Presentation:
Literacy in Science Years 9-13

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Starpath
A University of Auckland Partnership for Excellence

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NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

"No, this is its nucleus, not its cell phone."

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Ko tōku reo
Tōku rangatiratanga

Learning Intentions

Develop understanding of:

1. Literacy in Science
2. Vocabulary instruction
3. Preparing your students to read
4. Preparing your students to write

Programme

9am	Introductions Why is literacy important? Developing students' vocab knowledge
10.30am	Morning tea
10.50am	Developing students' reading skills
12.45–1.15pm	Lunch
1.15-3pm	Developing students' writing skills
3.15pm	Questionnaire and exit

Why is literacy important?

"All teachers are teachers of literacy because all students learn through language. Language is fundamental to thinking and learning. Language is the primary means by which we gather and communicate information."

Effective Literacy Strategies p7

Literacy in Secondary School

- “Secondary school presents learners with many literacy challenges. In every subject area students need to read and write increasingly sophisticated texts as they progress through secondary school.”

- “Literacy teaching is just as important for academic success in Year 13 as it is in Year 9.”

- “Teachers have a responsibility to find out where each individual student is at in their learning.”

Effective Literacy Strategies p7

The Curriculum

For each (learning) area, students need specific help from their teachers as they learn:

- The specialised vocabulary associated with that area;
- How to read and understand its texts; how to communicate knowledge and ideas in appropriate ways;
- How to listen and read critically, assessing the value of what they hear and read.

NZC p16

Year 9 and 10 Baseline Data

To be considered at ‘expected level’ students should be reading at or above Curriculum Level 4 on entry to high school.

However, the Starpath Year 9+10 Baseline Data Report (Earl Irving) indicates that the following groups were at or below Curriculum Level 3 in AsTTle reading at the beginning of Year 9:

- 28.5% of New Zealand European students (n=6652)
- 56.3% of Māori students (n=8179)
- 70.4% of Pasifika students (n=8201)

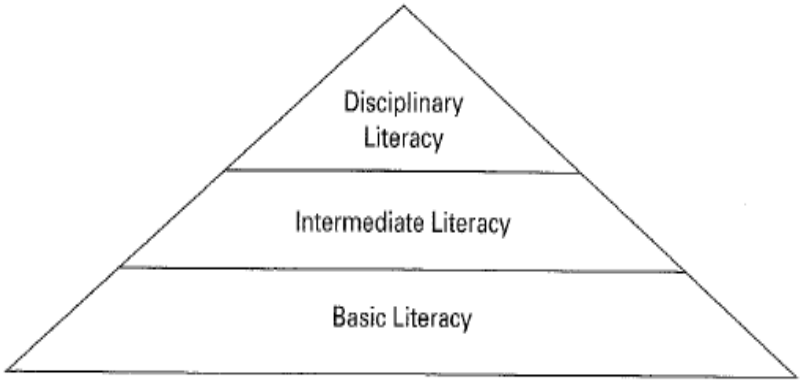
Data from the PAT listening comprehension tool also indicates many students’ oral listening comprehension is below expectation, with 66.8% of Māori and 91.4% of Pasifika students having scores at Stanine 4 or below.

What does this mean for Science teachers?

We must provide our students with language rich environments, where they have access to challenging texts and plenty of opportunities to read, write and talk about these texts.

Shanahan and Shanahan (2008)

FIGURE 1 *The Increasing Specialization of Literacy Development*



Basic Literacy: Literacy skills such as decoding and knowledge of high-frequency words that underlie virtually all reading tasks.

Intermediate Literacy: Literacy skills common to many tasks, including generic comprehension strategies, common word meanings, and basic fluency.

Disciplinary Literacy: Literacy skills specialized to history, science, mathematics, literature, or other subject matter.

Optimal conditions for literacy learning

- A language-rich environment in which students regularly read, write and discuss challenging texts
- An emphasis on students developing their own literacy strategies in a gradual withdrawal of support model
- Targeted teaching of specific needs identified through inquiry

Vocabulary key concepts

- Comprehension appears to depend on knowing between 90 – 95% of words in a text
- Students need frequent and repeated opportunities to experience and use new vocabulary
- Vocabulary is best learned in context

  Amplify rather than *simplify* vocabulary

Confusing Language in Science

- Different meanings in different branches of Science, e.g. nucleus, cell, filament, plasma
- Different meanings in Science compared to everyday usage, e.g. weight, pressure, power, basic, mole, revolution, animal,
- Concepts which are confused by everyday usage, e.g. weight/mass/density, theory of evolution, respiration/breathing, heat/temperature
- Quantity of new language required e.g. Biology labels, organic chemistry

Vocabulary Learning

- Academic verbs
- Vocab jumble
- Traffic lights
- Word map
- Disappearing definition
- Word solving strategies

Academic Verbs in Science

Verb	Definition	Answer
Describe		
Explain		
Identify		
Investigate		
Compare		

Vocab Jumble

physical properties valence discuss
reacts copper metal Al_2O
electron configurations ductile
electrons justify charge
aluminium oxide atom water pipes
sodium metal suitable malleable
aspects outer shell
describe reactive universal indicator
balanced symbol equation
chemical properties word equation
ions reaction vigorously

Traffic Light Activity

Green: all words you are very confident you know the meaning of

Orange: words you have seen before but are a little unsure about their meaning

Red: words that are completely new to you

Math Word Map

Definition

Synonyms(s)

Antonym(s)

Math Vocabulary Word

What real world situations would you use this word in?

Draw a picture or visual example

Use it in a sentence

Disappearing Definition

- Provide a good example of a definition students in Science need to know
- Write this on the whiteboard
- Begin by deleting a handful of words at a time
- Keep repeating this process

Word Solving Strategies
(from Lubliner 2001)

- **Consider the context**
- **Substitute a synonym**
- **Study the structure** e.g. Root word, prefix or suffix
- **Mine your memory:** Have you ever seen this word before?
- **Ask an Expert**
- **Place a post-it**

Preparing Your Students to Read

"When students have difficulty reading and understanding subject area texts, they hit a "literacy ceiling" that limits what they can achieve both in the classroom and in their lives outside of school."

Reading For Understanding p5

Preparing Your Students to Read

- Road Blocks and Strategies – metacognitive exercise
- Strategies of good readers
- 3 Level Reading Guides
- Final Word Strategy
- Sentence levels
- Long noun phrases, pronouns, subordinate clauses
- Active/passive voice

Class set of Roadblocks and Strategies

Road Blocks	Strategies

Metacognitive Conversations
(Braunger et al, 2005)

- Predicting – I predict… In the next part I think… I think this is…
- Picturing – I see… I picture…
- Making connections – This is like… This reminds me of…
- Identifying a problem – I got confused… I'm not sure… I didn't expect…
- Fixing up – I'll need to…, I think I will….

Strategies of Good Readers

Good readers will:

- Re-read
- Read forwards and backwards for comprehension
- Self-correct
- Attack new/unfamiliar vocab
- Read everything on the page
- Visualise as they read
- Re-establish concentration if it is lost
- Use headings, sub-headings, titles, captions, graphics etc
- Ask questions of the text
- Notice/pay attention to words in bold, italics, capitals, underlining
- Skim and scan
- Read at different speeds
- Activate prior knowledge and put this on hold if need be
- Make predictions
- Take breaks
- Make notes/annotations
- Continue reading – persevere – they don't give up

Talking About Text

Recent studies suggest that promoting extended discussion about rich texts may be even more effective than direct instruction.

Typical Patterns of Classroom Talk

I-R-E = teacher **I**nitiation, student **R**esponse, teacher **E**valuation

Criticized on basis that it is:

- one-sided, teacher-centred
- privileges transmission of information
- leaves little room for exploration of ideas (needed for deeper understanding)

Activity

Read the scenario by Ian Wilkinson

Key Features of Extended Discussion

- More time for open-ended discussion
- Feature authentic open teacher questions which serve to explore rather than ‘test’ students’ understanding,
- Attempt to increase ‘uptake’ whereby teachers prompt for elaboration and incorporate and build on students’ ideas (Applebee, Langer, Nystrand, & Gamoran, 2003).

Talking About Text

- Barriers?
- Strategies?

What Makes Text Difficult?

Language: density of unfamiliar, abstract, polysyllabic and technical or highly specialised words.

Sentence Length and complexity: Long sentences are harder to read than short ones. Complex sentence structure also affects difficulty.

Conceptual difficulty: Difficulty of a text depends on how abstract the ideas are and the amount of prior knowledge they require.

Idea density: the density of ideas and the ways in which they are embedded affect text difficulty.

Relevance: How important is this text to the reader? Texts about motivating topics 'feel' less difficult.

Reading for Understanding, p143

The Three Level Reading Guide

Purpose:

Three level thinking guides promote active reading for meaning at different levels and encourage critical reading. The class discussion that takes place after the students have completed the guide is an important part of this strategy.

Effective Literacy Strategies p91

Three Levels of Thinking

A three level thinking guide consists of a series of statements, about a specific text, presented at three levels of thinking:

Level One	knowledge	fact	reading on the lines
Level Two	comprehension	interpretation	reading between the lines
Level Three	application analysis synthesis evaluation	elaboration	reading beyond the lines

Effective Literacy Strategies p94

Some Tips for the Teacher

Select a text with content that is worth studying with close attention, because the guide takes time to prepare and to work through with the class. Begin by writing the higher level three statements and work backwards to levels two and one.

Do not use this strategy as a homework exercise or as a test. The value of the activity lies in the discussion it generates among the students as they give their views and justify what they say by referring back to the text.

Provide plenty of time for the students to work through the guide, because it has the potential to stimulate a lot of lively discussion and debate in the classroom.

Effective Literacy Strategies p92

Three Level Reading Guide
For Students

Level One: Literal Meaning – Reading on the lines - the answers are in the story.

Select the statements which say what the text says.

Level Two: Inference / Reading between the lines - to interpret what the author might mean

Select the statements which you think are true from what the text says. Be prepared to give reasons for your answers.

Level Three: Evaluative – Reading beyond the lines - I will have to think for myself.

Select the statements you think the author would agree with. Be ready to give reasons for your answers.

Final Word Strategy

- Person 1 reads one of their highlighted sections without comment
- Each other person in the group comments in round-robin order about that section without interruption or comment or cross-talk from the others
- Person 1 who read the item first then paraphrases the trends and key ideas then has the ‘final word’ by sharing their thinking about the item.
- Repeat

Sentence Levels

Students experience difficulty in their reading when:

- sentences are long and complex in nature
- sentences contain long noun phrases
- text is written in the passive voice

Long Noun Phrases

A tornado is a rapidly whirling, funnel-shaped cloud that reaches down from a storm cloud to touch the Earth's surface.

Military activities, hunting, mining and other actions that might harm the environment are banned.

Compare the distribution of the weight of newborn lambs on Bill's farm with ....

Active versus Passive Voice

Active voice is generally regarded as easier to comprehend than the passive voice

Active: People (*agent*) today are making their packages environmentally friendly(*affected*)

Passive: Packages *(affected)* are being made environmentally friendly by people (*agent*)

Agentless passive: packages are being made environmentally friendly

Preparing Your Students To Write

- In Your Own Words – metacognitive task
- Strategies of good writers
- Sentence combining
- Interruption construction
- Vocab toolbox
- Using visuals for writing

In Your Own Words

Using the three paragraphs and the diagram on seasons, write, in your own words, a summary explaining why the seasons occur and why they occur differently in the different hemispheres.

Strategies of Good Writers

Good writers will:

- Determine their purpose and audience
- Invest time in their writing
- Find, select and use the most appropriate content or ideas
- Use topic statements
- Use suitable vocabulary/subject terminology
- Structure and sequence content appropriately, using headings/sub-headings/captions as necessary
- Use connectives to link ideas
- Present the text, with suitable visual material for the intended audience
- Attend to surface features (spelling, grammar and punctuation)
- Edit – review drafts (edit later and edit lots)
- Proof read the writing and make necessary corrections
- Ask for feedback on their writing
- Share their writing with others

Sentence Combining

Combine the five sentences in as many ways as you can. Add additional descriptive words in order to combine if you like

- The mouse was hungry
- The mouse was grey
- The mouse ate the cheese
- The cheese belonged to the vicar
- The cheese was in the fridge

Interruption Construction

1. Cereal grains, such as wheat, rye, oats, barley and corn, which serve as staple foods for humans, are types of grasses.

2. Grasses, including corn, wheat and rice, and plants, such as lilies and tulips are monocots.

Writing on the Digestive System Vocab Toolbox

Parts	Functions
Mechanical Processes	Chemical Processes

Writing Based on Visual Texts

1. Choose one of the following concepts and an image that best demonstrates it:
   - Unbalanced forces
   - Balanced forces
   - Gravitational potential energy
   - Greatest friction
   - Kinetic energy
   - acceleration

Writing Based on Visual Texts

2. In your group create a word bank explaining why your image demonstrates your concept. Use appropriate scientific vocab that students might use. Include technical terminology. (As an extension you could include some words that are NOT applicable).

3. Now use your word bank, and add to it, writing a few sentences to form a paragraph, explaining why/how it demonstrates the concept. Can you find one another image that is similar? Contrasting? What would you say about the two images side by side?

4. Higher level thinking task – write suitable questions that could be used for this concept in Science.

Exit Questionnaire

Please use this link to our questionnaire and provide us with some feedback on today's workshop:

http://goo.gl/forms/10JqSNt6y6

Summary of Strategies

To help you with the questionnaire, here is a summary of strategies we have promoted today:

Vocab:

- Academic verbs
- Vocab jumble
- Traffic lights activity
- Word map
- Disappearing definition

Reading:

- Road blocks and strategies
- Three level reading guides
- Final word strategy
- Sentence levels

Writing:

- In your own words
- Sentence combining
- Interruption construction
- Vocab toolbox
- Using visuals for writing

Resources

- Reading for Understanding by Ruth Schoenbach, Cynthia Greenleaf and Lynn Murphy
- Effective Literacy Strategies in Years 9-13 Ministry of Education
- I’ve Got Something to Say by Gail Loane with Sally Muir
- TKI – Literacy Online
- TKI – ESOL Online
- TKI – Literacy Leadership