Section Four

The impact of literacy in the development of *Knowledge* in action competence

The material discussed in this document is **section four** of a four section report written for the Director of Enviroschools by Faye Wilson-Hill.

The following findings are discussed in this section:

- Teaching and learning from the dimensions of knowledge (Jensen 20002) for action competence had a large emphasis on the *effects* or science based ideas and concepts. There weren’t as many planned learning experiences to help students develop knowledge of a wide range of perspectives of an issue including the *causes* (this can also be expressed as social, cultural and economic ideas), how to go about making *change* and exploring *alternatives and visions*.

- Literacy was instrumental for students to *make* and *create meaning* (Ministry of Education 2007, p. 18) from the knowledge learning experiences. Literacy approaches were used in multiple ways and included using all strands of the English curriculum with thought provoking examples of using language, symbols and texts as a way for students to show their increasing knowledge and understanding of sustainability issues.

The full report includes the following sections and can be accessed from www.enviroschools.org.nz

Section One: Introduction and summary of findings
Section Two: The impact of literacy in the development of *experience* in action competence
Section Three: The impact of literacy in the development of *reflection* in action competence
Section Four: The impact of literacy in the development of *knowledge* in action competence
What’s important about **KNOWLEDGE** in developing action competence?

Previous research into action competence suggests that the focus for **knowledge** be on understanding environmental and sustainability issues to inform action. Taking action for sustainability requires an understanding of the issue or problem connected to the project being undertaken. In order to do this an integrated and holistic approach to teaching knowledge and understanding of environmental and sustainability issues is recommended.

**In this project some of the knowledge students developed included:**

- Changes in the seasons
- Sorting and classifying animals
- Differences in plants and animals
- The needs of living things
- Parts of a plant
- Parts of a building
- How plants grow
- Life cycles
- Human impact on ecosystems
- Types and functions of habitats
- Conservation approaches
Some more thoughts about KNOWLEDGE

Jensen (2002) a researcher from Denmark has investigated action competence in both health and environmental education. He talks about the need to develop four dimensions of knowledge: of effects and causes, for change and visions and that these be taught in an integrated and holistic way. These dimensions are explored in Figure 1.

Figure 1: Dimensions of knowledge for action competence

Knowledge about root causes – why do we have the problems we have?
In this dimension knowledge is about understanding the social, cultural and economic circumstances that have led to the problem or issue.

Knowledge about strategies for change - how do we change things?
Knowledge in this dimension is about the skills and attitudes we need to take action and how we relate to others when attempting change. This dimension incorporates learning how to learn. Although not explicitly discussed by Jensen (2002), Eames, Barker, Wilson-Hill & Law, (2010) included knowing how to use information as part of the knowledge aspect. Learning how to learn is also important in the intent and direction of New Zealand Curriculum (Ministry of Education 2007, p. 8-9).

Knowledge about effects – what kind of problem is it?
In this dimension knowledge is about defining the problem and uses science to explore this. It awakens concern and gets our attention.

Knowledge about alternatives and visions – where do we want to go?
This dimension is about being able to articulate future possibilities and includes considering how people in other cultures and places may already address this issue or have resolved it in the past.

Sustainability Issues

Knowledge in teaching and learning to develop action competence

It is important that teaching and learning explores an issue from and between each of the dimensions of knowledge set out in Figure 1. The New Zealand Curriculum lists the outcomes for learning areas separately, but in action competence teachers and facilitators need to consider how understanding of issues can be developed by interweaving and connecting ideas from the learning areas, values explorations and the key competencies in a cohesive way. In education for sustainability the goal of taking action is an important focal point for connecting knowledge and understanding.

This is challenging as often the ideas or concepts that help students to understand an issue require much prior knowledge. In this project, many times teachers found the immediate need for students was to know facts or basic truths to enable understanding of concepts like biodiversity or interdependence to in turn inform action. This requires teachers to be responsive to the needs of their students and the willingness to take time to develop, sequence and scaffold learning with students, AND as indicated previously keep a focus on taking action.
What did this project tell us about knowledge in action competence and literacy development for learners?

In this project significant ideas that emerged from the data included:

1. teaching and learning from the dimensions of knowledge (Jensen, 2002) had a large emphasis on the effects or science based ideas and concepts. There weren’t as many planned learning experiences to help students develop knowledge of a wide range of perspectives of an issue including the causes (this can also be expressed as social, cultural and economic ideas), how to go about making change and exploring alternatives and visions.

2. literacy was used in multiple ways for students to make and create meaning (Ministry of Education 2007, p. 18) from the knowledge learning experiences. It included using all strands of the English curriculum with thought provoking examples of using language, symbols and texts as a way for students to show their increasing knowledge and understanding of sustainability issues.

Finding 1: Emphasis on knowledge about effects or a scientific perspective

Analysing a sample of teaching and learning experiences carried out by the eleven teachers in this research shows that there was a far greater emphasis on developing knowledge about effects and understanding the kind of problem. This is evidenced by the number of experiences described as having objectives linked to science (78) compared to teaching and learning experiences focused on developing knowledge of the other three dimensions of knowledge causes, change and visions which, totalled 33.

These learning experiences had achievement objectives and learning intentions from a range of learning areas of the New Zealand Curriculum, with Social Sciences and English dominant over Visual Art, Technology and Mathematics. Figure 2 (see pages.11-14) provides details of learning experiences categorised into effects, causes, changes and visions. This raises further questions in terms of knowledge development:

Was the large focus on effects influenced by the timing of our research in the teaching process?

Is there an inclination to build science type knowledge at the beginning of a unit of work as the basic truths to build conceptual understandings on? As one teacher described it We needed to get the science stuff sorted first before we were able to bring in the social science, Teacher class 11. Data from the two youngest classes in the research (Y0-Y1) suggests this was the case given the ratio’s of knowledge experiences 15:1 (effects: causes, changes and visions). Jensen (2004) discusses the notion that knowledge of effects should create a starting point for action. Had data continued to be collected through to the completion of a project based on Jensen’s claim, the ratios for the knowledge should be more evenly balanced across the four dimensions.

The challenge indicated from these findings is to ensure the knowledge of effects creates a starting point that is built on through the dimensions of causes, changes and visions to take action. The challenge for teachers is balancing teaching time when student’s learning needs may seem to dictate learning within the effects dimension.
Finding 2: Literacy supported the development of knowledge for action competence in multiple ways

1. Oral language was a corner-stone for knowledge exploration and development:
   i. Using a thinking tool or strategy to tease out an idea or reflect on learning from an experience e.g. thinkers keys on the advantages and disadvantages of home gardening, De Bono’s thinking hats to process an experiences, consequence wheel on attracting tui to the native bush area;
   
   ii. Planning for and sharing of writing that processed knowledge of effects e.g. Reports on native animals, explanations of how seeds grow;

2. Reading materials and resources were used across all levels to learn more about the issue, for example:
   i. School journal articles about native plants and animals, insects
   ii. Junior readers e.g. Sally and the leaves
   iii. Other books such as Andrew Crowes Wild Stories series A kiwi has no wings, Where does the Tui go?
   iv. Technical resources such as biodiversity charts, plants for bird food developed by Councils, Department of Conservation etc.

3. Presenting knowledge and understanding using a diagram. This was a combination of students drawing, annotating and viewing others work to show their growing understanding of biodiversity and interdependence in a native forest ecosystem. This required students to apply the key competency of using language, symbols and texts and provided a valuable formative assessment strategy. At the time of data gathering students were demonstrating their knowledge of effects through the diagrams. Another version of this was to use a picture of an ecosystem and have students either talk about or annotate their thinking and ideas.
Finding 3: There is a need to connect knowledge to the goal of taking action

In this project there were two distinct approaches:
1. Classes who had selected an action project already and were investigating knowledge to inform the best way to undertake a project: and
2. Classes who were exploring big ideas and conceptual knowledge to uncover and issue or project and decide on an appropriate action to take.

There was an assumption by the researchers that because classes in group 1 had a focus for their action, students would be connecting their developing knowledge to that action. The data indicates that there were limited connections being made by students to taking action in response to the question *how could you use this learning?* Some of the students in class 1 (How can we develop places that nurture native animals and native plants in our school?), were clear that they were investigating animals to find out whether they were suitable to introduce to their native bush, but one or two responses from this class aligned with a more common theme from across the classes that they were learning ideas and knowledge that would be *used in the future*, for example:

- *When we get older we will know how to care for the trees and other animals*
- *And if we want to be a gardener when we get older then we’ll know all about plants*
- *Maybe use them again when I get older*
- *Could be helpful for your whole life keep it in mind so I could answer the question*
- *As I grow older become part of DoC and work for them, save the environment*
- *Might grow up to be an insect scientist spread out the world help people to learn more about insects, what you can do to save their habitat not letting them become endangered.*

Students classes 1, 3, 7, 10 and 11

Another group of responses strongly indicated that students were going to use their learning to inform others, but this desire to inform lacked the specificity of an issue or concern that needed to be addressed, for example:

- *... For the environment and help people if they don’t understand*
- *So we can get more information so we can teach other people*
- *We can spread the news with other people*
- *Going to make a book for the school [about] all the soils and insects*
- *Share it with other people [so] that they know also know about them*
- *We can show other people showing them how insects change*
- *We could make a website that would learn about insects share with family go through the generation*
- *Tell other schools about insects*

Students classes 3, 6, 7 and 8

It could be argued that as learning progressed and the action became the focus, students may have articulated reasons for their learning connected to action and therefore timing of the data collection influenced the results. However, as outlined in Figure 2, all classes had an overall focus question or learning outcome and few of the students responses aligned to intended overall outcomes.
There is no question that most students knew the purpose and intended outcomes of specific lessons for example in response to the question *What did you think you had to do?* students said:

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[Learn] About how insects grow so we know all about them
To learn about insects and soils and things that live in the edible garden
We had to find out where they are usually found in the playground, where they usually found, which ones are harmful and harmless
We had to draw a native bush and do what the creatures and living things do to connect like what they ate and who they ate
Draw something on what a coastal habitat looked like draw seal sand rocks water Write about what you need for photosynthesis.
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What was missing was the connection between the specific lessons, the overall unit outcomes and the reason for taking action or to future possible action.

**So what’s important from all this?**

For teachers and facilitators the focus for knowledge in action competence needs to connect students developing understanding of a sustainability issue to inform action with everyday lesson intentions. However, as discussed previously there are some challenges in this to ensure student’s learning needs are being responded to and developing an understanding of sustainability issues from across the four dimensions of knowledge.

**Other suggested phrases to keep learning focused on action**

- *We are learning this because....*
- *We are going to....*
- *We need to understand this so that we can....*
- *What does that make you think now about our issue, project?*
- *How does that idea compare to what we currently do?*
- *What would happen if....?*
- *How might that look at our school?*
- *What have you seen, heard, read or discussed that you think would make the biggest difference?*

Many learning experiences clearly had dual purposes and these were usually very clear in the teacher’s mind. For example, writing a report on an animal has learning outcomes in Science and English. For science, students are learning information about the requirements of animals to stay alive, while in English students are learning about the features of language required for a report. In order to also support students in knowledge for action competence a two-fold discussion of such learning is suggested, on what students know and understand about:

1. the animal and how it interacts in the world and implications of this for action; and
2. reports and how they might be used in an action project.

In one school teachers were actively displaying the unit intention or big idea, using shared journals of learning experiences and was trialling times to develop a culture of reflection in the school to support students to make connections between lesson and unit intentions. For more ideas and discussion of using reflection to process learning experiences to develop knowledge refer to the *reflection* story.
In a unit on waste what might each of the dimensions of knowledge incorporate?

Knowledge about Effects
Exploring the effects of waste might include studies of decomposition of organic and inorganic materials, determining volumes waste, classifying it, and clarifying the end point for waste in the school such as recycling bins, landfill and compost. What is waste? is a key question for investigation.

Knowledge about Causes
Exploring the causes of waste in a school might involve finding out where waste comes from in the school. Carrying out a survey of waste may highlight an issue with ‘litter’, quite often plastic wrappers (such as snack packets) and lead to asking why we buy and wrap food in this way? This might create some discomfort as we acknowledge that our busy lives lead us to buy items for convenience and speed when preparing food for school.

Helping students to understand that the issue with litter is situated with society (us) is crucial in empowering students to make choices and decisions for action that will really make a difference. How we choose to package and manage food for hygiene regulations and often convenience re-orientates the litter problem away from tidying the environment to examining our everyday practices. Discussions and investigations in class might revolve around questioning the need for convenience food and the types of packaging used. This will undoubtedly lead to discussions about how we operate in families and cultural understandings connected to food, the cost (both in money and time) of having (or not having) convenience foods, flowing onto health, wellbeing and employment issues. In this way the issue which started as litter – has developed into an exploration of the social, cultural and economic debates about how and why we do things the way we do and the on-going consequences of these choices. Such an exploration requires learning from across the learning areas (see side bar).

Getting uncomfortable - dealing with conflict is part of action competence

Research by the Royal Danish School of Education (1999, 2009, p.34), stated that there is a real need for learning to focus on “students understand[ing] environmental issues as societal issues”. This means that too often the messages students latch onto are to ‘look after nature’ or care for the environment’ but as they point out, nature doesn’t need looking after, it doesn’t have a problem with the environment. Instead we need to reflect on our interaction and use of natural resources in coming to understand the source of environmental and sustainability issues. Focusing thinking in this way leads to exploring the conflicts in people’s use of resources and whether the consequences of choices we make, work with or against nature.

For further reading on this see http://www.environmental-education.net/?page_id=53.
Knowledge about Change

By learning that waste comes from people producing and using resources in a way that nature is not able to cope with, the challenge in this dimension is to consider what changes we might make to our choices, systems at school and behaviour. Is it enough to recycle our plastics and paper, or can we consider alternatives that either reduce or eliminate our use of items that create non-renewable waste that harms the environment? Teaching and learning in this dimension is about gaining knowledge of how to present differing perspectives for ways waste is managed and the consequences of our current resource use that do not harmonise with nature.

Knowledge about Visions

Although Jensen (2002) has presented these dimensions sequentially, there is a need as highlighted in this research, for teachers and facilitators to seek strategies that develop knowledge from the dimensions concurrently. As students learn that some items do not break down in the environment such as plastics, they may also learn about examples from the past where the only remains from ‘waste pits’ are bones or shells. Discussion of this might centre on Why did they do this [put their waste in one place]? What are the consequences of that choice? What can we learn from them? Students might visit another school, group or business who manages their waste so that little or nothing goes to a landfill. They might list many ideas for possibilities in their school throughout the unit which are modified and adapted as their knowledge of the effects, causes and changes grows.

In this way students are constructing, evaluating and re-evaluating their knowledge and understanding constantly and making meaning relevant to their learning context and setting. Uzzell (1999, p.398) describes this as knowledge being socially constructed. It is about adults seeing students as equal and responsible partners in, and agents of, socio-environmental change and supporting them with the knowledge and skills to do so.
From what we found we suggest that:

- Planning for teaching and learning includes experiences that will explore knowledge from the four dimensions effects, causes, changes and visions;
- Students need support to connect knowledge and understandings from lesson intentions to unit outcomes to inform action;
- Processes for learning and taking action be made explicit;
- Exploring perspectives and ideas that might make us uncomfortable is a great learning opportunity and way to model relating to others and managing self;
- Using a range of literacy approaches is effective in developing students knowledge and understandings of sustainability issues; and
- Using language, symbols and texts is a great way for students to create diagrams that show their growing understandings.

Questions for discussion as a staff, team, syndicate, envirogroup

What is the focus for the kinds of knowledge we plan for in education for sustainability and Enviroschools?

Have we talked and thought about knowledge to do with:

- Effects - facts (scientific understandings and concepts) of the issue;
- Causes - social, cultural and economic setting of the issue;
- Change strategies - how students are learning to learn and relating to others (is there an important link to literacy learning here about how literacy will support them with skills to understand this issue); and
- Exploring alternatives and visions?

How do we ensure that students expect to use their learning about the environment and sustainability issues to take action?

How do we know that our chosen context and concept(s) are an area of need for our students? What does their prior knowledge tell us?
**Figure 2**
Selection of learning experiences from each class sorted into the potential to develop Jensen’s (2002) and Eames, Barker, Wilson-Hill & Law (2010) dimensions of knowledge

<table>
<thead>
<tr>
<th></th>
<th>Unit focus Intended outcome</th>
<th>Knowledge about effects</th>
<th>Knowledge about causes, change and visions</th>
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</table>
| 1 | Biodiversity in the school native bush area How can we develop places that nurture native animals and native plants in our school? | 1. Survey birds in the bush  
2. Observe and draw bush  
3. Transects of bush find and identify living things  
4. Classify plants and animals  
5. Research special features of NZ plants and animals  
6. Construct food webs and life cycle diagrams  
7. Pool of knowledge about the inter-relationships in a native bush ecosystem  
8. Focus on the needs of the tui | 1. Investigate the history of the native bush (vision)  
2. Investigate how different people view the native bush, Māori, European (Causes)  
3. Investigate the impact of people’s actions on native plants and animals (visions and causes)  
4. Ask what could be here (visions)  
5. Legend where have the tui gone? (causes)  
6. Discussing an article about tui having gone from a nearby area (causes)  
7. Interpreting a tui food guide to decide what to plant (visions)  
8. Examining what others have done to make changes to attract and nurture birds |
| 2 | School native bush area How can we develop and use our knowledge about living things to create a place that nurtures nature in our school community? | 9. Read what is an animal?  
10. Sorts pictures of animals into vertebrates and invertebrates  
11. Research into characteristics of vertebrates  
12. What things are there currently in our native bush?  
13. Choose an animal write a report using a graphic organiser  
14. In pairs students co-construct a report to show what animals live in the bush and what they need to survive. * Note while this is factual in content the process of working together is also about change | 9. Presenting scenarios – do you think it would be possible to get bellbirds living in our native bush? Is it a good idea to donate money to an organisation who wants to control possums, stoats and weasels on a local mountain range? What might Tane the atua think? (causes)  
10. Write an argument that will convince a panel of judges why/why not a specific chosen animal should live in our bush? (change)  
11. Write a letter to possum to stay out of our bush (change) |
| 3 | How we can cultivate food to help our community learn ways of growing food that nurtures the environment | 15. What is an environment?  
16. What is living and non-living? What is an animal? What is a plant? Is a tree a plant? Why are plants important?  
17. Sorting fruit and vegetables.  
18. Naming different parts of a plant, shoot, stem, roots, veins, petals, leaves etc and what their jobs are  
19. Learning what photosynthesis is and what it does | 12. Tane and his children, Maori perspectives about the environment |
| 4 Y1 Y2 | To complete a bottle house to start growing plants for our school and wider community |
| 5 Y0 | What lives in our environment? |
| 6 Y5 Y6 & 7 Y3 Y4 | Creatures on the move – we are learning how change affects us and the community we live in |

<p>| 20. What do we need to know about growing seeds? Investigation and what plants to grow. |
| 21. Investigating the bottle house site |
| 22. The students brainstorm ideas to identify different parts of the house that need attention. |
| 23. Comparing the bottle house to a traditional structure to learn the vocabulary e.g. walls vs. sides |
| 24. Observing seeds growing |
| 25. Viewing video of seeds growing |
| 26. Creating a short drama of how a seed grows and what it needs to survive |
| 27. Seed experiments – some in the dark, some in light, some with water some without. |
| 28. Children writing a book about how seeds grow |
| 29. Sorting animals into groups |
| 30. Expert speaker what is an insect? |
| 31. Search for and record the animal life in the bushes, edible garden and a square metre of the playground. |
| 32. Information reports on insects. |
| 33. Labelling insect parts |
| 34. Butterfly life cycle |
| 35. Class mural of different areas of school grounds – what would you find there? |
| 36. Reading for information about different insects |
| 37. Research helpful and harmful insects |
| 38. Expert speaker how do insects help us? |
| 39. Soil investigation – pH, soil type |
| 40. Soil research |
| 41. Insects Changes- how insects adapt/change to the environment to survive |
| 13. Sharing The House that Jack Built (visions) |
| 14. Looking at video and pictures of another schools bottle house (visions) |
| 15. Interview students who worked on the bottle house previously – what do they know? (visions) |
| 16. What do we need to be able to finish the bottle house – investigation (change) |
| 17. Students suggest alternatives for fixing the roof and draw their ideas (visions) |
| 18. Writing a person account of an experience with an insect (causes) |
| 19. Museum visit- What human impact has on the environment over time, and the changes to NZ because of certain introduced species (visions) |
| 20. Art Gallery viewed the art work and discussed Bill Hammond’s art-work relating to birds/insects. (visions) |
| 21. Designing an insect from clay and making a suitable habitat drawing for it (visions) |
| 22. Design a ‘ridiculous’ insect for our edible garden using thinkers keys |
| 23. What if, critical thinking taking a scenario and exploring what if bees were the size of eagles? (vision) |
| 24. Arguing a point of view – are insects helpful or harmful? (causes) |</p>
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<td>8</td>
<td>Y1</td>
<td>Y2</td>
<td>Change – what happens to living things as the seasons change?</td>
<td>42. Mind map on what children know about change</td>
<td>25. Planning and making a bird feeder</td>
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<td>9</td>
<td>Y0</td>
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<td>Change – what happens to living things as the seasons change?</td>
<td>49. Brainstorm what happens in each season</td>
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<td>43. Observing and discussing photos of different seasons and the changes or differences between them</td>
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<td>44. Life cycle of a tree and what happens to it in each season</td>
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<td>45. Investigation into items gathered at the Botanic Gardens, size, shape, texture</td>
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<td>46. Weather words describing weather</td>
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<td>47. Predicting and taking temperature for the week</td>
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<td>48. Discussion what do we need to stay alive and what do other animals need to stay alive? How does the changing weather affect the birds?</td>
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<td>50. Decorating trees on the wall to show what changes happen to them in different seasons</td>
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<td>51. Looking at pictures of different seasons describing what they see</td>
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<td>52. Visit to botanic gardens to see the changes in plants in the autumn</td>
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<td>53. Reading poem about autumn leaves, going outside and standing on them and listening to the sound CRUNCH</td>
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<td>54. Discussion comparing the seasons and what they look like</td>
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<td>55. Sequencing pictures of the seasons and putting them in the right order</td>
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<td>56. Discussion what do birds do in winter? Can we help them?</td>
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<td>57. Observing the birds at the bird feeder – counted them.</td>
<td>57. Observing the birds at the bird feeder – counted them.</td>
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| 10 | Coastal environments  
The requirements of living things to stay alive and how they are suited to their habitat | 58. Classification of living and non-living things  
59. What do all living things need MRS GREN  
60. What is an environment?  
61. Investigate the groups of animals that live in a coastal environment.  
62. Living together the relationships between coastal plants and animals, food webs.  
63. People of the coastline who live there and why?  
64. Protecting coastal regions developing an understanding of the uniqueness of coastal regions. | 27. Develop a rationale about why the coastal environment needs to be preserved.  
28. Investigate how our regional coastal areas can be protected.  
29. Visit to beach ecosystem, to conduct a beach clean up. |
| 11 | Unique Aotearoa and Conservation of Unique Aotearoa | 65. Living and non-living things  
66. Identifying and naming NZ native flora and fauna  
67. Visit to wildlife park  
68. Classification of animals  
69. Habitat exploration, types and functions  
70. Visit to local reserve and LEOTC programme  
71. Definitions of environment, biodiversity, interdependence, ecosystems, connectedness, sustainability  
72. Food chains and webs, connectedness through language  
73. Individual inquiry and reading for information about NZ native animal  
74. Photosynthesis  
75. Life cycles  
76. Classification  
77. Pests – habitats  
78. Web of life experiential activity | 30. Exploring what if scenarios at local reserve connected to human activities.  
31. National park scenario in local area canvassing a range of perspectives and views, evaluate using SOLO – significant, can’t be changed, by whom? How?  
32. Exploring other conservation approaches and breeding in captivity programmes  
33. Exploring what we might do in response to understanding what is happening for native animals. |