Digging deeper into National Monitoring Study of Student Achievement data

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Outline

- Developing the 2012 NMSSA science assessment
- Student responses
  - Describing
  - Explaining
  - Science diagrams
    - Food chains
    - Food webs

Assessment Components

Paper and pencil "test"
Years 4 and 8
2000 students at each year level

- Performance and interview tasks, one on one or small groups
  - Sub-sample of above
- Questionnaires
  - Students, teachers, principals

The framework

Science claim

- Students can communicate their developing ideas about the natural world and engage with a range of science texts.

Framework (example from Y4)

Sub-claim

Written text

Students can describe what they notice about the natural world

Students will be able to:

- Use rich vocabulary to describe precisely
- Attend to multiple elements
- Observe accurately
- Sequence events in logical order

Observing and describing

What were the Year 4 students asked to do?

Describe differences and similarities between a possum and a cat.

Drawings were provided.

Comparisons – student responses

Similarities

- The pussum is in the tree and the cat is in the tree.
- The possum has big ears and the cat dose to.
- They both have tails.
- Both climb trees.
- Their ears both stick up.
- furry
- the feet

Differences

- Possums have sharper claws.
- The possum does not have stripes like the cat.
- Cats nose is smaller.
- Possum has a black tail and the cat doesn't.
- their eyes
- tail

Observing and describing

What were the Y8 students asked to do?

1. Describe a kea so another person would be able to recognise one if they saw it. A photograph was supplied.

2. Describe the pattern shown in a diagram of the trajectory of a ball.

Clear description

It's quite plump. A 50c coin is about the size of one claw. It has 4 claws. It has quite a sharp beak that curves down. It has small black beady eyes. It's feathers gets bigger as it moves down the bird.

not based on observation

A kea is a very smart bird. It is green and yellow. It eats like a human with its hands. They are know to break into locked cars.

non-specific description

Its got claws and feathers and a beak.

What we found out

- Few students gave detailed descriptions, often just describing one or two features.
- Often students' descriptions were very general, e.g., their tails; it has wings, it went up then down.
- Some students included details that could not be observed from the stimulus.
- Some Year 4 students did not use comparative vocabulary, or just discussed one animal.
- A few Year 4 students included details of the background rather than the animals.

Explaining

Types of tasks

- support choices
- justify answers
- use a science idea
- explain a pattern in data.

Answer	Assessment focus	Examples
Explanation links to/implies temperature	Using information to think with: explaining. We are looking for explanations that link melting to an increase in temperature	The water is warmer than ice. It melts when it warms up. The sun melts it.
Explanation doesn't link to temperature		**No link to temperature** Ice melts in water It dissolves in the water The water will make it melt. **Links to time, not temperature** After a while it melts. If you leave them a long time they will melt.

Melting butter

Henry thinks that the heat travels up the metal stick (i.e., provided with a hypothesis). How do the results from his investigation show that his idea might be right?

Answer	Assessment focus	Examples
Explanation includes reference to time melting (shown on the graph) **and** distance from water (shown in the diagram)	Using information to think with: justifying We are looking for students' ability to support conclusions with evidence from data	Because sample 3 is closest to the heat so it was faster. 3 is closest to the boiling water so once it melted 2 melted and finally 3 melted.
Partial explanation that draws on only one piece of evidence (graph or diagram)		Because sample 3 was nearest to the bottom (*distance but not time*). Because it's the only thing that's hot (*draws from diagram only)* Because without heat travelling up nothing melted. Butter sample 1 still gets heat.

What we found out

- Many students even at Year 8 struggled with writing a coherent explanation.
- Simple explanations based on students' personal experiences were easier tasks.
- Items that required students to draw on abstract science knowledge, or to make inferences from patterns in complex data tended to be more difficult.

Life cycle diagrams

Year 4:
Read a short description of a life cycle of an insect likely to be familiar to students (a butterfly) and draw a diagram to show this. Simple drawings of each element of the life cycle were provided.

Year 8:
The task was the same but the life cycle of the insect (huhu) was likely to be unfamiliar.

How were the items judged?

(2): the diagram accurately communicated the life cycle using accepted science conventions

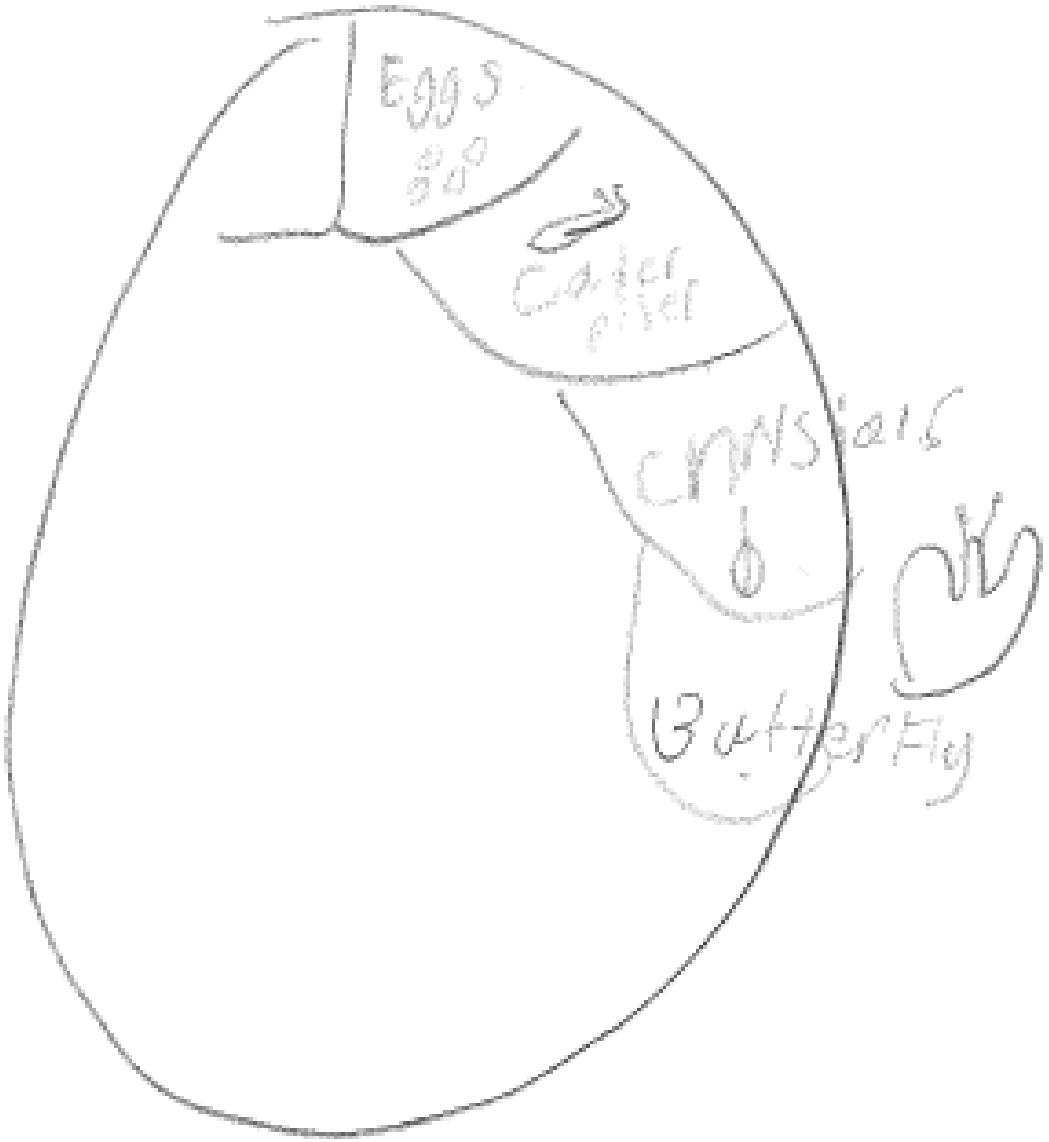
(1): the diagram clearly communicated the life cycle using students' personal conventions, or a mixture of these and accepted science conventions

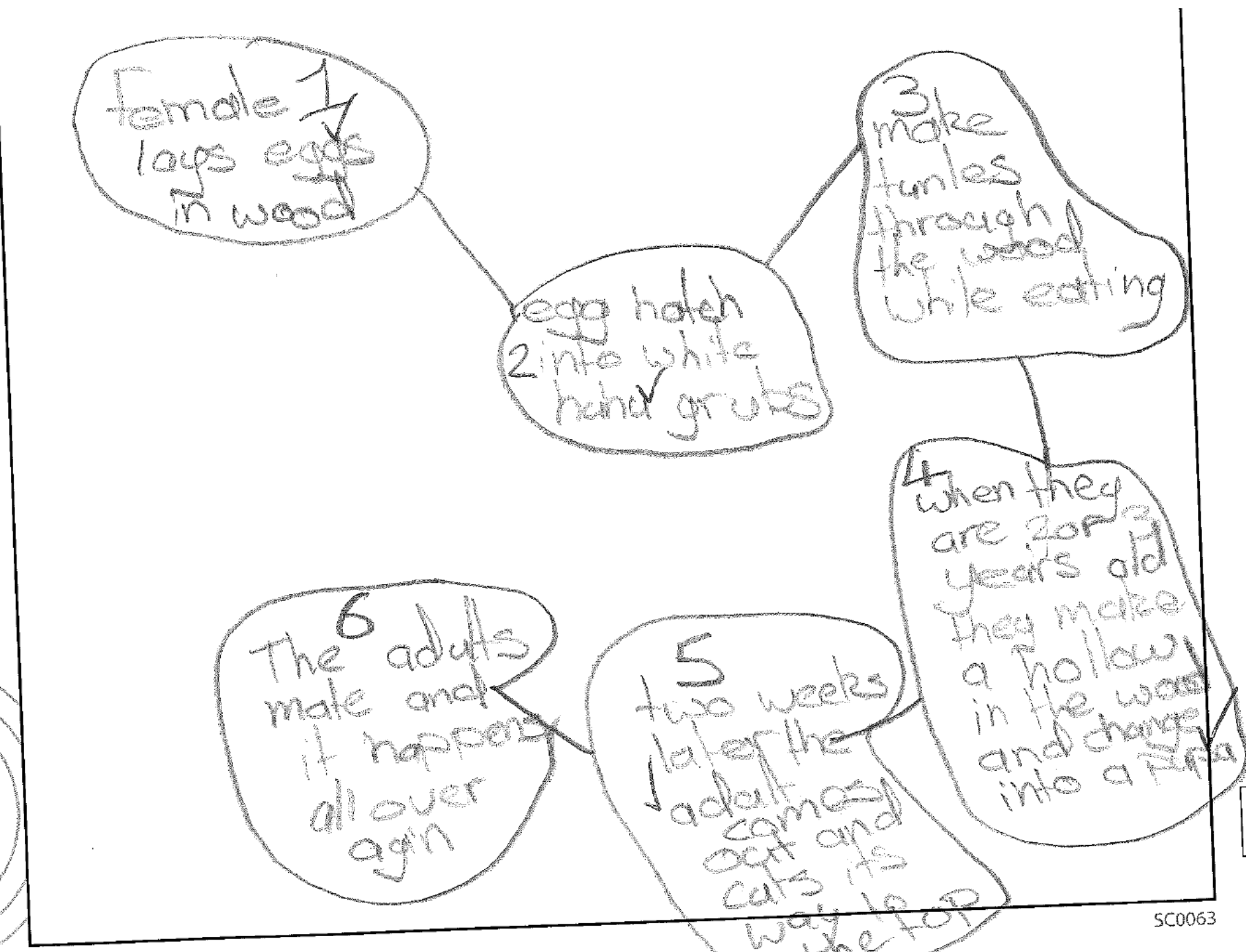
What we found out

Students' responses showed a clear progression from using their own conventions to using scientific conventions.

Even though all the information was provided, the unfamiliar context was more difficult than the familiar.

Many year 8 students added a lot of written material extra to the life cycle.


Eggs
Caterpillar
Chrysalis
Butterfly


female 1 lays eggs in wood
egg hatch 2 into white haired grubs
3 make tunles through the wood while eating
4 when they are 2or3 years old they make a hollow in the wood and change into a
5 two weeks later the adult comes out and cuts its way to the top
6 The adults male and it happens all over agin

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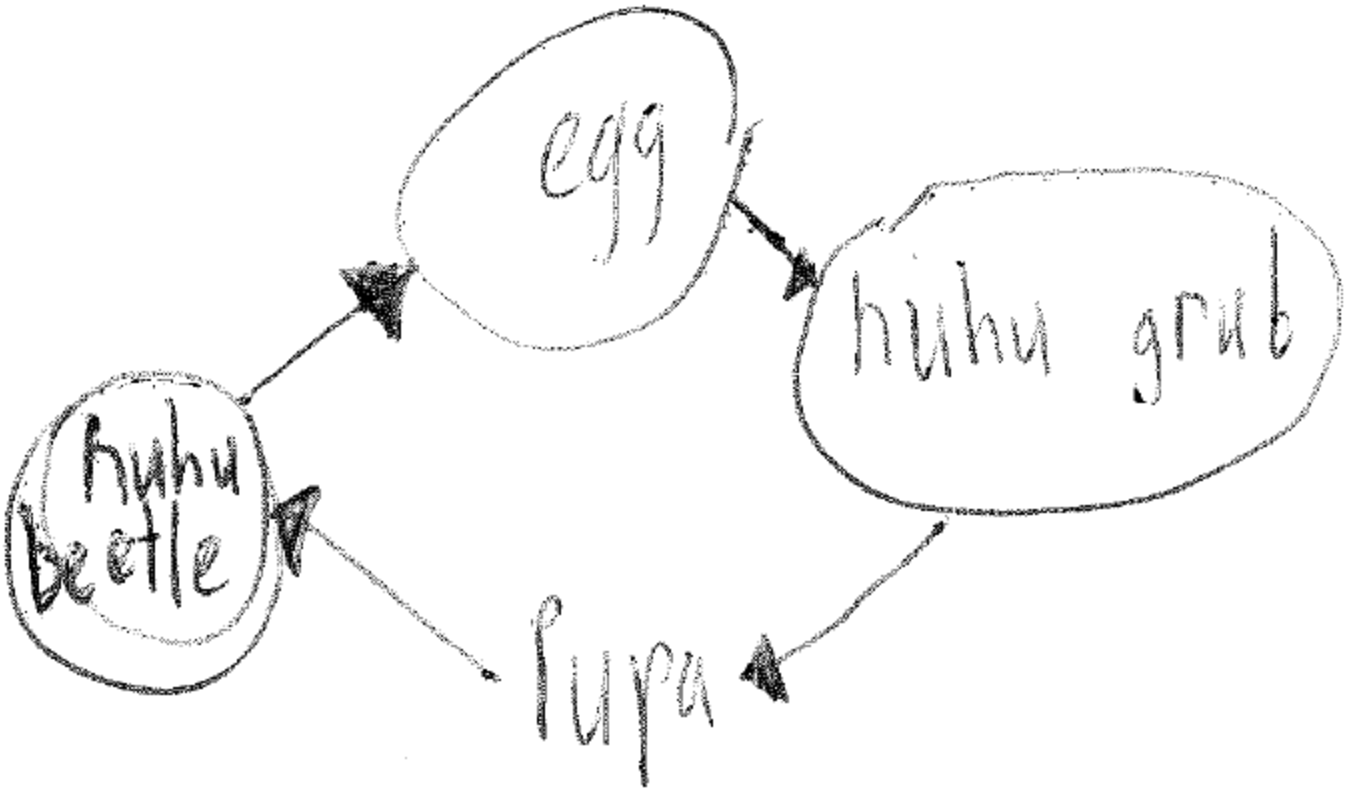

egg
huhu grub
huhu beetle
pupa

Food chains/food webs

Year 4:

1. Write two things a simple food chain (3 elements) tells us about the animal in the middle.
2. Draw a food chain to show the described feeding relationship between three things.

Year 8:

a) Add another two animals to a very simple food web, using information about what they eat.
b) Use the food web to explain a simple impact on another animal if one animal is removed.
c) Use the food web to explain the impact on another animal if one animal is removed.

What we found out

Reading a food chain/web

- While many Year 8 students could identify immediate impacts of a change, being able to infer possible long term impacts was much more difficult.
- Reading from a food chain or web was easier than constructing one.

Constructing a food chain/web

- Year 4 students' food chain diagrams varied, from using their own ways of showing feeding relationships to using science conventions correctly
- Year 8 students, possibly because they were adding to an existing food web, mostly attempted to use the science conventions modelled.
- A few Year 4 students did not recognise "food chain" to be specialised science vocabulary.
- It was common for students at both years to draw and read the arrows in the incorrect direction.

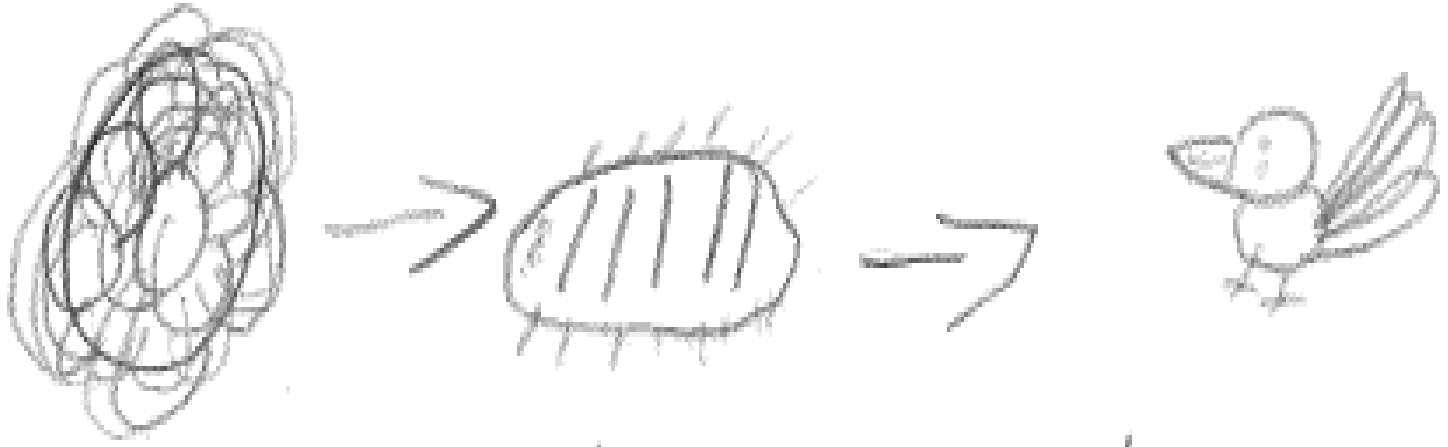
Write 2 things this food chain tells you about rabbits.

Correct answers

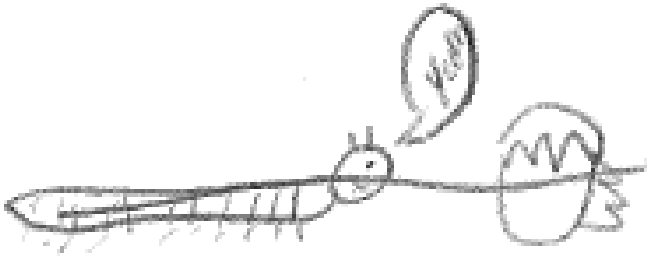
- Rabbits eat grass.
- Stoats eat rabbits.
- Rabbits die from stoats.

Misreadings

- They eat grass and turn into a stoat.
- The stoats are very mean to rabbits.
- Rabbits turn into stoats



cabbage caterpillare bird



Year 8 responses

It wouldn't effect them because sheep don't eat rabbits.

The sheep will not be afected because sheep eat grass, not rabbits

Will fill lonely

Example of immediate impact

There might be more grass for the pukeko to eat because there would be no more rabits to eat it.

Example of systems thinking

The pukeko would have more grass to eat, but it would have a bigger threat from the stoats.

There would be more food for the pukeko but the pukeko would be the only food of the stoat so the pukekos numbers would go down quicker.

What does all this mean for teachers and students?

Give students lots of opportunities to:

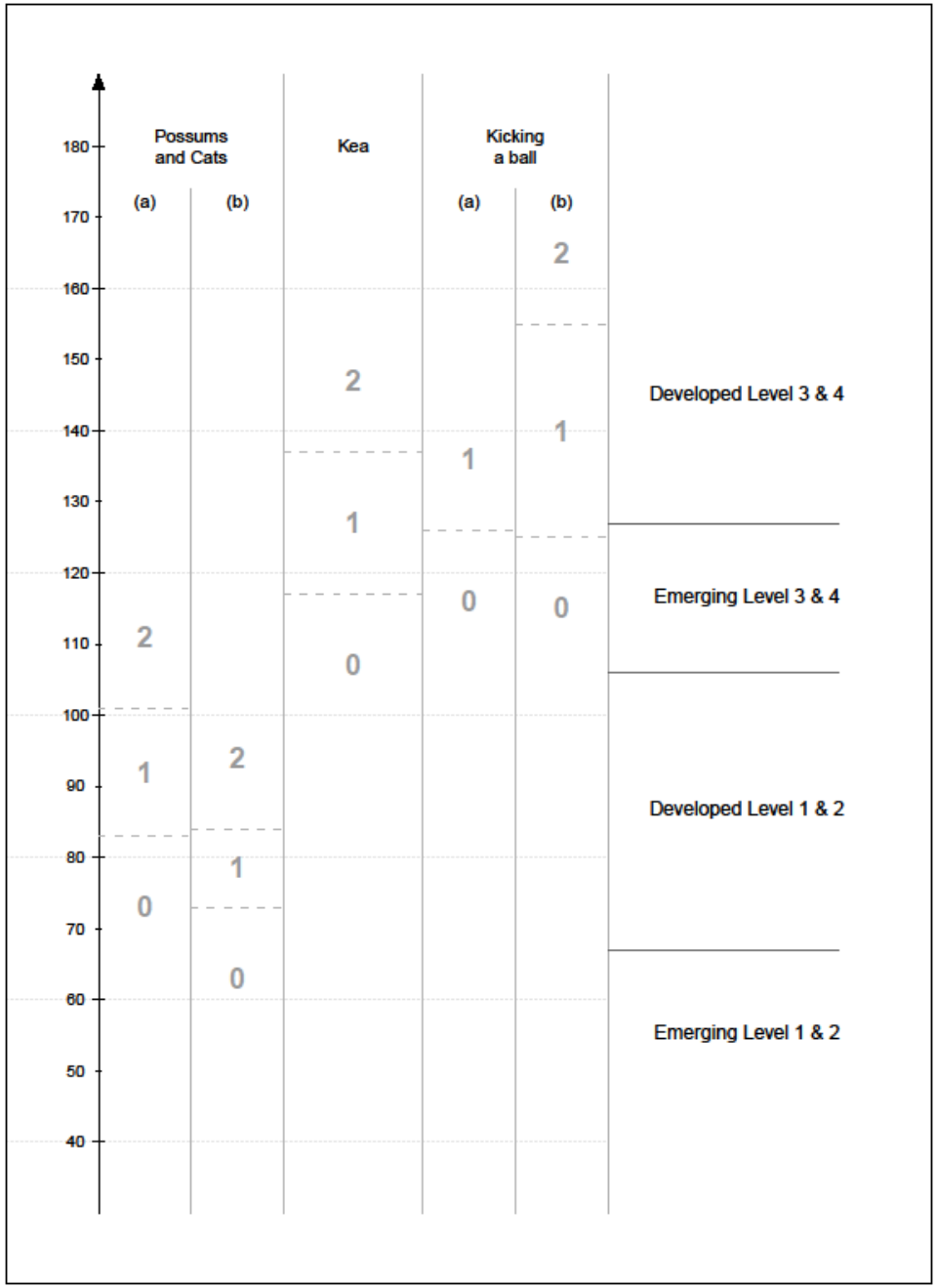
- Experience science in a variety of contexts.
- Talk about their ideas, and practise using evidence to support these.
- Think about what the available data can and can’t tell us.
- Critically explore both informal and formal ways of communicating ideas in science.

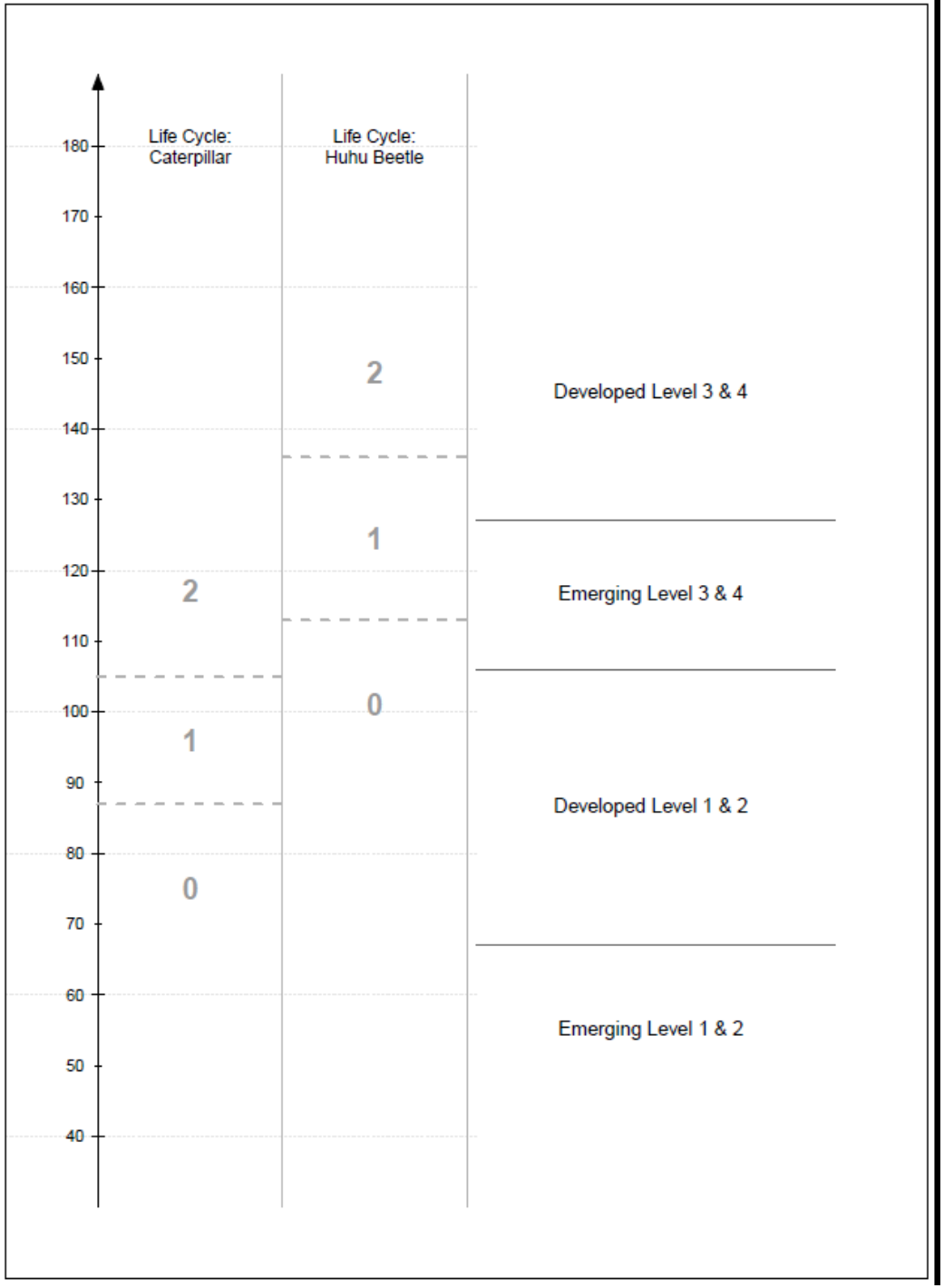
Where to get inspiration

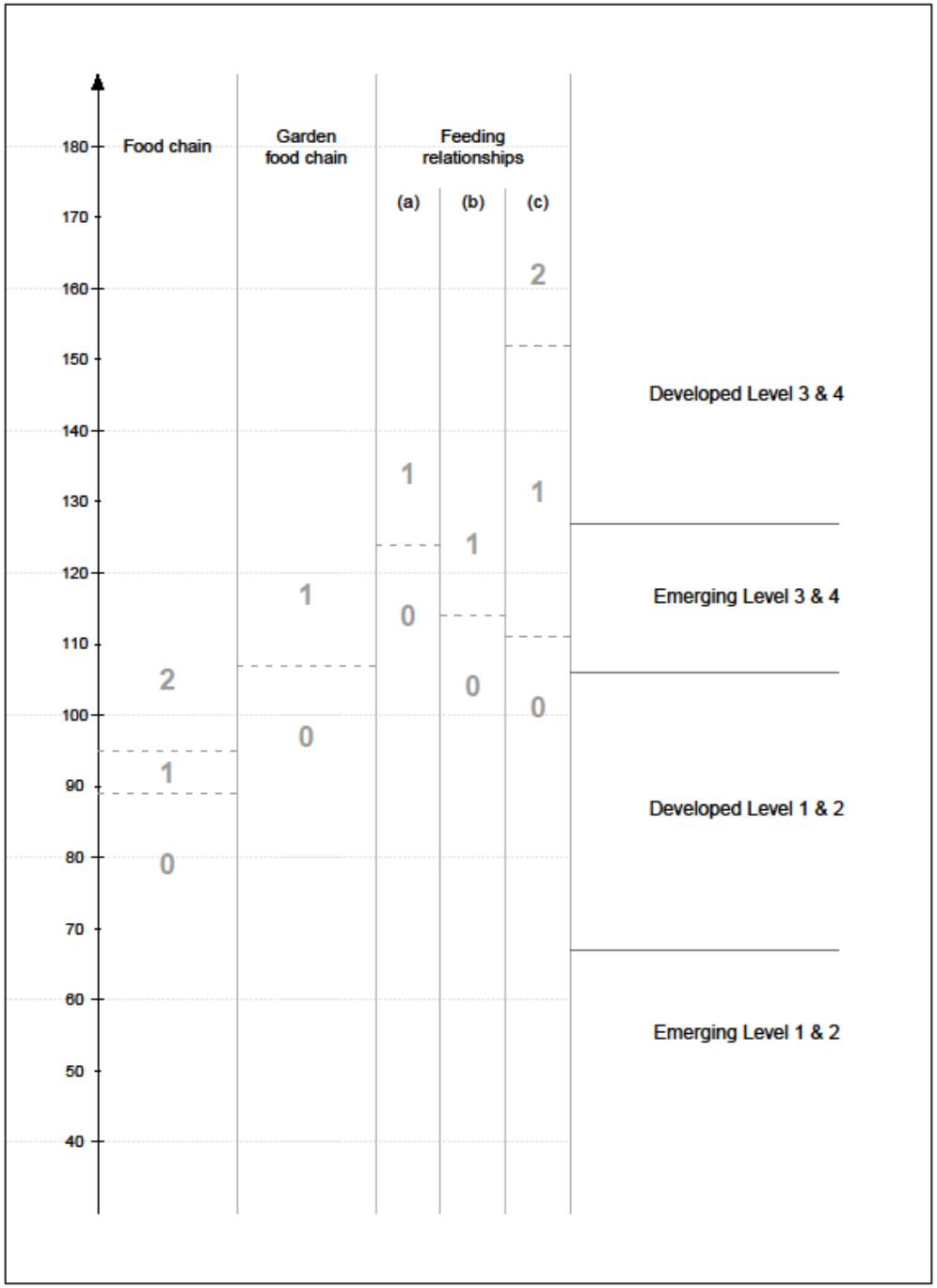
http://scienceonline.tki.org.nz/Introducing-five-science-capabilities

- Gather and interpret data
- Use evidence
- Critique evidence
- Interpret representations
- Engage with science

Scales possibly for using during discussion time.


Possums and Cats
Kea
Kicking a ball
(a)
(b)
(a)
(b)
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
2
1
0
2
1
0
2
1
0
2
1
0
2
1
0
Developed Level 3 & 4
Emerging Level 3 & 4
Developed Level 1 & 2
Emerging Level 1 & 2


Life Cycle:
Caterpillar
Life Cycle:
Huhu Beetle
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
2
1
0
2
1
0
Developed Level 3 & 4
Emerging Level 3 & 4
Developed Level 1 & 2
Emerging Level 1 & 2


180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
Food chain
Garden food chain
Feeding relationships
(a)
(b)
(c)
2
1
0
1
0
2
1
0
1
1
0
0
Developed Level 3 & 4
Emerging Level 3 & 4
Developed Level 1 & 2
Emerging Level 1 & 2