Science research article

Science teaching and learning at the interface with mātauranga Māori

Stephen Ross, Pākehā, recently completed his Master of Education degree. His study explored how the interface of mātauranga Māori and science provides opportunities for teaching and learning. He has some useful insights for those in the classroom trying to use both knowledge systems in their science teaching. This article is based on some of Stephen's research and is described through his Pākehā perspective.

Defining mātauranga Māori

There is much written about mātauranga Māori, but academic descriptions only capture a part of the big picture. Literature tells us that mātauranga Māori is any knowledge or understanding originating from a Māori world view, which is passed down through generations in the form of traditions, stories, and skills (McAllister, 2019). This knowledge is:

- Place-based.
- Includes Māori values and ways of knowing and being.
- Founded on systematic evidence-based practices.
- Lived, practised, tested, and updated each generation.

Mana ōrite

Following a review of NCEA by the Ministry of Education (MoE), seven changes were generated to strengthen NCEA. One of these was mana ōrite – giving mātauranga Māori equal status in each learning area.

In the documents describing this parity, the MoE talks about *integrating* and *incorporating* mātauranga Māori. Although these words mean bringing parts together into a whole, Stephen suggests we need to be careful with our language.

For instance, *integrate* and *incorporate* could imply mātauranga Māori being changed to form something new; mātauranga being absorbed into western knowledge; or the cherry picking of whatever mātauranga is most convenient and a "best fit" with science, rather than each being preserved and maintained as separate and unique.

Dan Hikuroa standing by the tiny remainder of Lake Rotoitipaku, in the rohe of Ngāti Tūwharetoa ki Kawerau. The rest of the lake was filled with toxic waste from the former Tasman Pulp and Paper Mill, and overgrown with weeds. Used with permission from Ngā Pae o te Māramatanga, 2011, Lake Rotoitipaku: The Mauri Model. *(See p3, top).*

Conceptualising the interface

When science and mātauranga Māori are brought together, whether inside or outside the classroom, insights and processes from the two knowledge systems can be used to strengthen one another. But this interface can also be challenging, discomforting and filled with tensions.

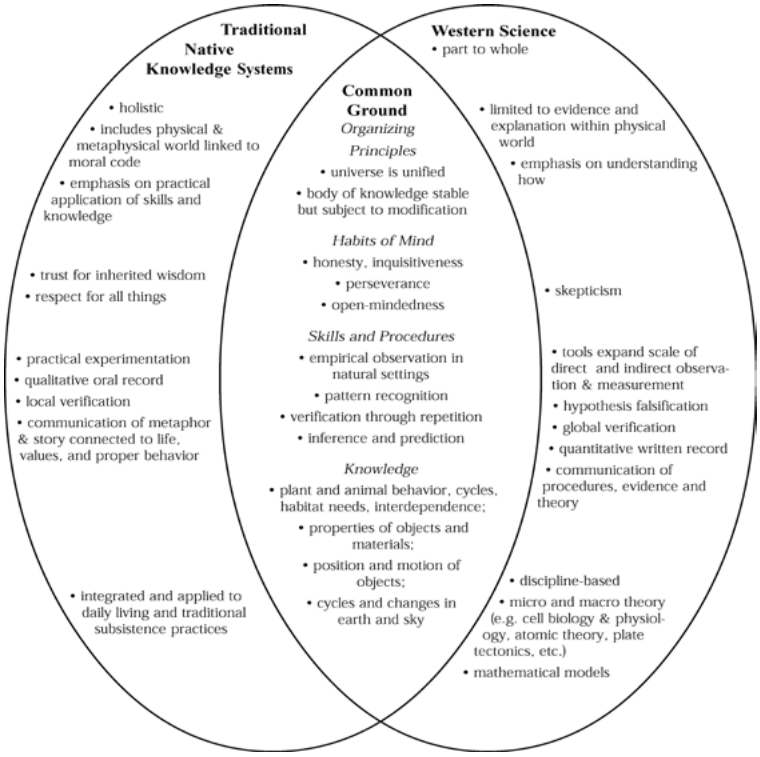
Dan Hikuroa (2011) says it is important to overcome the tension about which knowledge system is superior when a problem requires a solution that neither knowledge system can provide in isolation. The intention should be to work together for mutual benefit, and remember that both knowledges need equal status.

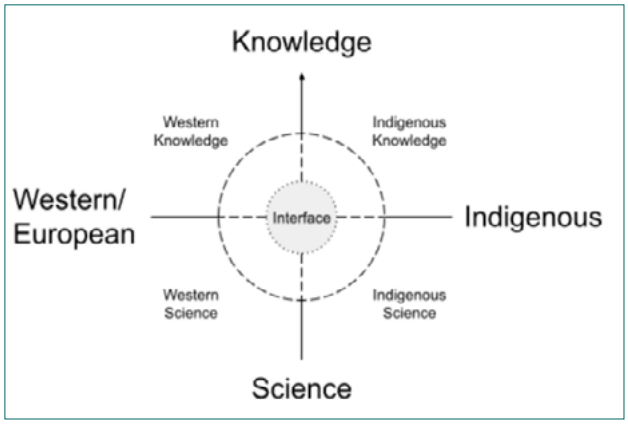
It can help to visualise this interface, and Stephen presents four models (see images, p2):

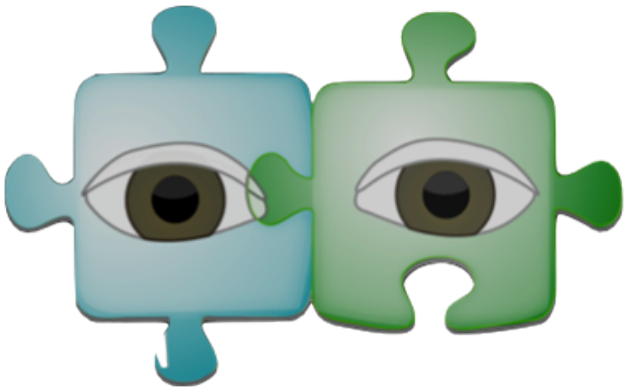
1. Venn diagram – Barnhardt & Kawagley (2005) used this graphic organiser to look at the similarities and differences between Indigenous and western science in an Alaskan context. This image may help teachers to better understand the common ground but also improve their awareness of what makes two knowledge systems unique.

2. Compass-Point Model – Mercier's (2007) image positions science and knowledge at opposite ends of an axis, at right angles to another axis between western European and Indigenous cultures. The circle in the middle is where these four intersect, ideally drawing from the four in equal amounts, but in reality often biased to a particular direction.

3. Two-Eyed Seeing – Hatcher et al. (2009) proposed an interface where we "see the strengths of Indigenous ways of knowing through one eye and the strength of western ways of knowing through the other." This image suggests taking in both world views without comparison or competition, while







Four interface models. Above: 1. Venn diagram of the interface from a native Canadian perspective, 2005. Below: 2. Mercier's four-point model; then 3. Two-Eyed Seeing, 2009. Bottom: 4. The braided Kamau Te Urua/Tasman River, image by Emma Willett.

being aware and respectful of differences.

4. Braided rivers – Macfarlane (2012) describes two knowledge streams that alternate between meandering separately, combining to strengthen each other, and diverging again depending on the context and the issue.

Contexts to explore the interface

Teaching mātauranga Māori and western traditions in science is helped by having experience of curriculum integration, where experts on both sides have input.

It is important *not* to assume that all ākonga Māori or all Māori colleagues will have strong links to their iwi, have knowledge of mātauranga Māori, or be prepared to share what they know. Furthermore, in any science/mātauranga conversation teachers should be ready to reciprocate rather than only to receive.

McKinley & Stewart (2012) found that Māori contexts (eg, hāngī, rongoā) were often taught in a shallow, cliched way and were missing aspects of te ao Māori (the Māori world) such as, for instance, tikanga, waiata, karakia, pūrākau, or whakataukī.

Non-Māori teachers need ongoing development of cultural capability, and reflective practice, to rethink how they have been drawing on te ao Māori when teaching science.

Stephen suggested some useful contexts to explore the interface of mātauranga Māori and science:

- ***What are living things*** – MRS GREN is how science categorises things as living or not. Te ao Māori holds different views about what is alive, which includes rocks and rivers. Venn diagram and two-eyed seeing may be useful here.
- ***Rongoā*** – Dr Jonni Koia's research into anti-diabetic compounds in native plants. A braided river may be useful here.
- ***Bird classification*** – Comparing Māori and Latin names and the ways birds of Aotearoa are

Ngā Kupu

From Paekupu and Te Aka Māori Dictionary

Ākonga – Learner, student
Awa whiria – Braided river
Hāngī – Earth oven, or food cooked in one
Karakia – Prayer, ritual chant
Mauri – Vital essence, life force
Pūrākau – Ancient story
Mana ōrite – Equality
Whakataukī – Proverb, aphorism
Rongoā – Traditional Māori medicines, health practices
Tikanga – Correct procedure, rule, convention.

categorised, as well as their different names in different places. Two-eyed seeing may be useful here.

- ***Weather and climate*** – Tohu/signs to predict weather from te whanau ā Apanui and NIWA. Use of Venn diagram or braided river approach may support this context.
- ***Mauri*** – Hikuroa (2011) wrote about the restoration of mauri in Lake Rotoitipaku. Use the compass point model to explore knowledge system biases and power structures involved.

All of these may be useful for new Science standards 1.1, 1.2 and 1.3.

Compare and contrast

Stephen brought to our attention Hikuroa, Morgan, Durie, Henare & Robust's (2011, p109) useful comparison of some differences and similarities between Indigenous knowledge (IK) and science (WS).

Empirical databases	
Similarities	***Differences***
Observation of nature	IK: Trial and error
Information accumulated over time, systematised, stored and transmitted either orally or in written form	WS: Experimentation; repetitive, under controlled conditions
	IK: Holistic
	WS: Primarily quantitative
	IK: Over millennia
	WS: Short term
Theories and predictions	
Similarities	***Differences***
Theoretical constructs common to both systems	IK: Uses intuitive learning paradigm
	WS: Strong reliance on theory
	WS: Focus on predictability of results (variance)
Testability	
Similarities	***Differences***
Seasonal practices involve repeatedly testing IK integrity	IK: Natural, uncontrolled conditions
	WS: Pre-selected parameters
	WS: Experiments, peer review, publications
Explanations of cause and effect	
Similarities	***Differences***
Both systems involve explanations of cause and effect as important components	WS: Limited to objective, ideally mathematical, linear, gender- culture- & value-free, apolitical, analytical
	IK: Uses all information

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References

Barnhardt & Kawagley, 2005, Indigenous knowledge systems and Alaska Native ways of knowing. *Anthropology & Education Quarterly, 36*(1), 8-23.

Hatcher, Bartlett, Marshall, & Marshall, 2009, Two-eyed seeing in the classroom environment: Concepts, approaches, and challenges. *Canadian Journal of Science, Mathematics & Technology Education, 9*, 141-153.

Hikuroa et al., 2011, Integration of Indigenous knowledge and science. *International Journal of Science in Society, 2*(2).

Macfarlane, 2012, "Other" education down-under: Indigenising the discipline for psychologists and specialist educators. *Other Education: The journal of educational alternatives, 1*(1), 205-225.

McAllister et al., 2019, Kua takoto te mānuka: mātauranga Māori in New Zealand ecology. *NZ Journal of Ecology, 43*(3), 1-7.

Mckinley & Stewart, 2012, Out of place: Indigenous knowledge in the science curriculum. *Second international handbook of science education*, 541-554 [Abstract free, requires login].

Mercier, 2007, Indigenous knowledge and science. A new representation of the interface between indigenous and eurocentric ways of knowing. *He Pukenga Korero, 8*(2), 2013.