

## *Table of Contents*

<b>Preface: Why Teach Science Online? .....</b>	<b>10</b>
How To Get the Most Out of This Book .....	13

### **Section I: Planning the Course**

#### **CHAPTER 1—TOOLS FOR THE ONLINE TEACHER .....14**

1.1 Personal Technology .....	14
1.2 Colleagues, Mentors, and Instructional Designers .....	19
1.3 Online Resources .....	21
Cross-Curricular .....	21
Biology .....	22
Chemistry .....	22
Geology .....	22
Physics .....	23

#### **CHAPTER 2—GENERAL TIPS & STRATEGIES .....24**

2.1 Expect the Unexpected .....	24
2.2 Plan to Differentiate for Technological Skill .....	25
2.3 Having your Course Reviewed .....	27
Ten questions to ask your course reviewer/colleagues .....	28
Quality Matters .....	29

#### **CHAPTER 3—THE PEDAGOGY YOU NEED TO SUCCEED.30**

3.1 Adult Learning Principles .....	30
The Learner’s Prior Experience.....	30
The Learner’s Self-Concept .....	30
The Learner’s Need to Know .....	30
The Learner’s Readiness to Learn .....	31
The Learner’s Orientation to Learning .....	31
The Learner’s Motivation.....	31
3.2 Best Practices in Undergraduate Education .....	32
3.3 Investing Your Time Up Front .....	34
3.4 Course Ownership.....	39

<b>CHAPTER 4—BOOKS/ONLINE HOMEWORK SYSTEMS ..41</b>
4.1 To Textbook or Not to Textbook? ..41
4.2 Textbook Format Options ..43
4.3 Open Educational Resources ..44
4.4 Online Homework Systems ..46

<b>CHAPTER 5—CHOOSING LABORATORY ACTIVITIES.....50</b>
5.1 Labs or No Labs? .....50
5.2 Lab Kit Companies .....51
5.3 Instructor-Written Labs Using Household Materials .....52
5.4 Virtual Labs .....53
5.5 NANSLO .....55
5.6 Effectiveness of Online and At-Home Laboratory Activities .....56
5.7 Faculty Liability .....58

## Section II: Building the Course

<b>CHAPTER 6—MAKING THE MOST OF YOUR LMS ..60</b>
6.1 Learning Management System Tools.....60
Announcements .....60
Instructor Information .....62
Assignments .....62
Discussions .....63
Gradebook .....63
6.2 Accessibility .....64
Universal Design .....64
Tips for Teaching an Accessible Online Course.....66

<b>CHAPTER 7—LESSON DESIGN FOR ONLINE DELIVERY ..68</b>
7.1 Student Learning Objectives ..68
7.2 Creating Diverse Learning Experiences ..71
Dale’s Cone of Experience ..74
Verbal Symbols.....74
Visual Symbols.....75
Multimedia ..75
Exhibits.....75
Study Trips ..75
Demonstrations.....76

Dramatization .....	76
Contrived Experience .....	76
Direct Purposeful Experience.....	76
Learning Activities in Online/F2F Science Courses .....	79
Lecture .....	79
Reading Textbook.....	80
Online Homework System (Used as homework) .....	80
Hands-on Laboratory Activities .....	81
Lab Kits .....	81
Labs Using Household Materials .....	81
Virtual Labs .....	82
NANSLO .....	83
Quizzes/Tests .....	83
Discussions .....	84
Group Collaboration.....	84
Written Assignment .....	85
7.3 Active Learning.....	86
The 5E Model .....	90
7.4 Group Collaboration .....	92
Rubrics.....	97
7.5 Discussion Forums .....	108

<b>CHAPTER 8—HOW TO CONSTRUCT AN EFFECTIVE ONLINE COURSE SYLLABUS .....</b>	<b>115</b>
8.1 Similarities and Differences Between F2F and Online Syllabi	115
8.2 Course and Instructor Information.....	117
Course Information.....	117
Instructor Information .....	117
Required Course Materials .....	119
Learning Objectives .....	119
Course Calendar .....	120
8.3 Course Grading Information .....	120
Instructional Methods .....	120
Assignment Descriptions.....	120
Grading Criteria & Grade Scale .....	120
Academic Dishonesty .....	121
Exam Proctoring.....	121
Late Work/Make-up Work .....	122

8.4 Attendance.....	123
8.5 Student and Faculty Time Management Tips.....	126
8.6 Technology Back-up Plan .....	128
8.7 Student Resources & Support .....	129
LMS Support .....	129
Technical Assistance.....	129
Library Access .....	129
Disability Services & ADA Statement .....	129

## **CHAPTER 9—ORGANIZATION IS KEY .....130**

9.1 Course and Calendar Organization .....	130
Linear.....	131
Modular .....	133
9.2 Building a Better Calendar.....	135
9.3 Exam Windows .....	139

## **Section III: Facilitating the Course**

### **CHAPTER 10—ORIENTING STUDENTS TO THE COURSE 142**

10.1 Welcome to Online Learning .....	142
10.2 Types of Orientations .....	144
Orientation to the Learning Management System.....	145
Orienting Students to the Course Content .....	147
Safety Orientation.....	148

### **CHAPTER 11—BUILDING A COMMUNITY OF LEARNERS ..153**

11.1 Communicating With Your Students .....	153
11.2 Learning Communities.....	155
11.3 Discussion Forums .....	157
11.4 Social Media .....	157
11.5 Facilitation of Student Collaboration .....	158
11.6 Communication Tools .....	159

### **CHAPTER 12—STRATEGIES FOR ONLINE STUDENT SUCCESS & COURSE COMPLETION .....162**

12.1 Retaining Your Online Students.....	162
Understanding Student Procrastination .....	163
Frequent, Consistent Deadlines .....	165
12.2 Student Needs and Motivation.....	165

<b>CHAPTER 13—ASSESSMENTS .....</b>	<b>169</b>
13.1 Formative Assessments .....	169
13.2 Laboratory Assessments .....	173
13.3 Summative Assessments .....	178
13.4 Plan for Feedback .....	180
Assessment Rubric .....	183
<b>CHAPTER 14—COMBATTING ACADEMIC DISHONESTY ..</b>	<b>184</b>
14.1 Academic Dishonesty in Online Classes.....	184
14.2 Paid Academic Dishonesty .....	186
14.3 Plagiarism Detection Tools .....	188
14.4 Exam Proctoring Options .....	189
<b>COPYRIGHT FAIR USE GUIDELINES .....</b>	<b>192</b>
What Types of Creative Work Does Copyright Protect? .....	192
Permission: What Is It and Why Do I Need It? .....	192
Obtaining Clearance for Coursepacks .....	193
Using a Clearance Service .....	194
Educational Uses of Non-Coursepack Materials .....	194
Guidelines Establish a Minimum, Not a Maximum .....	195
The Difference Between the Guidelines and Fair Use Principles...195	195
What is an “Educational Use?” .....	195
Rules for Reproducing Text Materials for Use in Class .....	196
Rules for Reproducing Music .....	196
Rules for Recording and Showing Television Programs .....	197
References .....	198
Index .....	220

# **Table of Figures**

<b>Table 1.1A – Data use for Internet activities .....</b>	<b>18</b>
<b>Figure 6.1A – Sample Welcome Announcement .....</b>	<b>61</b>
<b>Figure 6.1B – Sample Instructor Information .....</b>	<b>62</b>
<b>Figure 7.1A – Bloom’s Taxonomy (Revised) .....</b>	<b>69</b>
<b>Figure 7.2A – Characteristics of Students Who Took Some or All of Their Courses Online .....</b>	<b>72</b>
<b>Figure 7.2B – Percentage of Students with Nontraditional Characteristics Taking Some or All Courses Online .....</b>	<b>73</b>
<b>Figure 7.2C – Dale’s Cone of Experience .....</b>	<b>74</b>
<b>Figure 7.2D – Integrated Learning Activities .....</b>	<b>77</b>
<b>Figure 7.4A – Virtual Collection Group Project Instructions .....</b>	<b>94</b>
<b>Figure 7.4B – Rubric – Individual Portion Ecology .....</b>	<b>98</b>
<b>Figure 7.4C – Rubric – Group Portion Ecology .....</b>	<b>101</b>
<b>Figure 7.4D – Group Project Presentation Rubric .....</b>	<b>104</b>
<b>Figure 7.4E – Group Project Collaboration Rubric .....</b>	<b>106</b>
<b>Figure 7.5A – Icebreaker Discussion Forum Instructions .....</b>	<b>111</b>
<b>Figure 7.5B – Sample Discussion Rubric .....</b>	<b>112</b>
<b>Figure 8.3A – Proctoring Exams .....</b>	<b>121</b>
<b>Figure 9.1A – Sample Linear LMS Organization Unit Folder .....</b>	<b>131</b>
<b>Figure 9.1B – Sample Main Selection Button .....</b>	<b>132</b>
<b>Figure 9.1C – Linear LMS Organization Weekly Modules .....</b>	<b>132</b>
<b>Figure 9.1D – Modular Organization Plan and Calendar .....</b>	<b>134</b>
<b>Figure 9.2A – Sample Modular Calendar.....</b>	<b>137</b>
<b>Figure 9.2B – Sample Face-to-Face Calendar.....</b>	<b>138</b>
<b>Figure 9.3A – Sample Linear Exam Window Calendar.....</b>	<b>140</b>
<b>Figure 9.3B – Sample Modular Exam Window Calendar .....</b>	<b>141</b>
<b>Figure 10.1A – Sample Welcome to Online Bio. Email.....</b>	<b>142</b>
<b>Figure 10.2A – Sample Online Lab Safety Agreement.....</b>	<b>151</b>
<b>Figure 11.2A – Student Technology Efficacy.....</b>	<b>156</b>
<b>Figure 13.1A – The Unit Assessment Cycle .....</b>	<b>170</b>
<b>Figure 13.2A – Levels of Organization &amp; Diversity of Life Assignment: Nature Selfie! .....</b>	<b>174</b>