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SHORT COMMUNICATION

Mātauranga Māori—the ūkaipō of knowledge in New Zealand

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ABSTRACT

Mātauranga Māori spans Māori knowledge, culture, values and world view. Pūrākau and maramataka, forms of mātauranga Māori, comprise knowledge generated using methods and techniques developed independently from other knowledge systems. Hitherto mostly ignored or disregarded by the science community because it seemed to be myth and legend, fantastic and implausible, mātauranga Māori includes knowledge generated using techniques consistent with the scientific method, but explained according to a Māori world view. Acknowledging this extends the history of scientific endeavour back to when Māori arrived in Aotearoa and Te Wai Pounamu, many centuries ago.

TUHINGA-WHAKARĀPOPOTO

Ka whārikitia te mātauranga Māori ki te ahurea Māori, ki ngā uaratanga me te ao mārama. Ko te pūrākau me te maramataka, he momo puna mātauranga anō hoki i waihangatia e ngā tikanga me ngā tāera i whakawhanake motuhake ai, hāunga i ērā atu mātauranga kē. Mai rāno kua pīhia kua takahia rānei te mātauranga Māori e te hāpori pūtaiao hei mea whakateka noa iho hei kōrero huakore. I te mea hoki, kua waihanga ai tēnei mātauranga (Māori) i ngā tikanga ōrite pū ki ngā tāera-ā-pūtaiao, ēngari ka whakamāramatia kētia e te ao mārama. Mā te whakamana pū o tēnei whakaaro, kātahi ka whakahokia te tino whakapapa o te pūtaiao, ki te wā i tau mai ai ngā waka whakapata o ngā mātua tīpuna ki Aotearoa ki Te Waipounamu, i ngā rautau ki muri.

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Introduction

Mātauranga Māori is the pursuit and application of knowledge and understanding of Te Taiao, following a systematic methodology based on evidence, incorporating culture, values and world view. Pūrākau and maramataka comprise codified knowledge and include a suite of techniques empirical in nature for investigating phenomena, acquiring new knowledge, and updating and integrating previous knowledge. Pūrākau and maramataka can be both accurate and precise, as they incorporate critically verified knowledge, continually tested and updated through time.

Mātauranga Māori is the term most commonly used to describe Māori knowledge (Mead 2003), incorporating 'the body of knowledge originating from Māori ancestors,

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including Māori world view and perspectives, Māori creativity and cultural practices' (Māori Dictionary 2003), the knowledge, comprehension, or understanding of everything visible and invisible existing in the universe, including present-day, historic, local and traditional knowledge; systems of knowledge transfer and storage; and Māori goals, aspirations and issues (Landcare Research 1996) and 'the unique Māori way of viewing the world, encompassing both traditional knowledge and culture' (Waitangi Tribunal 2011). The world view of a culture determines what they perceive reality to be: what is regarded as actual, probable, possible or impossible (Marsden 2003). Marsden (2003) offers one understanding of a Māori world view as Te Ao Mārama. Mātauranga Māori is therefore a method for generating knowledge, and all of the knowledge generated according to that method.

After their arrival in Aotearoa and Te Wai Pounamu many centuries ago, Māori developed various forms of codifying knowledge—many based upon oral delivery. Some narrative forms include moteatea (chants, poems), whaikorero (oratory, speechmaking), maramataka (calendar), waiata (songs), pepeha (quotations), whakataukī/whakatauāki (proverbs), whakapapa (genealogies) and pūrākau (stories)—each with its own categories, style, complex patterns and characteristics (Lee 2008).

Whakapapa is the central principle that orders the universe (Salmond 1991), demonstrates an interconnectivity between everything (Salmond 2012), and is a cognitive genealogical framework connecting creation of the universe to everything that exists within it via descent from ancestors (Marsden 2003; Roberts 2013). In Māori cosmogony, because there is only one set of primal parents (Ranginui and Papatūānuku, from whom everything ultimately traces descent), all things are related (Roberts 2013).

Mātauranga Māori is considered by some scholars as incompatible with science (e.g. Howe 2016). Pūrākau and maramataka have hitherto generally been ignored or disregarded by the wider science community. What those who disregard it fail to comprehend is that pūrākau and maramataka is knowledge generated using the scientific method, explained according to a Māori world view.

Pūrākau

Pūrākau are a traditional form of Māori narrative, containing philosophical thought, epistemological constructs, cultural codes and world views (Lee 2009). Pūrākau are an integral part of mātauranga Māori and were deliberate constructs employed to encapsulate and condense into easily understood forms, Māori views of the world, of ultimate reality and the relationship between the atua (deities), the universe and humans (Marsden 2003). In traditional Māori society, pūrākau were fundamental to understanding the world. This is contrary to the widespread belief in the science and wider community that the numerous collections of pūrākau (e.g. Reed 2011) are just myths, ancient legends, incredible stories and folklore. Pūrākau explained as myths invalidate Māori ontological and epistemological constructs of the world, and pūrākau understood as just 'stories' is an inadequate explanation of the importance of pūrākau in teaching, learning and the intergenerational transfer of knowledge (Lee 2008).

Pūrākau represent a type of codified mātauranga Māori. As an example, a pūrākau regarding the Waitepuru stream (located in Matata, eastern Bay of Plenty) refers to a taniwha in the form of a ngārara (lizard) residing there. The Waitepuru headwaters lie

in uplifted strata on the western edge of the Rangitaiki Plains. The stream is comprised of a single main, sinuous channel, with few, short tributaries oriented normal to the channel, before it flows out on the low-lying Rangitaiki Plains. The taniwha's upoko (head) and waewae me ngāmatimati (front feet and toes) are in the headwaters, the tinana (body) and hind feet in the main drainage course. The base of the hiku (tail) starts as the stream flows out of the uplifted land onto the Rangitaiki Plains and is said to flick from side to side. The presence of a taniwha is precautionary and suggests that there is danger associated with the stream. From a scientific point of view, a tale of a lizard in a stream as a sign of danger is difficult to comprehend. But it makes perfect sense when viewed from a mātauranga Māori perspective. The morphology of the stream and its tributaries are broadly reminiscent of a ngārara—the main channel a long, sinuous tinana, with the tributaries as waewae me ngā matimati reaching out perpendicular from the tinana, reducing in thickness and branching out as they reach further from the channel. After large flood events, the channel in the headwaters maintained its location, whereas the channel on the low-lying section often changed its course. Over the course of many centuries therefore, the unconfined low-lying stream section moved back and forth from side to side. Thus the reference to a taniwha in the form of a ngārara has multiple meanings. It represents both an understanding of the physical geomorphology of the stream and its behavior (e.g. the hiku [tail] flicking from side to side), as well as acting as warning of the inherent danger that the stream poses. The use of pūrākau as metaphor is well documented by Lee (2008). The Waitepuru pūrākau is simultaneously metaphorical and literal; a codified form of knowledge, incorporating geomorphology with disaster risk reduction. Consideration of the taniwha was taken in account when selecting building sites for the four marae in Matata. Accordingly, when two debris flows smashed into Matata in 2005, although a number of houses were destroyed, not one of the four marae was impacted.

Maramataka

The maramataka is a calendar that divides the Māori year into lunar months. The word marama means both moon and lunar month. The maramataka is a framework to mark time, based upon the moon's orbit around the Earth and is structured to respond to the natural rhythms and variations of the lunar cycle. Centuries of detailed observations built up evidence, and hypotheses and predictions were made, tested and critically analysed. Inductive reasoning was employed with results and conclusions subjected to verification and testing. Different hapū and iwi developed their own respective rohe-specific maramataka. The key role of the maramataka is as a predictive tool for scheduling activities critical to the continued success of hapū and iwi such as fishing, gathering kai moana, and planting and harvesting food.

The Te Whānau-Ā-Apanui maramataka has either 30 or 31 named nights (Tawhai 2013). Most months have 30 nights and, from time to time, an extra night is required (Tāwhai 2013). Te Whānau-Ā-Apanui have devised a simple method to account for the variation, inserting an extra night, Takatakapūtea, when required. Their maramataka accounts for one extra night, but does not predict when it will occur. Mutuwhenua is the new moon (Tāwhai 2013), the night when the moon is not visible. The following night is crucial to determine if Takatakapūtea is required. On the morning after Mutuwhenua if no new moon is observed, then that month is one day longer and Takatakapūtea is

used. If, however the new moon is seen on the morning following Mutuwhenua, Takatakapūtea is not required for that month. The maramataka is not fixed and static, it is dynamic, and when it was taught to the next generations, the method was a combination of authority teaching and experiential learning—the maramataka was lived. Importantly, a critical component of the teaching and learning process was to continually test the knowledge, to ensure that it was still valid. This continuous testing derives from an understanding that in natural cycles, change is the only constant. The knowledge pertaining to gardening practices can only have been generated using experimentation and observation. Accurate and precise maramataka were critical to the success and wellbeing of whanau, hapū and iwi.

In contrast, the Gregorian calendar is a framework to mark time, originally based upon the moon's orbit of the Earth (months) but is now fixed in its structure. It has months of 28, 30 or 31 days, with the addition of an intercalary day to February every fourth year. The monthly divisions in the Gregorian calendar were originally linked to the lunar cycle, but are now markers of time independent of it.

Pūrākau and maramataka are frameworks by which Māori understand and comprehend Te Taiao—the universe, the natural world (including us)—add to and test that knowledge, share it within generations, and pass it down through the generations. Pūtaiao is the Māori word used for science, literally referring to the tap root/roots or base (pū) of the natural world (taiao). Pūrākau and maramataka comprise knowledge critically verified and updated through time and therefore can be both accurate and precise.

Science

Science is both a method for generating knowledge, and all of the knowledge generated according to that method. The British Science Council (2009) defines science as 'the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence'. The scientific method is a suite of techniques for investigating phenomena, acquiring new knowledge, and updating and integrating previous knowledge, and includes the following: objective observation: measurement and data; evidence; experiment and/or observation as benchmarks for testing hypotheses; induction: reasoning to establish general rules or conclusions drawn from facts or examples; repetition; critical analysis; verification and testing: critical exposure to scrutiny, peer review and assessment.

Two key tenets of the scientific method are hypotheses and predictions. Hypotheses can be considered as logically possible explanations of cause-and-effect for how the world works, and the role of scientists is to explicitly organise the different possible explanations of cause-and-effect, and collect and consider evidence to evaluate our degree of confidence in one or more competing hypotheses (Crawford 2009). Empirical evidence, the foundation of science, is knowledge acquired by observation or experimentation, as distinct from deductive reasoning, abstract theorising or speculation. Therefore, and importantly, the senses are the primary source of empirical evidence.

Conclusions

Clearly there are significant similarities between mātauranga Māori and science. Specifically, pūrākau and maramataka comprise knowledge generated consistent with the

Table 1. Some differences between mātauranga Māori and science.

Mātauranga Māori	Science
Participatory 'experiencers' of systems	Detached 'observers' of systems
Explicit intrinsic values	Implicit instrumental values
Knowledge as belonging	Knowledge for control
Intuition as method	Intuition rarely acknowledged
Inclusion of facts and values	Facts and values separated
Everything is interconnected	Everything physical is interconnected

scientific method. The critical difference is that mātauranga Māori includes values and is explained according to a Māori world view. Some other relevant differences are outlined in Table 1.

Mātauranga Māori is, first and foremost, mātauranga Māori, valid in its own right. Both mātauranga Māori and science are bodies of knowledge methodically created, contextualised within a world view. As demonstrated herein, some mātauranga Māori has been generated according to the scientific method, and can therefore be considered as science. While there are many similarities between mātauranga Māori and science, it is important that the tools of one are not used to analyse and understand the foundations of another (Hikuroa et al. 2011). Thus, mātauranga Māori is mātauranga Māori, scientific in part, and in the context of this special issue, extends the history of scientific endeavour back to when Māori arrived in Aotearoa and Te Wai Pounamu, many centuries ago.

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