Hilton</i>	
Learning objectives	375
Introduction	375
Integrating technology into science lessons	376
Integrating technology for different purposes	380
Technology for inquiry learning and higher order thinking	383
Teachers using technology: What can it achieve? What should teachers consider?	388
Summary	391
Review questions	392
Research topic	392
Further reading	392
References	393

2.9 Bringing Australia's diversity into science education	394
<i>Linda Pfeiffer, Angela Fitzgerald and Geoff Woolcott</i>	
Learning objectives	394
Introduction	394
Diversity and cultural background	396
The diversity in disability	401
The diversity in socioeconomic status (SES)	406
Diversity and geographic location	408
Summary	413
Review questions	413
Research topic	414
Further reading	414
References	414
<i>Index</i>	416