The koru and the nautilus shell:

THE UNIVERSITY OF WAIKATO

Tukua Kia Rere

NATIONAL
CENTRE OF
LITERACY &
NUMERACY
FOR ADULTS

Inspiring Potential

Visualising growth in literacy and numeracy

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National Centre of Literacy and Numeracy for Adults
University of Waikato, New Zealand

ACAL Conference October 2014



Literacy: a learning spiral for life

I'm interested in ways in which visual metaphors shape our thinking

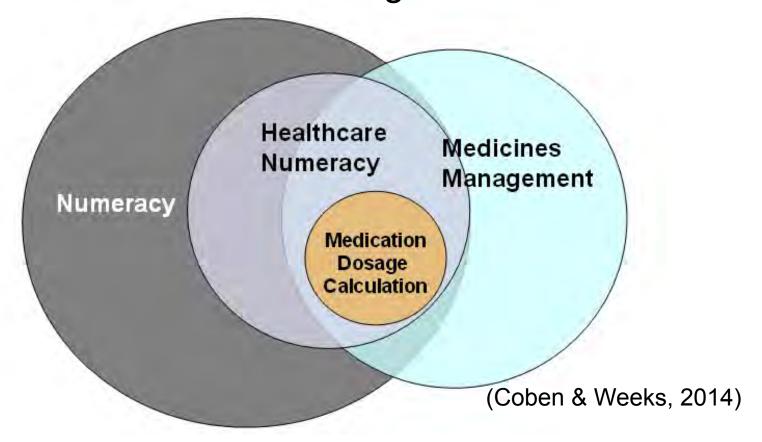
The koru and the nautilus shell symbolise growth in **literacy and numeracy as a learning spiral for life**

In what ways does this visual metaphor create possibilities or circumscribe them?

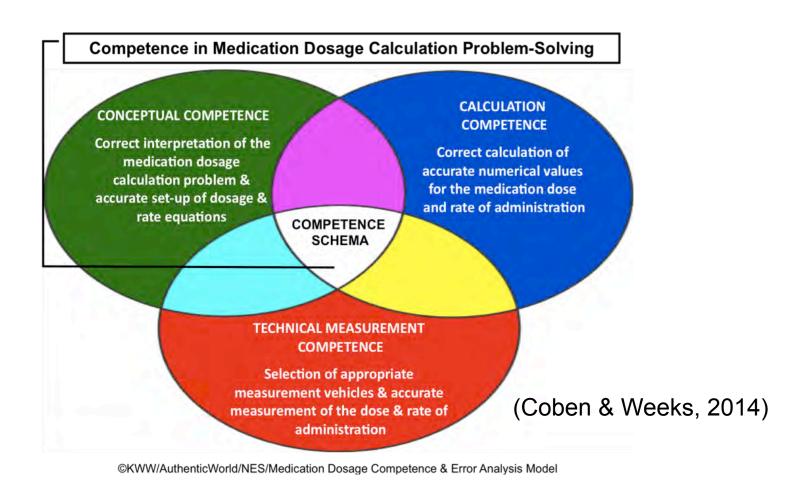
(thanks to Allie Clemans for inspiring this question at the Pre-Conference)

Visualising matters: numeracy in safetycritical contexts: nursing

Visualising medication dosage calculation in relation to numeracy, healthcare numeracy and medicines management



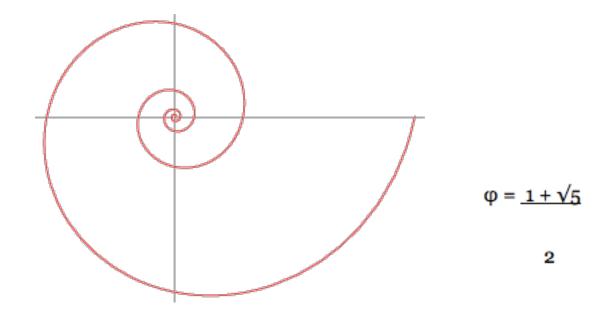
Visualising competence in a safety-critical context: medication dosage calculation problem-solving in nursing





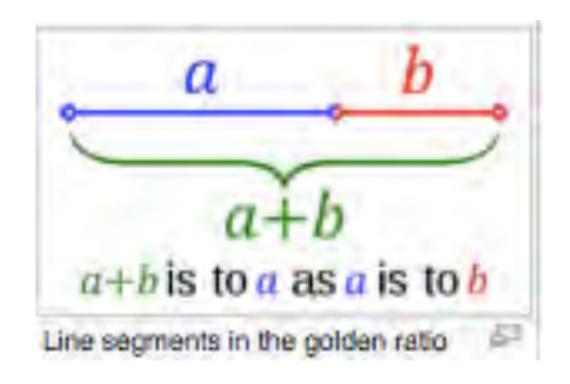


The golden spiral



A logarithmic spiral with a ratio of Φ (Phi)expressed as a non-repeating decimal: 1.6180339887....

http://mathworld.wolfram.com/LogarithmicSpiral.html



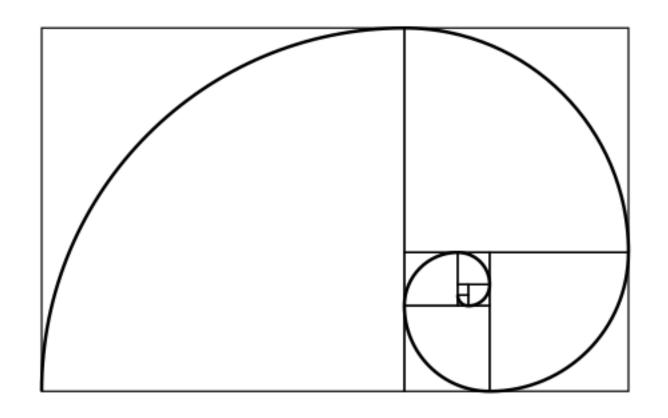
The Golden Ratio, aka Golden Section

two quantities are in the golden ratio if their ratio is the same as the ratio of their sum to the larger of the two quantities

Fibonacci Sequence

(0), 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, Known in India from 200-300 BC thanks to Sanskrit scholars counting short and long syllables

Introduced to Europe by Leonardo Di Pisa (aka Fibonacci) in his 1202 book *Liber Abaci* If you divide the larger by the smaller of adjacent numbers from 5/3 on in the Fibonacci Sequence you get a number close to Phi – try it - see http://splash.abc.net.au/media/-/m/154948/phi-challenge



A golden spiral based on the Fibonacci tiling sequence 1, 1, 2, 3, 5, 8, 13, 21 and 34

The length of the side of one square divided by that of the next smaller square is the golden ratio

Is the spiral of the Nautilus shell based on the Golden Ratio? Actually, no

"The nautilus is definitely not in the shape of the golden ratio. Anyone with access to such a shell can see immediately that the ratio is somewhere around 4 to 3."

(Falbo, 2005, p.127)

A ratio of 4 to 3 gives 1.3 recurring, not the 1.618... ratio of the Golden Spiral

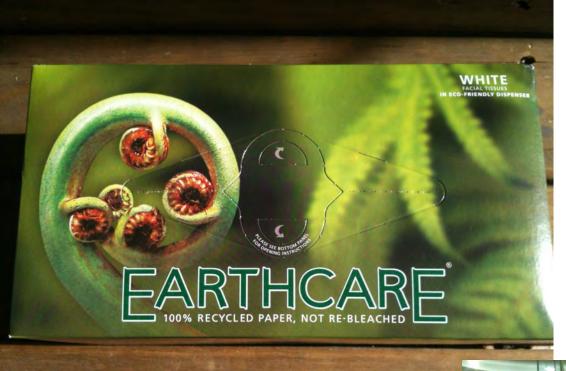
The spiral is redolent of healthy growth



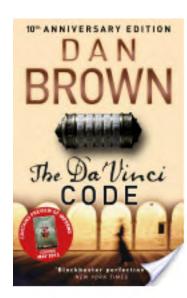


Māori pounamu (nephrite jade) koru symbolises creation and the way in which life both changes and stays the same

<u>Te Ara – The Encyclopedia of New Zealand http://www.teara.govt.nz/en/photograph/2422/the-koru</u>







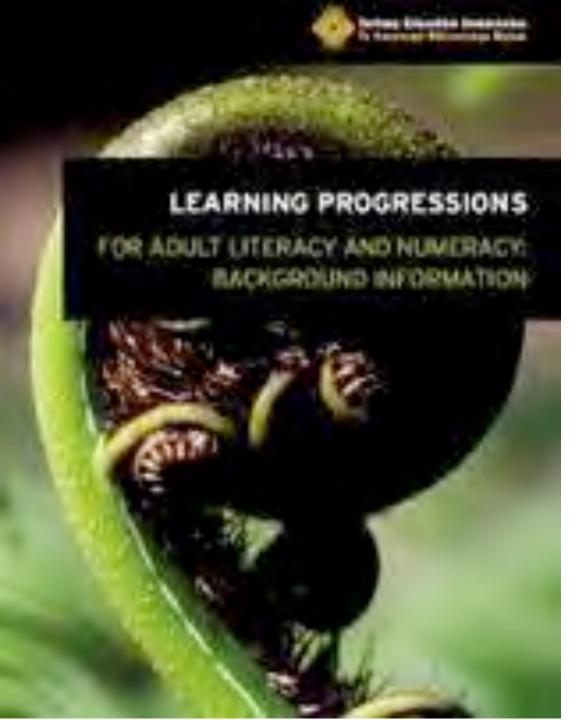
http://www.pinterest.com/ 1618paris/1618-goldenratio-harmony/

A popular image, used in many brands...



Learning and growth are associated with health but we live through birth – growth – decay - death

- Pikopiko (aka fiddleheads) are traditionally eaten and used medicinally in many parts of the world - NZ has 7 (of 312) edible species of fern
- But fern fronds generally contain ptaquiloside, a carcinogen (concentrations vary, some species have none) and thiaminase, which breaks down thiamine, leading to beriberi and other vitamin B complex deficiencies
- Invasive weeds (plants growing in the wrong place) can damage the environment
- Overgrowth of cells can kill: viz, cancer, Proteus Syndrome (Joseph/John Merrick, 'Elephant Man')



Spirals abound in nature, and the koru / pikopiko adorns the New Zealand Learning Progressions

https://www.literacvandnumeracvforadults.com/resources/354426

The koru / pikopiko in the Learning Progressions

"The koru (in its mature forms, pikopiko) was chosen as the symbol for the steps in each progression because it is a familiar and valued image for New Zealanders and because its natural and gradually unfolding growth pattern could be seen to reflect the process of successful learning, or ako."

Adult Numeracy Progressions

Make Sense of Number to Solve Problems

- Additive Strategies progression
- Multiplicative Strategies progression
- Proportional Reasoning Strategies progression
- Number Sequence progression
- Place Value progression
- Number Facts progression

Reason Statistically

- Preparing Data for Analysis progression
- Analysing Data for Interpretation progression
- Interpreting Data to Predict and Conclude progression
- Probability progression

Measure and Interpret Shape and Space

- Shapes and Transformations progression
- Location progression
- Measurement progression

Example: 'Make sense of number to solve problems'

Steps represented by koru / pikopiko with increasing numbers of fronds (from 1 to 6)

Steps vary in size and quantity

http:// www.literacyandnumeracyforadults.c om/resources/354426

Make Sense of Number to Solve Problems

Additive Strategies progression

Adults use counting and perfitioning strategies to add and subtract. These strategies make it easier to solve problems that involve numbers and to develop numeracy expertise. See page 23 for information about number strategies.

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Adult Literacy Progressions - listening, speaking, reading and writing in New Zealand English

Listen with Understanding

- Vocabulary progression
- Language and Text Features progression
- Comprehension progression
- Listening Critically progression
- Interactive Listening and Speaking progression

Speak to Communicate

Vocabulary progression

- Language and Text Features progression
- Using Strategies to Communicate progression
- Interactive Listening and Speaking progression

Read with Understanding

- Decoding progression
- Vocabulary progression
- Language and Text Features progression
- Comprehension progression
- Reading Critically progression

Write to Communicate

- Purpose and Audience progression
- Spelling progression
- Vocabulary progression
- Language and Text Features progression
- Planning and Composing progression
- Revising and Editing progression



Example: Listen with understanding Vocabulary Progression

http://www.literacyandnumeracyforadults.com/resources/354426

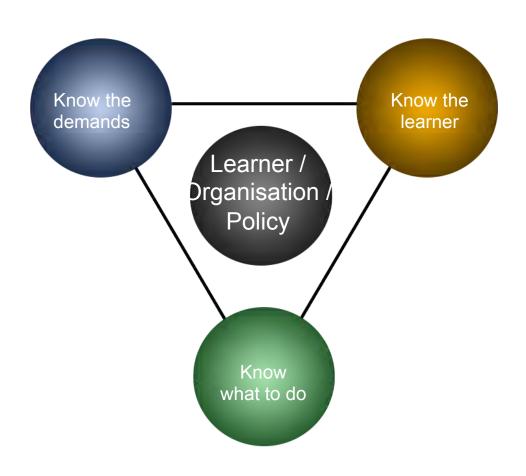
The Learning Progression 'steps'

The Progressions illustrate a typical learning pathway:

- describe steps along a continuum as learners build their expertise in a particular area of learning
- Steps represented by pikopiko with increasing numbers of fronds (from 1 to 6)
- Steps vary in size and quantity http://www.literacyandnumeracyforadults.com/resources/355004



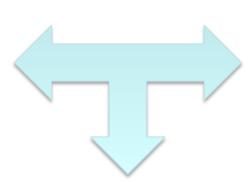
The NZ adult literacy and numeracy infrastructure: the '3 knowings'



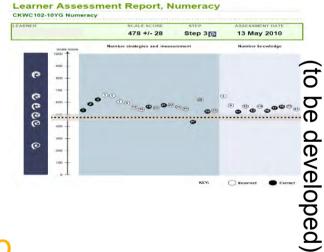
The '3 knowings' – articulating the infrastructure

Know the Demands

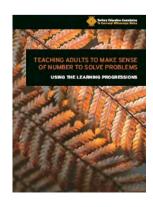


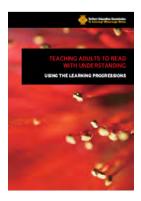


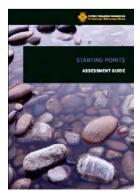
Know the Learner

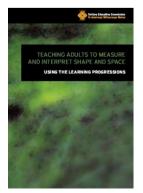


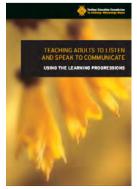
Know What to Do











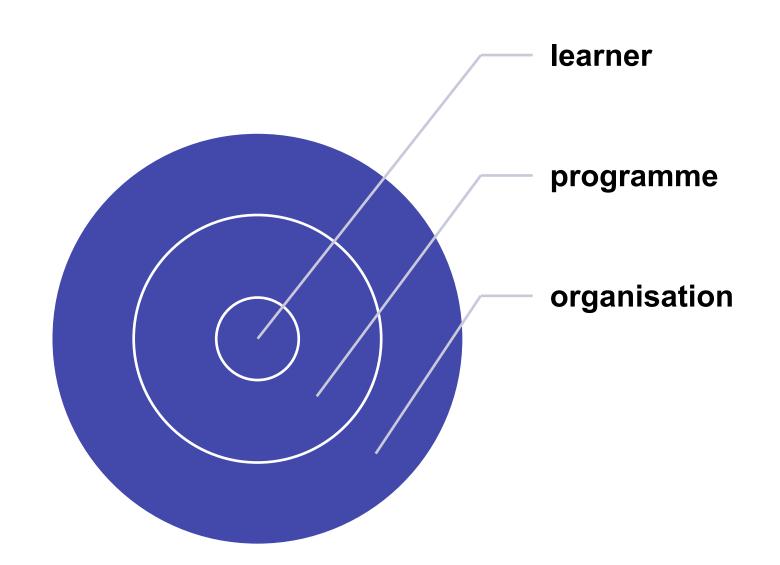
+ Pathways Awarua

practices measure

New Zealand National Centre of Literacy & Numeracy for Adults High quality professional learning High quality Strong teaching & partnerships learning resources Relevant qualifications Relevant Policy research engagement & advice

www.literacyandnumeracyforadults.com

Strengthening literacy and numeracy: Theoretical framework (TEC 2009)



Review of research evidence*...

On embedding literacy and numeracy in workplace programmes

LLN programmes in workplaces are successful in attracting learners who would not otherwise participate in learning programmes. These learners improve their attitudes to learning, their LLN and workplace practices, and their employability skills.

Programmes work best when:

- employers understand what literacy and numeracy is and are interested and supportive
- LLN skills are taught in relation to the LLN demands of the job, which are made obvious to learners.

On the need to develop measures of practice

 While there is limited evidence about the connection between proficiency (increased skills) and participation, there is a strong connection between participation and changed literacy and numeracy practices that lead to increased knowledge, skills and motivation. Therefore there is a need to develop measures of practice that can be used alongside the measures of proficiency to fully ascertain the outcomes for learners.

On hours of learning needed to achieve LLN skills' gain

- The hours of learning needed to achieve LLN skills' gain remain contentious because of the ways in which the researchers describe gain:
- in the USA, 100+ hours of teaching is associated with "measurable gain," described as improving a level / gaining a GED
- studies in the UK and New Zealand found that "statistically significant" gain was made in 35-39 hours
- short courses are appropriate for those who require a "brush-up" on skills.

On the need for a qualified teaching workforce

 A qualified teaching workforce is essential, and the more qualified this workforce, the greater progress made by learners. This applies for the teaching of literacy, numeracy and ESOL.

On the use of ICT

 There are positive signs that ICT engages learners and contributes to LLN skill gain, but more research is needed in this area

On improving the likelihood of retention and success

Embedding (the practice of combining / integrating literacy and numeracy into vocational and workplace training) improves the likelihood of retention and success when:

- vocational and literacy tutors work together
- literacy and numeracy content is deliberately connected to vocational or real life contexts
- there is a whole of organisation approach.



The '3 Knowings' framework – whole organisation approach at the centre



On the need for consistent policy

 Policy interventions need to be consistent over time and need guidance from the central government along with acknowledgement that educational change takes time, resource and support

'Finch's 4 Questions' which may be asked about any policy initiative

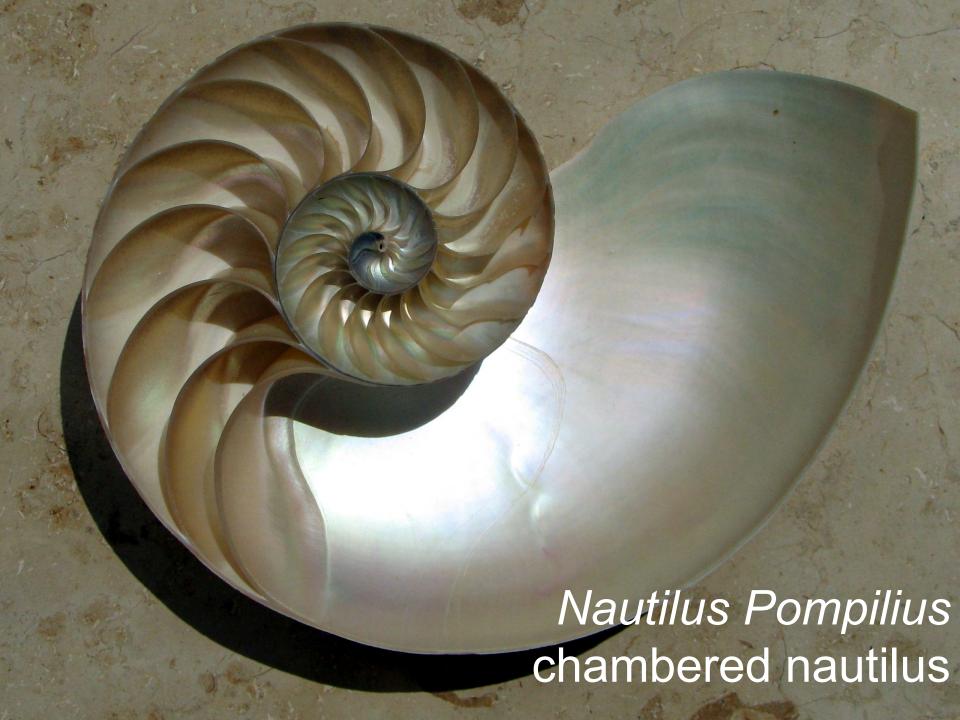
- 1. Why does the policy-maker so significantly engage in the provision of literacy and numeracy education?
- 2. What kinds of social policy ends are being pursued through this education, both overtly and covertly?
- 3. In whose interests are they being pursued and who actually benefits?
- 4. What kinds of outcomes ensue, both intended and unintended?

(adapted from Finch, 1984, p.4)

Individual (learner and educator), organisational and policy level concerns and issues

- Aspirations of / for learners within and beyond literacy and numeracy
- Compliance mechanisms impact on organisations and staff: targets; requirements for use of elements of the infrastructure; funding; other steers and sanctions
- Policy location: Education? Industry / Business?
 National? Regional / State?
- Purpose / policy direction:
 - human capital / social capital / human rights…
 - macro level change social / economic...
 - micro level change a man reading to his child...





The Chambered Nautilus by Oliver Wendell Holmes Sr (1858)

This is the ship of pearl, which, poets feign, Sails the unshadowed main,— The venturous bark that flings On the sweet summer wind its purpled wings In gulfs enchanted, where the Siren sings, And coral reefs lie bare. Where the cold sea-maids rise to sun their streaming hair. Its webs of living gauze no more unfurl; Wrecked is the ship of pearl! And every chambered cell, Where its dim dreaming life was wont to dwell,

As the frail tenant shaped his growing shell,

Before thee lies revealed,—

unsealed!

Its irised ceiling rent, its sunless crypt

Year after year beheld the silent toil That spread his lustrous coil; Still, as the spiral grew, He left the past year's dwelling for the new, Stole with soft step its shining archway through, Built up its idle door, Stretched in his last-found home, and knew the old no more. Thanks for the heavenly message brought by thee, Child of the wandering sea, Cast from her lap, forlorn! From thy dead lips a clearer note is born Than ever Triton blew from wreathèd horn! While on mine ear it rings, Through the deep caves of thought I hear a voice that sings: Build thee more stately mansions, O my soul, As the swift seasons roll! Leave thy low-vaulted past! Let each new temple, nobler than the last, Shut thee from heaven with a dome more vast, Till thou at length art free, Leaving thine outgrown shell by life's unresting sea!

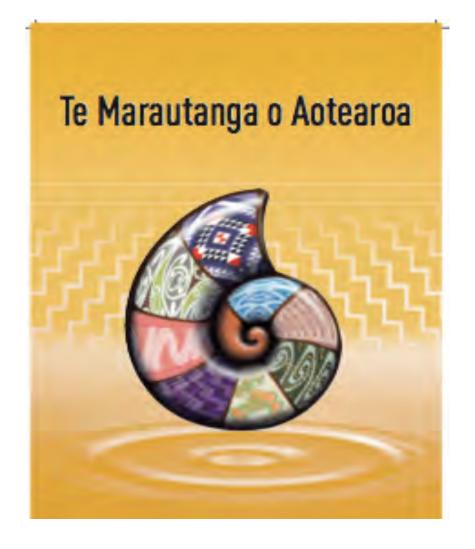


Literacy: a learning spiral for life

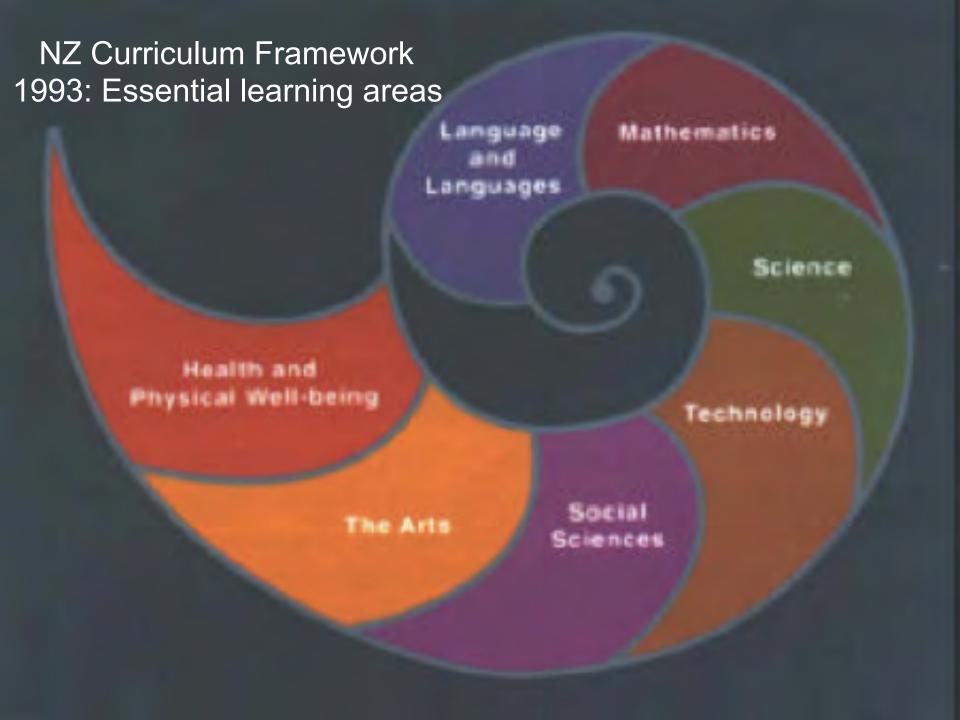


http://nzcurriculum.tki.org.nz/The-Curriculum-nautilus

"It is as a metaphor for growth that the nautilus is used as a symbol for the New Zealand Curriculum"



The NZ national curriculum for Māori-medium education







- In the LH image the focus is not on the path (because the course has not been predetermined) but on negotiating a path: on *currere*, running; on the instant of interpretation; on doing
- The RH image represents curriculum reductively 'framing' subjects of knowledge into separate learning compartments
- Although both images draw on the same metaphor, the purposes the metaphor is put to and the heuristics available from each image are quite different. (Sellers, 2003, p.15)

A teacher's reflections on the symbolism of the nautilus

The nautilus lives in the final chamber signifying a space of possibility, an opening for change and/or possibility, but always incomplete

The symbolism bespeaks tensions between disciplinary and curriculum boundaries, and spaces of possibility for critique and rethinking

In the NZ Curriculum, learning areas are represented as bounded chambers

"The irony that the nautilus' processional sameness still disturbs my engagement with ... curriculum does not escape me"

Some thoughts on the koru / pikopiko in the NZ Learning Progressions

- The Learning Progressions 'steps' are represented by koru / pikopiko
- ...but 'steps' implies stages in a linear progression from simple to complex, going against the koru's image of unfurling growth and the self-similarity of the golden spiral
- The risk is that adults are seen as, e.g., "a Step 3 learner" rather than as someone growing in literacy or numeracy capability

In what ways does the visual metaphor of literacy - and numeracy - as a learning spiral for life create possibilities or circumscribe them?



2014 Australian Council for Adult Literacy Conference 2 October Pre-conference Forum 3-4 October Conference

Crowne Plaza Surfers Paradise

Literacy: a learning spiral for life

The koru and the nautilus

- The koru and the nautilus are fruitful visual metaphors for adult literacy and numeracy learning - if they are used critically and not reductively
- Sentimental notions of learning as growth idealise the process and may leave those struggling to learn, or working to help others to learn, ill-equipped to do so
- Ultimately how we conceptualise and visualise literacy and numeracy learning is a political and moral issue:
 - What kinds of growth in literacy and numeracy learning are valorised, by whom and for what purpose?
 - Whose interests are served by nurturing, stunting or denying literacy and numeracy learning?
 - What is taught and learned and by whom?



Learning is a human right

It can be a matter of life or death

Malala Yousafzai, shot in the head in 2012 for advocating for female education

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*Coben, D., & Weeks, K.W. (2014). Meeting the mathematical demands of the safety-critical workplace: Medication dosage calculation problem-solving for nursing. *Educational Studies in Mathematics*, *86*(2), 253-270. doi: 10.1007/s10649-014-9537-3.

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* See also Weeks, Coben and others in the *Nurse Education in Practice* 'Safety in Numbers' series, 2013.

The nine papers in the *Safety in Numbers* series can be accessed at:

- *Editorial:* Sabin, M., Write and wrong: Authenticity and medication dosage calculation, Nurse Education in Practice (2012), http://dx.doi.org/10.1016/j.nepr.2012.05.015
- *Introductory Paper:* Weeks, K.W., et al., Safety in numbers: An introduction to the nurse education in practice series, Nurse Education in Practice (2012), http://dx.doi.org/10.1016/j.nepr.2012.06.006
- Paper 1: Young, S., et al., Safety in numbers 1: Essential numerical and scientific principles underpinning medication dose calculation, Nurse Education in Practice (2012), http://dx.doi.org/10.1016/j.nepr.2012.10.012
- Paper 2: Weeks, K.W., et al., Safety in numbers 2: Competency modelling and diagnostic error assessment in medication dosage calculation problem-solving, Nurse Education in Practice (2012), http://dx.doi.org/10.1016/j.nepr.2012.10.013
- Paper 3: Weeks, K.W., et al., Safety in numbers 3: Authenticity, Building knowledge & skills and Competency development & assessment: The ABC of safe medication dosage calculation problem-solving pedagogy, Nurse Education in Practice (2012), http://dx.doi.org/10.1016/j.nepr.2012.10.011
- Paper 4: Weeks, K.W., et al., Safety in numbers 4: The relationship between exposure to authentic and didactic environments and Nursing Students' learning of medication dosage calculation problem solving knowledge and skills, Nurse Education in Practice (2012), http://dx.doi.org/10.1016/j.nepr.2012.10.010
- Paper 5: Sabin, M., et al., Safety in numbers 5: Evaluation of computer-based authentic assessment and high fidelity simulated OSCE environments as a framework for articulating a point of registration medication dosage calculation benchmark, Nurse Education in Practice (2012), http://dx.doi.org/10.1016/j.nepr.2012.10.009
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- Paper 7: Weeks, K.W., et al., Safety in Numbers 7: veni, vidi, duci: A grounded theory evaluation of nursing students' medication dosage calculation problem-solving schemata construction, Nurse Education in Practice (2012), http://dx.doi.org/10.1016/j.nepr.2012.10.014

Images

Hubble Space Telescope Image of Messier 101 Galaxy: Stock Photo by NASA Public Domain Image Number: 0124-0906-2509-2407

http://www.acclaimimages.com/_gallery/_image_pages/ 0124-0906-2509-2407.html

Koru pendant: http://www.silverfernz.com/213-koru-greenstone-pendant.htm

Mother and children photo: "PikiWiki Israel 3200 Ein Hahoresh" by אין מידע Ein Hahoresh Archive via the PikiWiki - Israel free image collection project. Licensed under Public domain via Wikimedia Commons

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Nautilus shell photo: This <u>Wikipedia</u> and <u>Wikimedia Commons</u> image is from the user <u>Chris 73</u> and is freely available at //commons.wikimedia.org/wiki/ File:NautilusCutawayLogarithmicSpiral.jpg under the <u>creative commons cc-by-sa 3.0</u> license

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