Contents

Preface	ix
Acknowledgments	xiii
About the Author	xv
Chapter 1: An Introduction to Formative	
Assessment Classroom Techniques (FACTs)	1
What Does a Formative Assessment-Centered	
Classroom Look Like?	1
Why Use FACTs?	3
How Does Research Support the Use of FACTs?	8
Classroom Environments That Support Formative Assessment	10
Connecting Teaching and Learning	11
Understanding Misconceptions in Science:	
Misconceptions About Misconceptions	13
Making the Shift to a Formative	
Assessment-Centered Classroom	16
Connections to Current State Standards, A Framework	
for K–12 Science Education, Next Generation Science	
Standards, and Literacy Capacities	20
Chapter 2: Connecting FACTs to Instruction and Learning	25
Integrating Assessment and Instruction	25
Assessment That Promotes Thinking and Learning	26
Linking Assessment, Instruction, and Learning: The Science	
Assessment, Instruction, and Learning (SAIL) Cycle	28
Stages in the SAIL Cycle	30
Engagement and Readiness	30
Eliciting Prior Knowledge	34
Exploration and Discovery	34
Concept and Skill Development	35

Concept and Skill Transfer	35
Self-Assessment and Reflection	36
Selecting and Using FACTs to Strengthen the Link	
Between Assessment, Instruction, and Learning	36
Chapter 3: Considerations for Selecting,	
Implementing, and Using Data From FACTs	41
Selecting FACTs	41
Selecting FACTs to Match Learning Goals and Standards	41
FACTs and Core Disciplinary Content	43
FACTs and the Scientific and Engineering Practices	44
Selecting FACTs to Match Teaching Goals	53
The Critical Importance of Classroom	
Context in Selecting FACTs	55
Planning to Use and Implement FACTs	56
Starting Off With Small Steps	58
Maintaining and Extending Implementation	59
25 Ways to Lead Learning About Formative Assessment	61
Using Data From the FACTs	63
Chapter 4: Get the FACTs! 75 Science Formative	
Assessment Classroom Techniques (FACTs)	71
1. A&D Statements	<i>7</i> 5
2. Agreement Circles	79
3. Annotated Student Drawings	83
4. Card Sorts	88
5. CCC—Collaborative Clued Corrections	93
6. Chain Notes	97
7. Commit and Toss	101
8. Concept Card Mapping	105
9. Concept Cartoons	109
10. Data Match	115
11. Directed Paraphrasing	119
12. Explanation Analysis	122
13. Fact First Questioning	128
14. Familiar Phenomenon Probes 15. First Word–Last Word	131
16. First vvora–Last vvora 16. Fishbowl Think Aloud	135 140
17. Fist to Five	140
	144
18. Focused Listing 19. Four Corners	150
20. Frayer Model	154
21. Friendly Talk Probes	158
	100

22. Give Me Five	162
23. Guided Reciprocal Peer Questioning	165
24. Human Scattergraph	169
25. Informal Student Interviews	173
26. Interest Scale	177
27. I Think–We Think	180
28. I Used to Think But Now I Know	183
29. Juicy Questions	187
30. Justified List	191
31. Justified True or False Statements	196
32. K-W-L Variations	199
33. Learning Goals Inventory (LGI)	204
34. Look Back	207
35. Missed Conception	210
36. Muddiest Point	214
37. No-Hands Questioning	217
38. Odd One Out	220
39. Paint the Picture	223
40. Partner Speaks	226
41. Pass the Question	229
42. A Picture Tells a Thousand Words	232
43. P-E-O Probes (Predict, Explain, Observe)	235
44. POMS—Point of Most Significance	240
45. Popsicle Stick Questioning	242
46. Prefacing	245
47. PVF—Paired Verbal Fluency	248
48. Question Generating	251
49. Recognizing Exceptions	255
50. Refutations	258
51. Representation Analysis	261
52. RERUN	264
53. Scientists' Ideas Comparison	267
54. Sequencing Cards	271
55. Sticky Bars	274
56. STIP—Scientific Terminology Inventory Probe	278
57. Student Evaluation of Learning Gains	281
58. Synectics	285
59. Ten-Two	288
60. Thinking Log	291
61. Think-Pair-Share	295
62. Thought Experiments	298
63. Three-Minute Pause	302

64. Three-Two-One	305
65. Traffic Light Cards	308
66. Traffic Light Cups	311
67. Traffic Light Dots	314
68. Two-Minute Paper	317
69. Two or Three Before Me	320
70. Two Stars and a Wish	322
71. Two-Thirds Testing	325
72. Volleyball—Not Ping-Pong!	328
73. Wait Time Variations	331
74. What Are You Doing and Why?	335
75. Whiteboarding	338
Appendix: Annotated Resources for	
Science Formative Assessment	343
References	349
Index	355