

*Nurturing the*  
**Naturalist**  
intelligence

Dr Wan Inn Loh & Dr George Jacobs

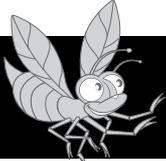


**Hawker Brownlow**  
Education a Solution Tree company

# Table Of Contents

## **NURTURING THE NATURALIST INTELLIGENCE**

<b>Charts</b>	Science Process Skills Chart .....V
	Science Process Skills In Lessons .....VI
<b>• INTRODUCTION .....VII</b>	

**Unit 1** **IS COOPERATION THE BEST SITUATION?** 

In this unit, students study how we as humans, and indeed all of nature, are connected in the web of life. Students use a wide range of intelligences as they draw, sing, chant, act, observe, categorise, design, reflect and move while blindfolded. They learn about: plant-animal interdependence, humans’ connections with other aspects of nature, connections between countries, interdependence of body parts and links within language.

**For Your Information, Key Ideas and Unit Vocabulary .....4**  
**Lessons**

1. Lean on me.....7
2. Let your fingers do the remembering .....8
3. Try to “finger” it out .....10
4. Play the system game .....11
5. The team inside of us .....17
6. Give advice.....18
7. Appreciate pests.....20
8. Dance what you want to say .....24
9. Take another look at snails .....26
10. Build a web .....30
11. Make connections .....37
12. Fish for the future .....39
13. Name that group .....43
14. Make your own collective nouns .....46
15. Realise how important you are .....47
16. Flock for cooperation .....49
17. Observe teams .....52
18. Realise the relations .....54
19. Investigate global connections .....57
20. Simulate human population increase .....58
21. Convince others.....61
22. See how sentences stick together .....64
23. Create crazy connections .....67

**Unit 2** **WHY ARE POLLINATORS OUR LIFELINE?** 

Bees are just about honey and stings, and butterflies are just about floating colours. Or, are they? In this unit, students discover the vital role bees, butterflies and other pollinators play in the web of life. Students imitate pollinators, write poems, raise animals, build models, investigate habitats and look at sayings about pollinators. They find out not only the value of pollinators, but which animals are pollinators, what plants are pollinated, how pollination takes place, what we can do to protect pollinators, and how pollinators use plants without harming them.

**For Your Information, Key Ideas and Unit Vocabulary .....72**  
**Lessons**

1. Who do we thank when we eat an apple?.....74
2. Pick the pollinators .....75
3. Eat an apple, thank a bee.....77
4. Shaped for pollinators.....79
5. Sip like a butterfly .....81
6. What does it mean to be a bee? .....82
7. Shaped for pollinators.....84
8. Ride the wind .....86
9. Different needs, different packaging .....91
10. Collect flowers .....94
11. Can’t now, can later .....96
12. Using without abusing .....98
13. Nurture a pollinator .....100
14. How to be a good host for butterflies.....105
15. Map the Pollination Path .....107
16. Wing It!.....108
17. Play the Success Game.....111
18. What does that mean? .....114
19. Dare to be different! .....117

# Table Of Contents

## **NURTURING THE NATURALIST INTELLIGENCE**

### **Unit 3** WHO ARE NATURE'S CLEANERS AND WHAT DO THEY DO?



In this unit, students explore how nature accomplishes the miracle of waste disposal. Students visualise, observe, experiment and dramatise nature's recycling process. They gain an appreciation for how all life depends on Nature's Cleaners: fungi, bacteria, beetles, termites and maggots.

**For Your Information, Key Ideas and Unit Vocabulary** .....122  
**Lessons**

1. Imagine you are a leaf .....124
2. Investigate nature's cleaners.....126
3. Where are nature's cleaners? .....131
4. Watch a cleaner in action .....134
5. Are earthworms farmers' best friends? .....138
6. Analyse your garbage .....143
7. Compost your organic waste .....146
8. Decomposers go on strike .....148

### **Unit 4** WHAT ARE YOU EATING?



Food, marvellous food! In this unit, students think more deeply about what they are putting into their mouths. Students have fun brainstorming, designing a questionnaire, observing, comparing, and best of all cooking, smelling, and tasting a variety of foods. They explore how foods can be categorised, what makes for a balanced meal, how foods are processed, our beliefs and legends about food and the problem of world hunger.

**For Your Information, Key Ideas and Unit Vocabulary** .....154  
**Lessons**

1. Know your vegetables .....157
2. Draw vegetables.....158
3. Know your fruits .....161
4. It's fine to define, but sometimes you've got to refine .....162
5. Oh no! What category do I put it in? .....166

6. Ask people about the differences between fruits and vegetables.....169
7. Can I eat it? .....170
8. Cut and observe grains .....173
9. Grow your own corn and beans .....175
10. What's in my cereal? .....177
11. What's on a cereal box? .....178
12. How are cornflakes made? .....180
13. What makes the "pop" in popcorn? .....181
14. Compare recipes .....184
15. Bake your own corn creations .....186
16. Reading can make you hungry .....188
17. Do foods have special powers? .....190
18. Find a food legend.....192
19. What am I smelling? .....194
20. What am I tasting? .....196
21. Where am I tasting?.....198
22. Does the nose know? .....204
23. Categorise your food.....207
24. Healthy eating .....209
25. Plan a meal.....211
26. Make delicious, healthful snacks .....212
27. Test for carbohydrates, fats, glucose and protein .....215
28. Get corny .....218
29. Build a solar cooker.....220
30. Help hungry people .....221
31. What did they eat in the good old days? .....222

### **Unit 5** WHAT CAN I DO TO SAVE TREES?



In this unit, students explore how important trees are to our lives and how scarce this resource is becoming. They collaborate to brainstorm, categorise, appreciate, estimate, calculate, recycle and write. They also learn about how recycling works, other ways to save trees, people who protect trees and alternatives to paper.

**For your Information, Key Ideas and Unit Vocabulary** .....228  
**Lessons**

1. What exactly is a tree? .....230
2. Profile trees, shrubs and herbs.....233
3. Appreciate trees .....236
4. Visualise what began life as a tree .....239
5. How many trees are we using up? .....240

# Table Of Contents

## NURTURING THE NATURALIST INTELLIGENCE

6. How many trees did you read today? .....	246
7. Generate ways to save trees.....	248
8. Use the “Reduce, Reuse and Recycle” categories .....	249
9. Create a story about the paper cycle .....	251
10. Make recycled paper .....	252
11. Fibres come alive .....	259
12. Write thank you notes .....	260

### Unit 6

## WHAT IS PRECIOUS AND FINITE?



In this unit, students come to appreciate the prominence and value of water. Students visualise, build models, conduct experiments, categorise, grow plants, audio record and audit their use of water. They learn about the various states of water, the water cycle, and how to conserve water.

**For Your Information, Key Ideas and Unit Vocabulary .....** 266

### Lessons

1. Know your Earth .....	268
2. Shape the world.....	270
3. Experiment about the value of water .....	272
4. Know your water .....	275
5. What roles does water play? .....	276
6. Predict the level .....	277
7. It’s cold in here! .....	281
8. It’s hot in here!.....	285
9. Cool Down! .....	288
10. Help! I’m melting! .....	290
11. An eternal cycle .....	294
12. It’s in the bag .....	299
13. Living without watering .....	303
14. How can we save water? .....	305
15. Drip, drip, drip: We’re dry .....	306
16. Do a water audit .....	309
17. Then and now .....	312
18. Convince others.....	314
19. Have an impact .....	315
20. Sounds of water .....	316
21. Simulate Earth.....	317
22. Acid attack! .....	319
23. View paintings of water .....	322

### Unit 7

## WHY DO ANIMALS PLAY HIDE AND SEEK IN NATURE?



In this unit, students investigate some of the survival techniques animals use in nature. Students recall, visualise, draw, compose a chant, make collages and role play. They examine such key concepts as natural selection, survival of the fittest, selective predation and adaptation.

**For Your Information, Key Ideas and Unit Vocabulary .....** 328

### Lessons

1. Remember Hide and Seek.....	332
2. List your hiding secrets.....	334
3. How sharp are your eyes? .....	336
4. Survival of the fittest.....	338
5. Snails and thrushes .....	344
6. Imagine you’re a snail .....	349
7. Play Thrushes and Snails .....	351
8. Should elephants go tuskless? .....	354
9. Chant like bacteria .....	358
10. Bacteria bounce back .....	360
11. Write a survival story .....	363
12. Create collages .....	364
13. Play Birds and Insects.....	366
14. A look again at the peppered moth .....	372

## WHY DON'T SPIDERS STICK TO THEIR OWN WEBS?

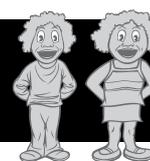


The wonders of nature are all around us, but we often don't notice them. In this unit, students go hands-on with one such wonder: spider webs. They discuss, speculate, imagine, analogise, dramatise and read poetry about this marvel of the natural world. Students learn what keeps spiders from sticking to their webs and how to see the world from spiders' point of view.

**For Your Information, Key Ideas  
and Unit Vocabulary** .....380  
*Lessons*

1. Why don't spiders stick to their webs .....382
2. Answering sticky questions .....385
3. Constructing a spider web .....388
4. Spiders and snakes: Friendship or fear? .....392
5. Building our knowledge of spiders .....398
6. If I were a spider .....401
7. Play the Web Game .....402
8. Not insects, but Arachnida .....406
9. Investigating Arachnida .....410

## HOW AM I DIFFERENT FROM YOU?



This unit celebrates the uniqueness of each of us. Students use diagrams, chant, predict, draw and debate. Starting with their own profiles, they come to understand what makes them distinctive as individuals as well as their similarities to others. This concept is explored via such topics as fraternal and identical twins, fingerprints and the distinctive patterning on tigers' faces.

**For Your Information, Key Ideas  
and Unit Vocabulary** .....420  
*Lessons*

1. Exploring similarities and differences .....422
2. Explore similarities and  
differences between partners .....423
3. Explore similarities and  
differences among the class.....427
4. Make a chant .....428
5. Runs in the family .....429
6. What are all those squiggly lines?.....431
7. Do forensics .....432
8. Is anyone like me .....434
9. Find a match .....436
10. Are my fingerprints the same for life? .....438
11. What's as distinctive as  
fingerprints for tigers? .....440
12. Are you my tiger? .....442
13. Trade places .....444
14. How can you prove you are really you? .....447
15. Play Same/Different with  
the *Prince and the Pauper* .....448
16. Are the twins identical? .....452
17. Squint at the prints .....456
18. Extract DNA.....458
19. Should governments keep  
citizens' fingerprints .....461
20. Fingerprint fun .....463

# SCIENCE PROCESS SKILLS

PROCESS SKILLS	
<b>Observing</b>	Using one or more senses — sight, smell, touch, hearing, taste — to gather information about organisms, objects or events. This includes the use of instruments to extend the range of senses and accuracy of observation.
<b>Comparing</b>	Looking at similarities and differences in organisms, objects, events and concepts.
<b>Classifying</b>	Grouping, sorting, arranging, categorising, ordering, sequencing and ranking according to properties or criteria such as shape, size, colour, use, genetic relationship, behaviour pattern.
<b>Measuring and manipulating materials</b>	Observing and using measuring devices for the purpose of quantitative description. Use of materials and apparatus in appropriate manner.
<b>Communicating</b>	Conveying and sharing information — ideas, directions, descriptions, data — orally, in written form or via visual images through logs, reports, journals, graphs, maps, pictures, charts, diagrams, tables, keys, models.
<b>Inferring</b>	Proposing interpretations and explanations of events based on observation and data collection.
<b>Predicting</b>	Declaring possible outcomes by making an educated and reasonable guess or estimate based on observations, prior knowledge and experiences.
<b>Investigating</b>	Experimenting on the basis of a hypothesis with variables defined and controlled.
• <b>hypothesising</b>	Formulating a testable statement of a relationship that might exist between two or more variables based on observations. A hypothesis is often formulated as an 'If..., then...' statement. Put simply, a hypothesis is one's tentative answers or untried solutions to a question or problem under investigation.
• <b>defining and controlling variables</b>	Recognising that many factors affect the outcome of events. Understanding how these factors relate to each other. Determining which factors should be studied and which factors should be controlled in an investigation.

# INTRODUCTION

## MY LIFE WITH NATURE

As a child growing up in Singapore, our garden always had a variety of tropical fruit trees — mango, custard apple and sour-sop among them — and vegetables such as lady's fingers (okra), aubergines (eggplant), beans of various types, and chilies. We also had roses, orchids, cacti and a variety of other plants. I can't remember a time when my mother wasn't actively working in her garden. Perhaps, she can be considered a naturalist at heart. My mother had no training in biology nor did she read any books on plants, but she loved to putter around her garden. Despite her lack of formal knowledge, she was able to identify plants and taught us how to grow them. To this day, I use my mother's lady's finger pods in my classes with teachers.

Plants were not the only salient aspect of nature in my daily environment as a child. I also kept pet chicks, in addition to the more common dogs. When I went to Ireland in my early teens, there was never any question what I would study in college — the biological sciences.

Growing plants, taking walks in parks and caring for pets have continued to be part of my life and later became part of my children's lives as well. Wherever we have lived, Australia, Taiwan or the U.S., we have always taken time to enjoy exploring the natural beauty of our host country. To this day, my children speak fondly of Jockey Hollow in New Jersey, the bear that they saw eating at a picnic table in Yosemite Park, the Dandenongs in Melbourne and Yang Ming San in Taipei.

## MULTIPLE INTELLIGENCES THEORY

In 1983, Howard Gardner proposed that humans have many different ways of interacting with the world around us. He made the controversial claim that intelligence was not a unitary phenomenon that was measured by a single score, our I.Q. (intelligence quotient). Instead, Gardner initially proposed that humans have

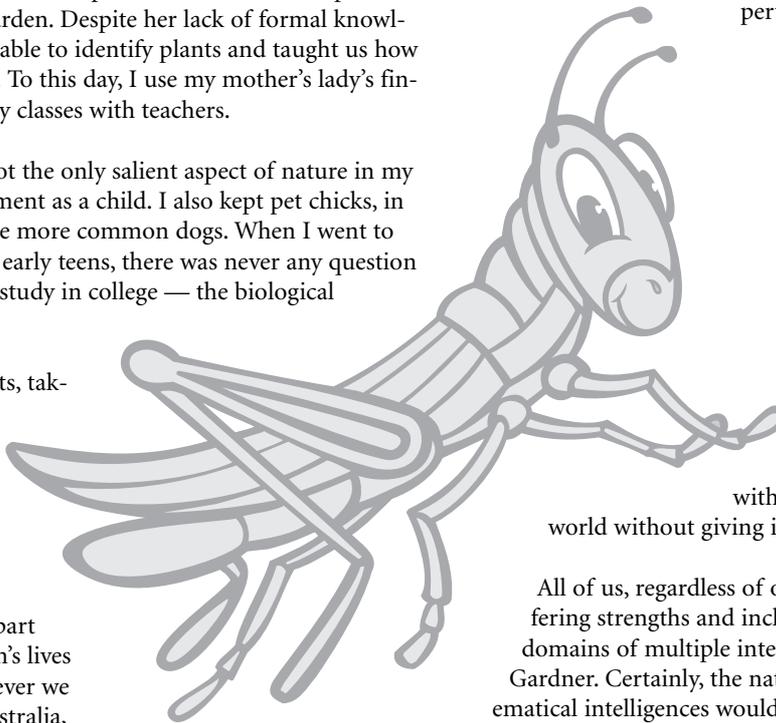
seven different intelligences or 'frames of mind'. Moving beyond the traditional focus of school on linguistic intelligence and logical-mathematical intelligence, he proposed that we also have spatial, bodily-kinesthetic, musical, interpersonal and intrapersonal intelligences. Subsequently, an eighth intelligence was proposed by Gardner (Checkley, 1997). However, Gardner does not claim that this is a complete list, and others have proposed other ways of categorising intelligences.

This eighth intelligence is the naturalist intelligence and pertains to an affinity for

learning about the natural world. Such individuals enjoy observing, sorting and classifying natural things. As a biologist, I could certainly relate to Gardner's description: perhaps a naturalist intelligence is taken for granted by those of us who observe, classify and identify with aspects of the natural world without giving it a second thought.

All of us, regardless of our background, have differing strengths and inclinations within the eight domains of multiple intelligences identified by Gardner. Certainly, the naturalist and logical-mathematical intelligences would be my strengths and interests compared to musical and kinesthetic intelligences. Whether my particular mix of strengths and weaknesses, inclinations and interests is due to heredity, or results from the influences of my environment, I have seen that same affinity with nature and ability to observe and classify in my children from an early age.

This close relationship with nature has been particularly obvious in my youngest child, Jason, who had developmental delays in various milestones in other areas. At three years old, Jason could gaze for a long time at birds and flying insects, catching insects with his bare hands, while delayed in speech and other areas. By age five, he had found eggs or caterpillars and nurtured them into butterflies. We hand-fed the butterflies and had them fluttering about our living room. Then, there was Brad,



the praying mantis who lived with us for many months, hand-fed by Jason with flies and mincemeat until released. To the horror of many of my friends, Jason kept jars of spiders, some poisonous, under his bed. He was able to classify these spiders from reference materials and learned how to look after them. Despite reports from his teachers that he was inattentive in class and a diagnosis of attention deficit disorder, Jason had an astonishing ability to focus for long periods of time when observing, catching and caring for insects and spiders.

Working with my own child and seeing how experiences with nature provided a focus for his development, convinced me of the vital importance of nurturing the naturalist intelligence. Many urban and suburban children have little or no contact with the natural world.

Children in today's world have many technological blessings, such as computers, CD-ROMs and video games, but can these take the place of real life experiences with nature? Can meaningful experiences looking after real life pets and plants, and seeing nature in the wild ever be replaced by keeping virtual pets, watching internet simulations or collecting fantasy animals, such as Pokemon<sup>®</sup>? Can an affinity with and respect for nature ever be nurtured without any contact with nature?

### **TEACHER'S ROLE IN PROTECTING THE ENVIRONMENT**

We live in a world where humans have rendered animals, such as the Dodo and Tasmanian Tiger, extinct while endangering the lives of many other animals, such as the Great White Shark and Orangutan. As teachers, it is timely for us to actively encourage our students to develop environmentally and socially appropriate values about nature. We can start by helping children become sensitive to the wonders of nature, learn about the importance of conservation of resources, and understand the interdependence of all life. If we do so, this generation of children will be more sensitive to ensuring an ecological balance when they become adults.

The naturalist intelligence is also crucial to nurture, given the current state of our planet. Teachers can play an important role in fostering children's naturalist intelligence and laying the foundation for scientific literacy. Teachers can match, stretch and celebrate children's naturalist intelligence so that in the future they can make informed choices on environmental issues.

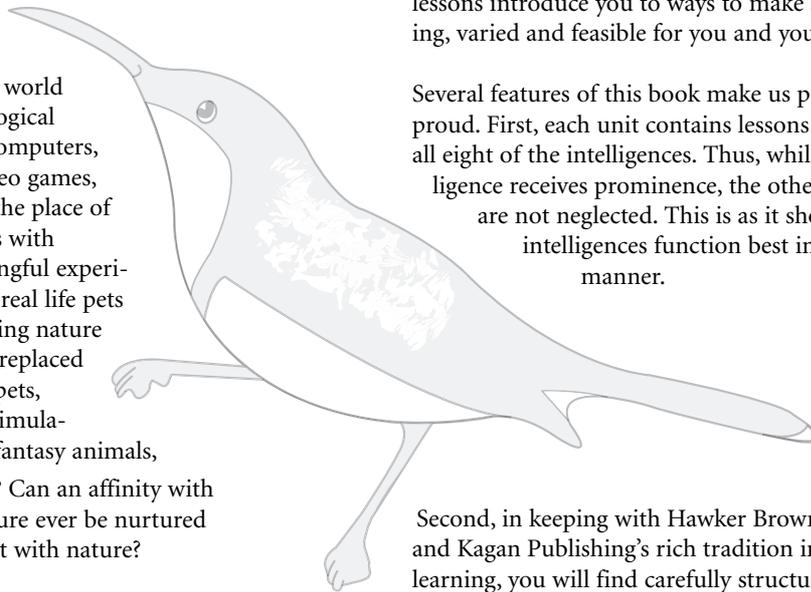
### **THIS BOOK**

*Nurturing the Naturalist Intelligence* is written with the goal of providing a resource to assist teachers in facilitating children's construction of knowledge of and attitudes toward the natural world. For the enthusiastic science teacher, we hope the lessons provide new kinds of activities to excite both you and your students. For the less confident or reluctant science teacher, we hope the lessons introduce you to ways to make science challenging, varied and feasible for you and your students.

Several features of this book make us particularly proud. First, each unit contains lessons that incorporate all eight of the intelligences. Thus, while naturalist intelligence receives prominence, the other intelligences are not neglected. This is as it should be, for the intelligences function best in an integrated manner.

Second, in keeping with Hawker Brownlow Education and Kagan Publishing's rich tradition in cooperative learning, you will find carefully structured cooperative activities combined with both teacher's direct instruction and individual work. As with multiple intelligences, cooperative group work flowers best in an integrated instructional environment.

Third, skills relevant to the process of conducting science hold an important place in learning about the natural world, and a wide variety of these come into play in the units. Finally, we have tried to make the book one that not only helps students learn about nature, but also involves them in helping to protect nature. Here, your help is necessary. You, your students, and your colleagues know your local context. You will know how best to intervene to help nature in the places where you live in order to have the greatest effect.



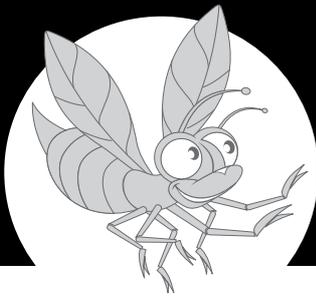
# Unit

## IS COOPERATION THE BEST SITUATION?



### UNIT OVERVIEW

In this unit, students explore various areas and aspects of interdependence. Areas include: plant-animal interdependence, humans' connections with other parts of nature, connections between countries, interdependence of body parts, links within language, and intra-species communication. In their explorations of interdependence, students use a wide range of intelligences as they write, draw, sing, chant, act, observe, categorise, design, reflect and move while blindfolded.



# Is Cooperation the Best Situation?

## LESSONS-AT-A-GLANCE

### FOR YOUR INFORMATION, KEY IDEAS AND UNIT VOCABULARY .....4

#### 1. LEAN ON ME .....7

Pairs of students experience and discuss their interdependence as they put their palms together and gradually move their feet backward till they are supporting one another. *15 minutes*

#### 2. LET YOUR FINGERS DO THE REMEMBERING .....8

One member of each pair is blindfolded. His/her partner leads him/her to a tree or other object and lets him/her use the sense of touch and other senses. Later, the blindfold is removed, and the student attempts to return to the object. *20 minutes*

#### 3. TRY TO "FINGER" IT OUT .....10

Students consider how their fingers work together when typing and generate sentences to illustrate this. *20 minutes*

#### 4. PLAY THE SYSTEM GAME .....11

Students consider how organs work together to form systems and then make board games to illustrate the functioning of a particular system. *Project*

#### 5. THE TEAM INSIDE OF US .....17

Students review the functions of different body parts and explore how these parts connect with one another. *45 minutes*

#### 6. GIVE ADVICE .....18

Students discuss how one body system affects others. Based on this they write an advice letter to a hypothetical student about how to protect his/her health. *45 minutes*

#### 7. APPRECIATE PESTS .....20

Students create a song to help others appreciate an animal or plant that most people consider to be a pest. *30 minutes*

#### 8. DANCE WHAT YOU WANT TO SAY .....24

Students learn how bees use dance to communicate. Pairs devise dances to communicate to other pairs. *25 minutes*

#### 9. TAKE ANOTHER LOOK AT SNAILS .....26

Students raise snails and consider their role in the web of life. *Project*

#### 10. BUILD A WEB .....30

Students build food chains and webs based on the food they eat. *60 minutes*

#### 11. MAKE CONNECTIONS .....37

Students use string to represent connections in the web of life. They display the connections in a mind map. *40 minutes*

#### 12. FISH FOR THE FUTURE .....39

Students do a simulation about fishing in order to explore the issue of sustainable resources utilisation. *30 minutes*

#### 13. NAME THAT GROUP .....43

Students learn about the different names used for groups in different animal species. *20 minutes*

#### 14. MAKE YOUR OWN COLLECTIVE NOUNS .....46

Students invent collective nouns for groups of different types of people. *20 minutes*